Real Time Speed Control of a DC motor by Temperature Variation using LabVIEW and Arduino

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***Abstract*- Nowadays from industrial application till to consumer application automation is the most popular technique is used. This paper presents the speed control of DC motor by variation in temperature. Cooling fans, Air conditioner, AC machines and in many applications DC motor is used. In order to develop the code LabVIEW platform is used. Since speed of the motor is controlled by variation in temperature, circuit of measuring temperature is interfaced through LabVIEW. The temperature sensor used here is a LM35. Both DC motor and temperature measurement code is done through LABVIEW software loaded into Arduino board. The communication between interfacing circuit on the Arduino Uno board and LabVIEW is possible only by the Makerhub. Initially for a set of temperature the duty cycle is generated using PWM by varying the width of the pulse. And average voltage values are generated for duty cycle, these voltage values are applied to DC motor for the variation of the speed. DC motor speed increases or decreases depending on the variation in temperature, this is controlled by the program done in the LabVIEW.**

Keyword- LABVIEW; Temperature sensor; Arduino Uno; DC motor.

I. INTRODUCTION

Most of the electronic devices available in the market need to be automated for the use of daily life. For example CPU in personal computer, Air conditioners etc... Need to be operated in a temperature controlled environment. In this method the motor speed is controlled automatically by variation in temperature. This method can be used in some industrial applications in order to maintain a constant temperature working environment. This helps the machines from damaging by reducing the temperature.

Motor speed can be automatically controlled by using different methods. Since motor speed need to be varied with temperature variation, this can be achieved by automating the system through software called LabVIEW. The coding or programming in LabVIEW is based on the platform like virtual instrumentation.

Compared to virtual instrumentation, conventional instruments are not cost effective and are generally doesn't perform the analysis and controlling of multiple signals simultaneously. Based on the constraints the use of new platform named as virtual instruments is emerged in last few years.

Arduino Uno board plays the role of Data Acquisition System. The DC motor is interfaced with PWM Controller in LabVIEW via Arduino Uno board.

II. BACKGROUND

DC Motor has a vital role in many industrial applications. With these high control requirements, it can be used in speed control systems like high precision tool, rolling mill etc. [1].

In order to implement the speed control of DC motor microcontroller plays an important role. Ali, Y.S.E. et.al proposes a system in which MC68HC11E9 fed by a DC chopper. Here the high frequency PWM signal is drived by Chopper. By controlling the PWM duty cycle, average voltage applied to the motor terminal is varied and hence the motor speed also varies [6].

Helei Wu et.al. Proposed a speed control of DC motor system, here the controller used is ARMS3C2410 and Microcontroller/Operating system-II, a RTOS. Where a closed loop system of motor speed control is developed that uses the PWM to control armature voltage. By regulating the armature voltage, motor speed can be controlled [7].

The most common method used for controlling the speed of the motor is Duty cycle variation or PWM.

$$\text{DUTY CUYCLE} = \frac{\text{Pulse HIGH}}{\text{Pulse HIGH} + \text{pulse LOW}} \%$$

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For example for 25% duty cycle the voltage value obtained is 1.25V, similarly for 50% of duty cycle voltage value getting is 2.5V, For 75% of duty cycle 3.75V is getting this is for the 5V of supply. In this method voltage applied to motor can be varied by increasing the pulse width of the signal and hence the seed also varies [2].

Compared to above previous existing methods, this method has the advantage that the motor speed can be automatically controlled through temperature variation in a cost effective manner using LabVIEW.

III. BLOCK DIAGRAM

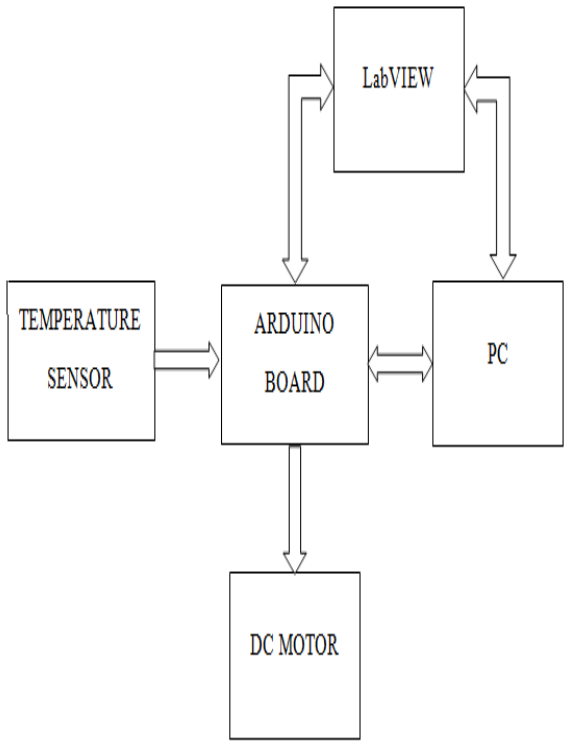


Figure 1: Block Diagram of speed control of DC motor.

The goal of this paper is that by the variation of temperature the speed of the dc motor should also vary. Here components used are temperature sensor, Arduino board, DC motor. The prototype board which is used here is Arduino board and the interfacing circuit is made on this board, and the above mentioned board supports LabVIEW platform. The temperature is measured through temperature sensor, and this temperature value is send to LabVIEW through Arduino. With respect to different temperature values, PWM will generate the duty cycle. According to that duty cycle, average voltage value applied to DC motor also varies. As the temperature value changes the voltage applied to the motor also changes and hence the speed. The current speed of the motor is displayed in front panel in the form of RPM (rotations per minute).

IV. FLOW CHART

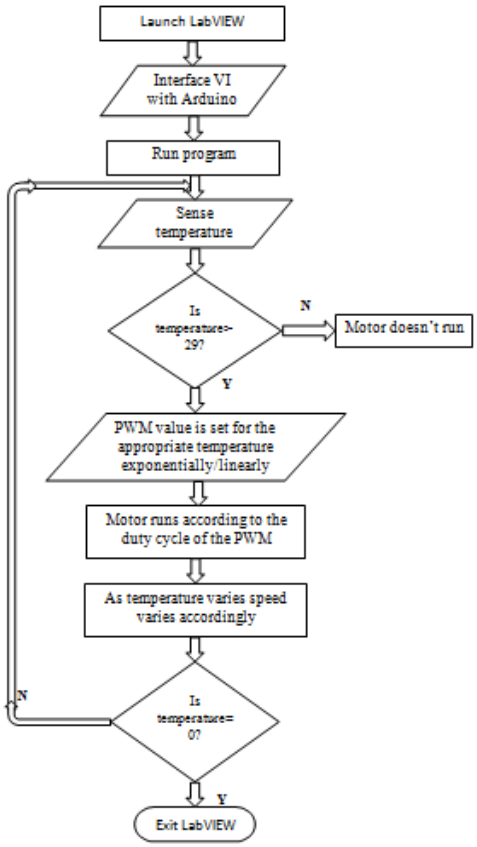


Figure 2: Flow diagram of proposed system.

V. CODE IMPLEMENTED IN LABVIEW

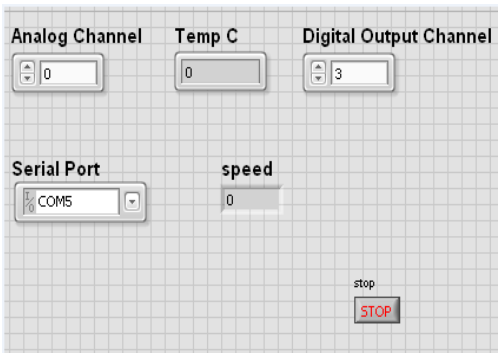


Figure 3: Front panel of code

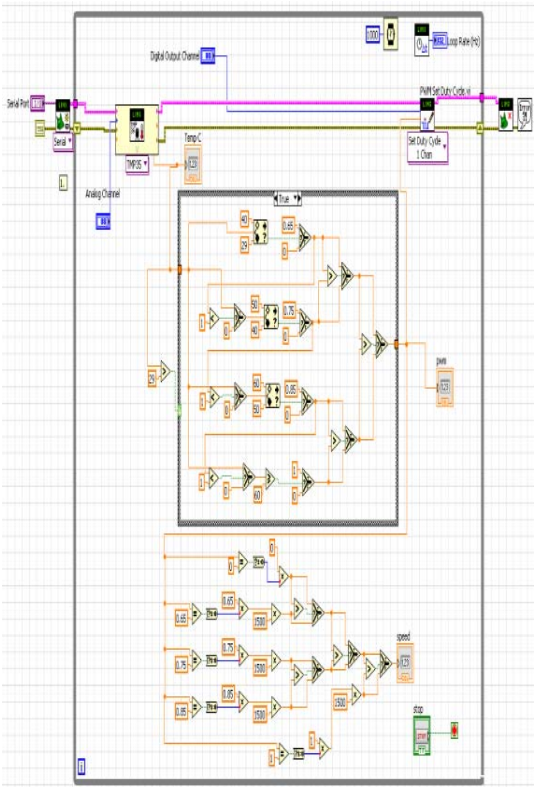


Figure 4: Block diagram panel of the code.

VI. RESULT

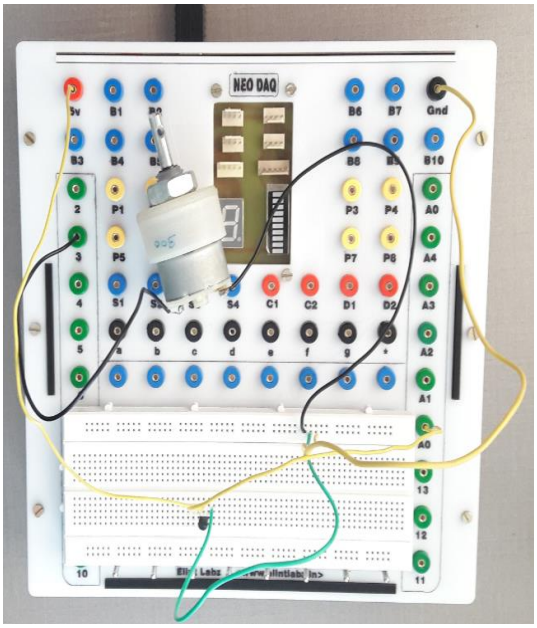
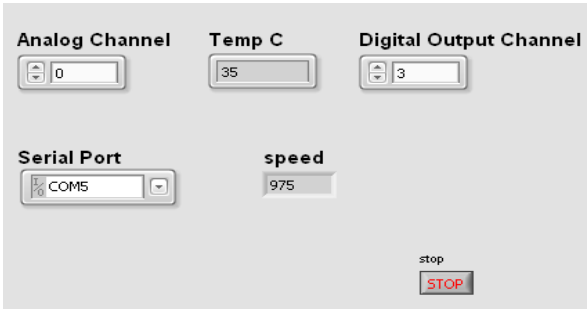
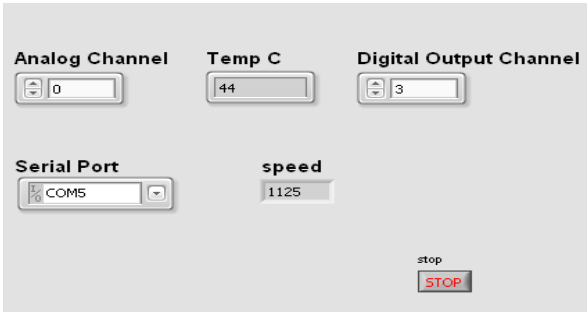


Figure 5: Hardware implementation.

A. Case 1: T=35, Speed=975.



B. Case 2: T=44, Speed=1125



VII. CONCLUSION

The structures and the data flow can be clearly understood by the graphical representation of program in LabVIEW. In our project as the temperature value changes, the PWM block used in the design judges the voltage that should be supplied to the motor and according to the supplied voltage the motor speed will vary. Hence this can be implemented in any field where the system works on temperature controlled environment.

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