International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in

Vol.2., Issue.1., 2014

RESEARCH ARTICLE

ISSN:2321-7758

ONLINE THERMAL PROTECTION, RPM MEASUREMENT AND CONTROL OF PMDC MOTOR USING LABVIEW

AMIT KUMAR SINGH[1], Dr. S. CHATTERJI[2] SHIMI S.L[3], ANSHUL GAUR[4]

[1,2,3]Department Of Electrical Engineering, NITTTR, Chandigarh, [4] RGEC, Meerut

Article Received: 12/02/2014 | Article Revised on: 28/02/2014 | Article Accepted on:02/03/2014


Amit Kumar Singh


Dr. S. Chatterji


Mrs Shimi S.L


Mr. Anshul Gaur

ABSTRACT

Remote enabled RPM measurement, control and thermal protection of PMDC motor is shown in this work. Many principles related with Instrumentation and Control Engineering can be demonstrated by means of Remote enabled laboratory and it is the advancement in Instrumentation course teaching. By using Lab VIEW developing software investigator has developed the remote control of the system for engineering labs and for industrial applications. The circuits as well as the combination of real and virtual are novel. The remote control was developed using Lab VIEW virtual instrumentation and they enable web control and monitoring of the equipment, allowing users to perform the control in real time, at their own computers, from anywhere and whenever is suitable for them and also at reduced cost.

Key Words: Instrumentation and Control, Thermal Protection, RPM of PMDC motor.

INTRODUCTION

Laboratories, which are found in all engineering and science programs, are an essential part of the education experience. Not only do laboratories demonstrate course concepts and ideas, but they also bring the course theory alive so students can see how unexpected events and natural phenomena affect real-world measurements and control algorithms. Teaching assistants are required to set up the laboratory, instruct in the laboratory and grade laboratory reports. These time-consuming and costly tasks result in relatively low laboratory equipment usage, especially considering that laboratories are available only when equipment and teaching assistants are both available.

All of these and many more exciting applications are now easily achievable with the new technology available with National Instruments LabVIEW remote panels. With this standard feature of LabVIEW, a user can quickly and effortlessly publish the front panel of a LabVIEW program for use in a standard web browser. Once published, anyone on the web with the proper permissions can access and control the experiment from the local server. If the LabVIEW program controls a real-world experiment, demonstration, calculation, etc., LabVIEW remote panels turns the application into a remote laboratory with no additional programming or development time.

RPM MEASUREMENT AND CONTROL OF PMDC MOTOR

In this application investigator has designed the LabVIEW software to control and measure the RPM of the PMDC motor. The RPM of the motor is displayed in the front panel.

The Front Panel consists of the following controls:

1. **STOP Button** This button is used to stop the running program at any desired time.
2. **Numeric Indicator (RPM of Motor) is** used to display the values of the RPM of the dc motor. These readings can be saved by the student for their records.
3. **Numeric knob Control (RPM control) is** used to control the speed of the PMDC motor.
4. **Numeric Meter Indicator (RPM OF MOTOR) is** used to display the RPM of dc motor in meter form as used in the vehicles.

The front panel of RPM Measurement of dc Motor is shown in Fig 1.

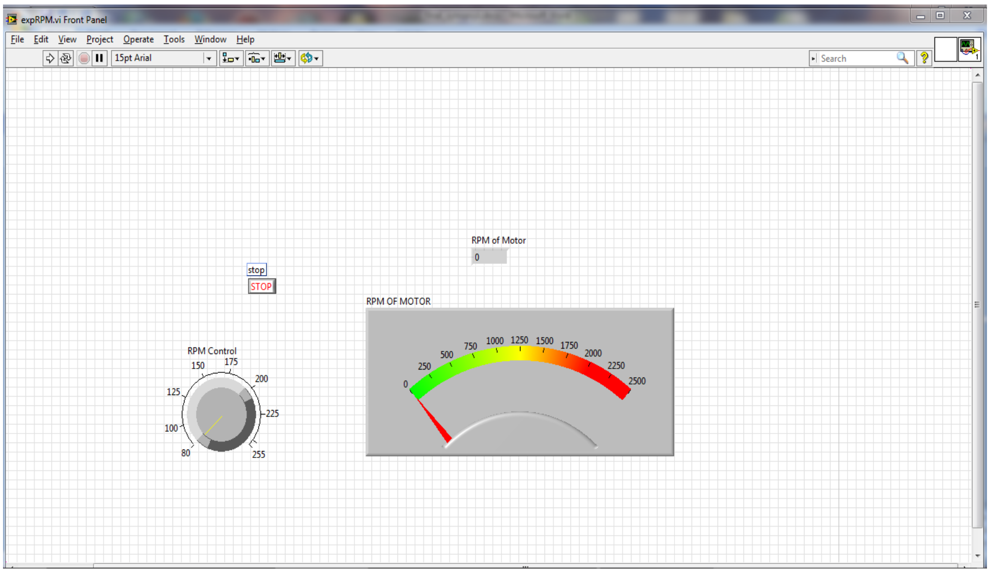

Fig 1: Front Panel of RPM Measurement of PMDC Motor

The block diagram of the RPM Measurement of PMDC motor is shown in Fig 2. The program consists of the four steps:

i. **Acquire data** The block diagram consists of the VISA functions for reading and writing the data through USB port. When the program is executed the program sends the channel number for the experiment to the microcontroller.

ii. **Data manipulations** The address and the data sent by the microcontroller is separated using index array functions. The signal is then manipulated as per the requirement of the application variable to be displayed.

iii. **Data representation** The acquired data is checked for the address of the application using formula node. If address matches then the manipulated signal is send to the front panel to be displayed.

iv. **Termination of loop** The loop is terminated using stop button or if the while loop count is completed as specified in the block diagram.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in
Vol.2., Issue.1., 2014

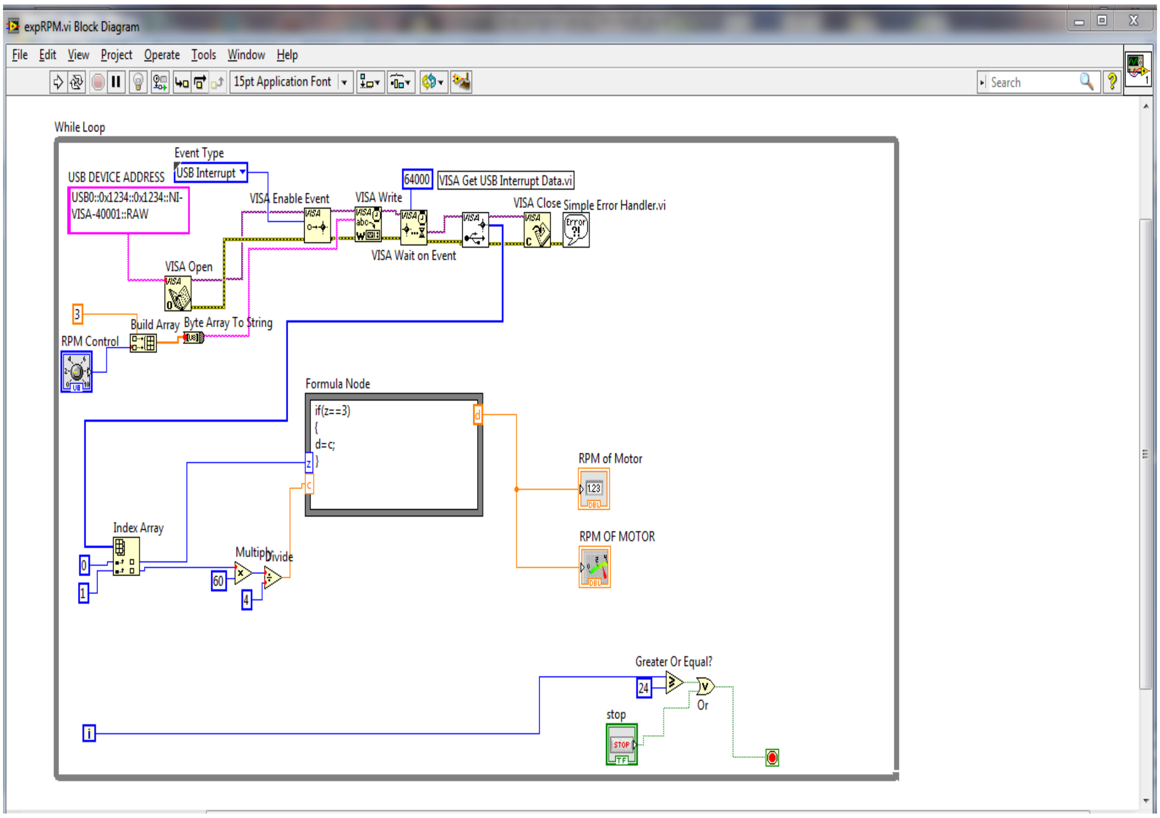

Fig 2: Block Diagram of RPM Measurement of PMDC Motor

ONLINE THERMAL PROTECTION OF DC MOTOR

In this experiment investigator has designed the LabVIEW software for the thermal protection of the dc motor and measure the RPM of the dc motor. The RPM of the motor is displayed in the front panel. The front panel of online thermal protection of dc motor is shown in Fig 3.

The front panel consists of the following controls:

1. **STOP Button** This button is used to stop the running program at any desired time.
2. **Numeric Indicator (RPM of Motor) is** used to display the values of the RPM of the dc motor. These readings can be saved by the user.
3. **Numeric Indicator (Temperature of Motor)** is used to display the values of the temperature of the dc motor in degree centigrate.
4. **Numeric Control (Cuttof of Temperature of Motor)** is used to input the desired cut of, of the temperature of the dc motor in degree centigrate.

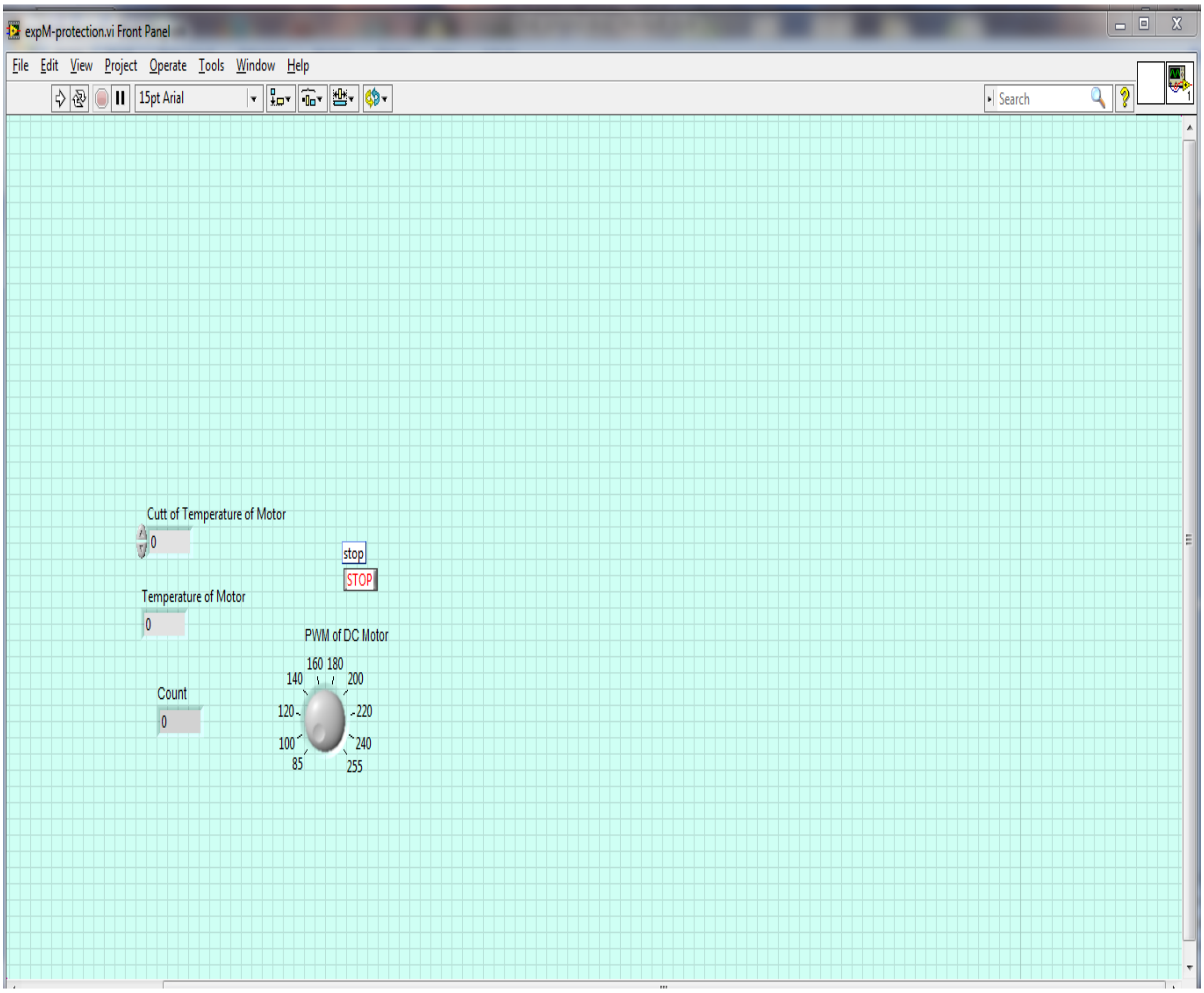

Fig 3: Front panel of Online Thermal Protection of dc Motor

The block diagram of the online thermal protection of dc motor is shown in Fig 4. The program consists of the four steps:

1. **Acquire data** The block diagram consists of the VISA functions for reading and writing the data through USB port. When the program is executed the program sends the channel number for the experiment to the microcontroller.
2. **Data manipulations** The address and the data sent by the microcontroller is separated using index array functions. The signal is then manipulated as per the requirement of the application variable to be displayed.
3. **Data representation** The acquired data is checked for the address of the application using formula node. If address matches the manipulated signal is send to the front panel to be displayed.
4. **Termination of loop** The loop is terminated using stop button or if the while loop count is completed as specified in the block diagram.

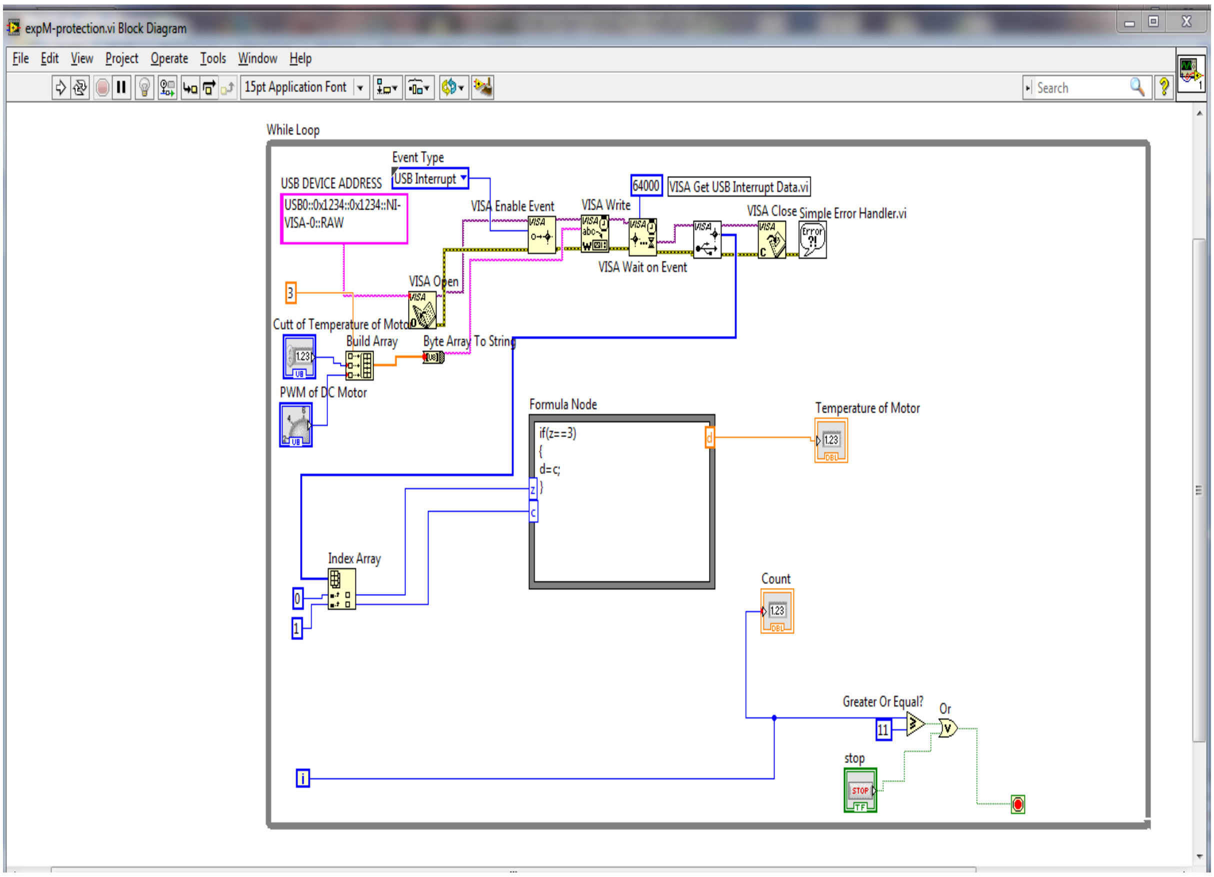

Fig 4: Block Diagram of Online Thermal Protection of dc Motor

DEVELOPMENT OF DAQ CARD

The circuit is made using PIC18F4550 microcontroller. It consists of the USB port and 10 bit ADC which is the basic requirement of the required system. The microcontroller is operated at 20Mhz frequency. The 16*2 smart LCD is used to display the concern experiment data to be visualized at the remote end of the experiment. LM7805 is used to provide the 5V dc supply for the system. J6 is the programming connector for ISP programming of the microcontroller. Power transistor is used for PMDC motor control. 12 V dc Relays are used for the bulb control. Different connectors are used to connect the PCB with the experimental setup.The diagram of DAQ card for setup is shown in Fig 5.

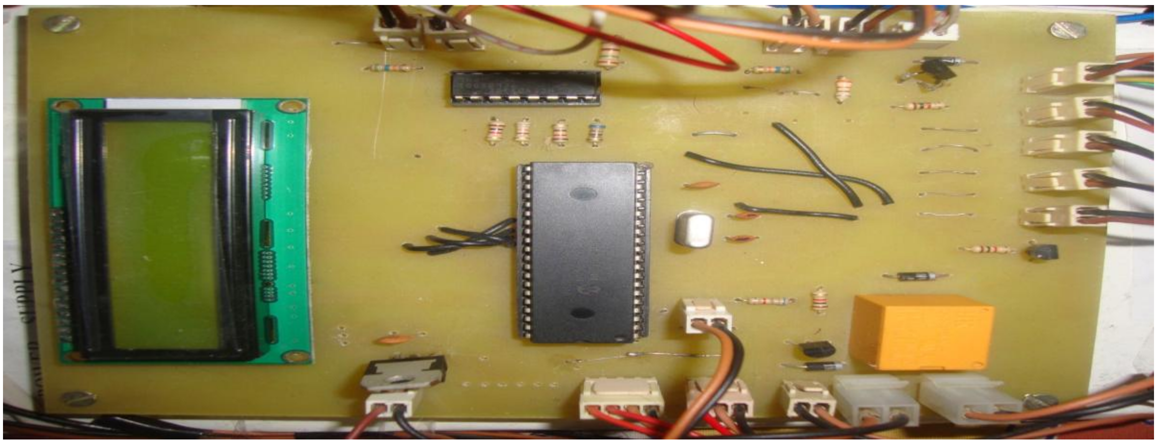

Fig 5: Photo of DAQ Card

Hardware Setup of RPM Measurement and Control of PMDC Motor

To control and measure the RPM of the dc motor the hardware is designed in Fig 5. The data of RPM measurement is taken through connector and the dc motor is controlled through connector. The digital pulse received from photodiode is sent to digital Port RD1. This signal is converted into RPM and then send the data to the host PC LabVIEW software shown in Fig 1. The setup of this application is shown in Fig 6. When the user starts the application by opening the Fig 1 on his laptop and run the LabVIEW program the microcontroller gets the address for the experiment and switches ON the trans-receiver photodiode. As soon as the trans-receiver photodiode is switched ON and the RMP of the dc motor changes the photodiode signal changes. This data is then sent to student laptop through microcontroller via USB port. The LabVIEW displays the RPM of dc motor. After completing the application the LabVIEW stops the setup. After that the system is ready for next round.

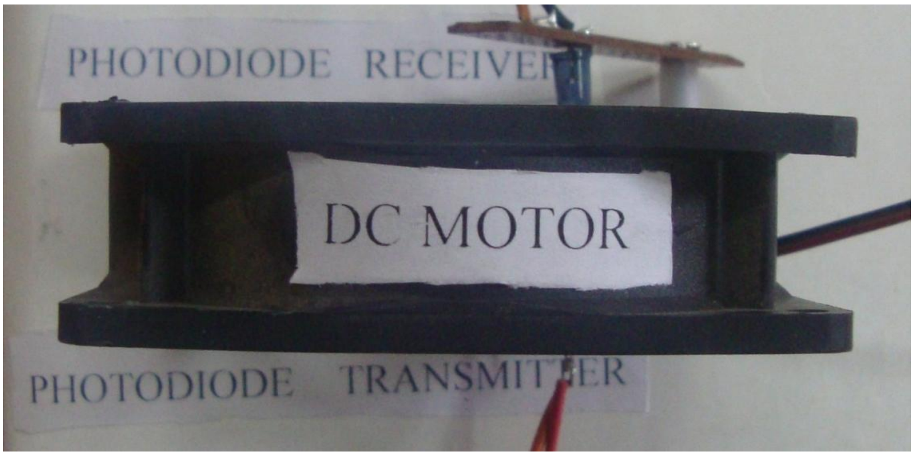

Fig 6: Setup of RPM Measurement and Control of PMDC Motor

Hardware Setup of Online Thermal Protection of dc motor

To protect the dc motor from overheating the hardware is also designed in Fig 5. The temperature measured of the dc motor is taken through Thermistor and is taken through connector. This analog voltage is sent to analog Port RA1 which has in built ADC on this port and convert the analog signal into 10 bit digital signal. The dc motor is controlled through connector. This signal is converted into temperature and then sends this data to the host PC LabVIEW software shown in Fig 3. The setup of this application is shown in Fig 7. When the user starts the application by opening the Fig 3 on his laptop and run the LabVIEW program the microcontroller gets the address for the application and switches ON the dc motor. As soon as temperature of the dc motor changes the resistance of the thermistor changes. This data is then sent to user laptop through microcontroller via USB port. The LabVIEW displays the temperature of dc motor. As the temperature increases beyond the limit set by the user the microcontroller stops the dc motor and the application is completed. After performing the application the LabVIEW stops the experiment. After that the system is ready for next round.

Fig 7: Setup of Online Thermal Protection of dc Motor

Real Time Remote RPM Measurement and control of PMDC Motor

First open the HTML page as shown in Fig 8 opens. Then click on the link for RPM measurement. When the HTML page opens right click on the window and select request control of vi. The control is now transferred to the remote HTML page. Now the user can run the vi program and speed control of dc motor and RPM measurement is shown in Fig 8.

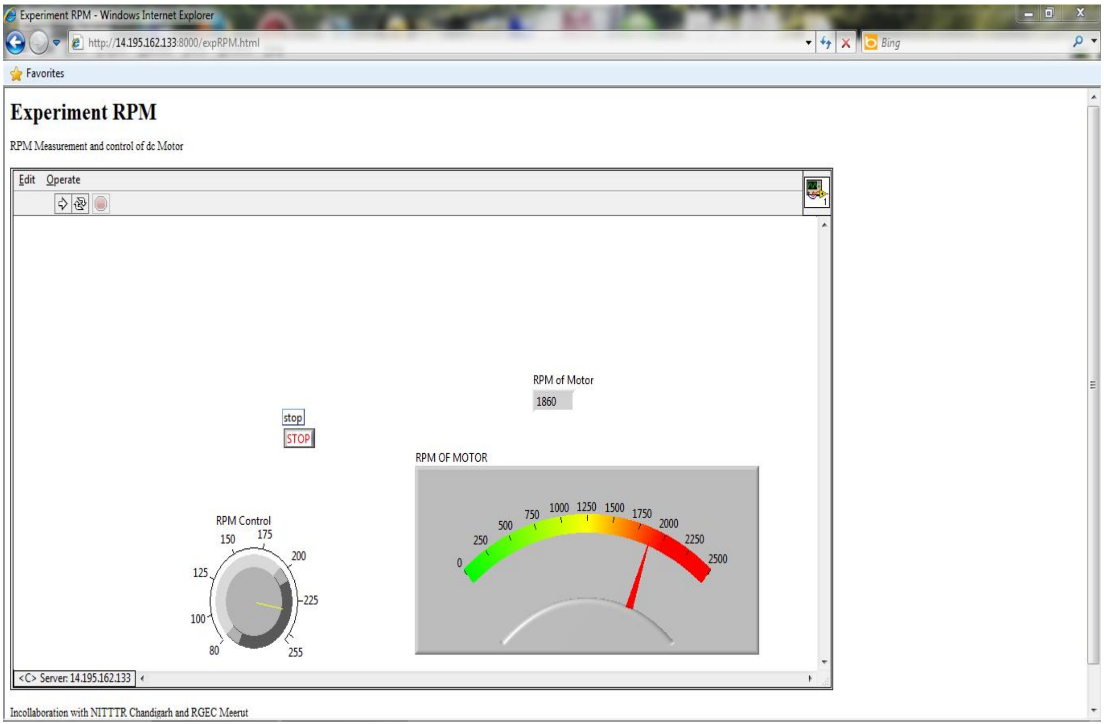

Fig 8: Response of RPM Measurement and Control of PMDC Motor

Response of Online Thermal Protection of dc Motor

First open the HTML page as shown in Fig 9 opens. Then click on the link for thermal protection for dc Motor. When the HTML page opens right click on the window and select request control of vit. The control is now transferred to the remote HTML page. Now the user can run the vi program and the temperature of the armature winding of the motor is measured and displayed in the HTML page. The desired cutoff of temperature of the dc motor is to be entered in the HTML page as shown in Fig 9.If the motor temperature crosses above the cut off temperature the DC Motor stops and the motor is protected. The speed of the DC motor can also be varied by changing the PWM of dc motor as shown in Fig 9. The table for ON and OFF of the dc motor for different temperature and PWM is shown in Table 1. The cutoff of the motor is set to 30 ^{0}C.

Table 1: Readings of Temperature of Armature Windings and PWM of dc Motor

S. NO	Temperature(^{0}C)	PWM of dc Motor	State of Motor
1	25	90	ON
2	26	100	ON
3	28	200	ON
4	30	240	ON
5	31	255	OFF

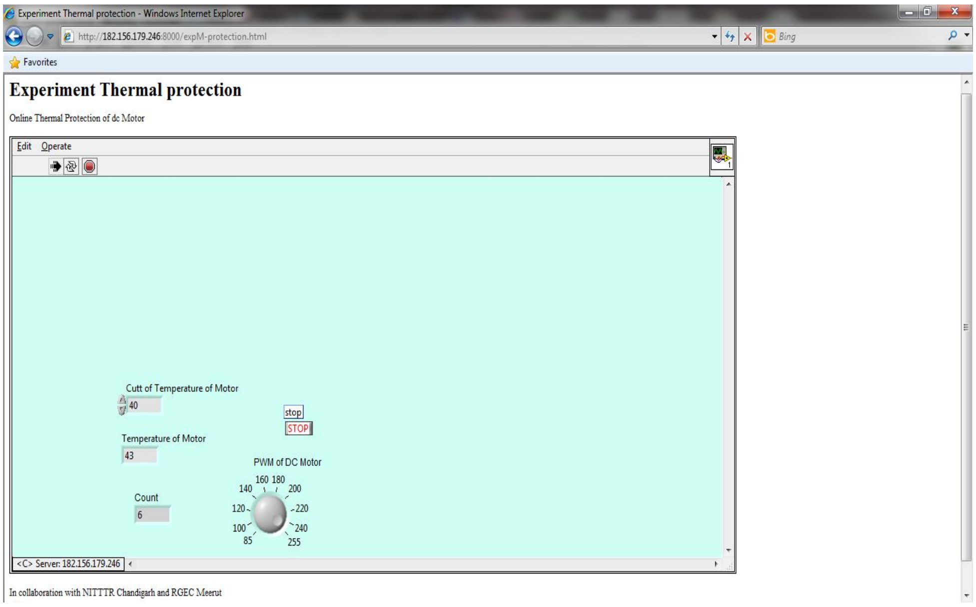

Fig 9: Response of Online Thermal Protection of dc Motor

REFERENCES

[1] Maria T. Restivo, Joaquim Mendes, Antonio M. Lopes, Carlos M. Silva and Fatima Chouzal, “A Remote Laboratory in Engineering Measurement”, IEEE Transactions on Industrial Electronics, Vol. 56, No. 12, pp 4836 - 4843 ,December 2009.

[2] B Kanmani, “An Alternate Approach to the Laboratory Implementation of Communication Experiments”, Digital Signal Processing Workshop and IEEE Signal Processing Education Workshop (DSP/SPE), Sedona, pp 517- 522, January 2011.

[3] Yujun Bao and Xiaoyan Jiang, “Application of Virtual Instrumentation which Based on Labview in Electronic Measurement Technology Course”, International Conference on Electronics and Optoelectronics, Vol. 1, Dalian, pp 215-218, July 2011.

[4] C. K. Maiti, S. Mahata and Ananda Maiti, “Design and Development of a Cost Effective Online Electronic Circuits Laboratory”, IEEE International Conference on Technology for Education, Chennai, pp 221-224, July 2011.

[5] Inderpreet Arora, Kannan M. Moudgalya and Sachitanand Malewar, "A Low Cost Open Source Single Board Heater System", 4th IEEE International Conference on E-Learning in Industrial Electronics (ICELIE), Glendale, pp 7-12, November 2010.

[6] H. Vargas, J. Sanchez, C.A. Jara, F.A. Candelas, F. Torres, and S. Dormido, "A Network of Automatic Control Web-Based Laboratories", IEEE Transactions on Learning Technologies, Vol. 4,No. 3, pp 197-208, July-September 2011.

[7] Ananda Maiti and Subhasis Mahata, "A Study of Switching Mechanisms in Remote Electronics Laboratories for Engineering Education", IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE), Hong Kong, pp W2B-4 - W2B-6, August, 2012.

[8] Kannan M. Moudgalya and Inderpreet Arora, "A Virtual Laboratory for Distance Education", IEEE International Conference on Technology for Education (T4E), Mumbai, pp 190-193, July 2010.

[9] Nuno Sousa, Gustavo R. Alves, and Manuel G. Gericota, "An Integrated Reusable Remote Laboratory to Complement Electronics Teaching", IEEE Transactions on Learning Technologies, Vol. 3, No. 3, pp 265-271, July-September 2010.

[10] S. Mahata, A. Maiti and C. K. Maiti ,"Cost-Effective Web-Based Electronics Laboratory using NI MultiSim, LabVIEW and ELVIS II", IEEE International Conference on Technology for Education (T4E), Mumbai, pp 242-243, July 2010.

[11] Nie Chun yan, Xu Shan shan and Ji Shu jiaoData, "Data Acquisition and Realization of Communication Transmission Based on LabVIEW ", International Conference on Computer Science and Electronics Engineering, Hangzhou, pp 215-218, March 2012.

[12] Eliane G. Guimaraes, Eleri Cardozo, Daniel H. Moraes, and Paulo R. Coelho, "Design and Implementation Issues for Modern Remote Laboratories", IEEE Transactions on Learning Technologies, Vol. 4, No. 2, pp 149-161, April-June 2011.

[13] G.A. Meneses, "Design of an Electronic Instrumentation Virtual Laboratory based on Free-Open Resources", IEEE 6th Colombian Conference on Computing Congress (CCC), Manizales, pp 1-6, May 2011.

[14] Junlong Fang and Fulu Wang, "Design of Green House Remote Monitoring System based on Labview", IEEE International Conference on Computer Science and Automation Engineering (CSAE), Shanghai, pp 536-539, June 2011.

[15] Angela Varadine Szarka, "Development of Remote Controlled Virtual Laboratory", XIX IMEKO World Congress Fundamental and Applied Metrology, Lisbon, pp 49-53, September 6−11, 2009.

[16] David Lowe, Steve Murray, Euan Lindsay and Dikai Liu,"Evolving Remote Laboratory architectures To Leverage Emerging Internet Technologies", IEEE Transactions on Learning Technologies, Vol. 2, No. 4, pp 289-294, October-December 2009.

[17] F. Garofanol, J. Gallardol, A. Guasch, B. Sanchez and R. Bragos, "iLabRS: A Remote Laboratory for Science and Technology in Secondary Education", IEEE 9th International Conference on Remote Engineering and Virtual Instrumentation (REV), Bilbao, pp 1-4, July 2012

[18] Franck Luthon, Anca Petre, Dan Steriu and Andrei Besleaga, "LaboRem: Open Lab for Remote Work", International Conference on Signals, Circuits and Systems, Medenine, pp 1-6, November 2009.

[19] D. Ursutiu, D. Iordache, C. Samoila and S. Dumitrescu, "Leveraging Ilab to Serve Client Less Online Laboratories for Electronics", IEEE 9th International Conference on Remote Engineering and Virtual Instrumentation (REV), Bilbao, pp 1-5, July 2012.