Control and Interfacing of Motors With NI-LabView Using NI-MYRIO

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Abstract

Motors are the necessary machines in the production of Robots and many Automation and Electrical, Electronic and Mechanical devices. This article deals with motors which are to be interfaced with the help of NI-MYRIO through NI-LabVIEW software. NI-MYRIO has inbuilt Analog and Digital signal Ports which provide necessary voltage and current to drive or to give excitation to a medium/high voltage dc or ac circuit. Relay Circuits require 5V signal from NI-MYRIO to provide 12V input for the DC Motor. When NI-MYRIO is interfaced with motors and PC installed with LabVIEW 2014, then with the help of PC or a Smartphone one can control the movements of the DC Motor
Keywords: NI-LabVIEW, NI-MYRIO, DC Motors, PC, Relay Circuit.

I. INTRODUCTION

DC motor depends on the fact that like magnet poles deters and unlike magnetic poles attracts each other. A coil of wire with a current flowing through it produces an electromagnetic field aligned with the core of the coil. By switching the current on or off in a coil its magnetic field can be switched on or off or by switching the direction of the current in the coil the direction of the produced magnetic field can be switched 180°[1]. A simple *DC motor* naturally has a fixed set of magnets in the stator and an armature by a successions of two or more windings of wire enfolded in shielded heap slots around iron pole pieces (called stack teeth) with the ends of the wires ending on a commutator.

The armature comprises the mounting bearings that retain it in the middle of the motor and the power shaft of the motor and the commutator networks. The winding in the armature remains to loop all the way round the armature and practices either single or parallel electrodes (wires), and can loop numerous intervals around the stack teeth. The whole sum of current directed to the coil, the coil's magnitude and what it's enfolded around command the power of the electromagnetic field produced. The arrangement of whirling a specific coil on or off commands what track the active electromagnetic fields are pointed. By switching on and off coils in order a turning magnetic field can be produced[2]. These rotating magnetic fields interrelate with the magnetic fields of the magnets (permanent or electromagnets) in the fixed part of the motor (stator) to generate a force on the armature which causes it to rotate. In certain DC motor schemes the stator fields use electromagnets to create their magnetic fields which permit more control over the motor[3]. At high power intensities, DC motors are almost always ventilated via forced air.

The quick implementation of the Personal Computers in the past 2 decades catalysed a emergence in instrumentation for experiment, measurement, and robotics. One of the foremost improvements ensuing from the omnipresence of the PC is the notion of virtual instrumentation, which deals numerous profits to engineers and experts who necessitate improved throughput, precision, and performance. A virtual instrument contains of an industry-standard PC or computer terminal furnished with dominant application software, economical hardware such as plug-in panels, and driver software, which composed accomplish the tasks of conventional instruments.

Virtual instruments symbolize an ultimate modification from conventional hardware-centred instrumentation arrangements to software-centred systems that use the computing power, efficiency, presentation, and connectivity competencies of widespread desktop computers and workspaces[4]. Though the PC and assimilated circuit technology have practiced noteworthy developments in the past 20 years, it is software that actually delivers the influence to construct on this influential hardware basis to build virtual instruments, resulting enhanced methods to update and considerably lessen cost. Through virtual instruments, engineers and experts construct measurement and automation structures that ensemble their requirements precisely (user-defined) as a substitute of being restricted by traditional fixed-function instruments (vendor-defined).

LabVIEW (short for Laboratory Virtual Instrument Engineering Workbench) is a system-design platform and progress atmosphere for a visual programming language from National Instruments[5]. The graphical language is termed "G". Initially created aimed at the Apple Macintosh in 1986, LabVIEW is universally employed for data acquisition, instrument control, and industrial automation on a multiplicity of platforms comprising Microsoft Windows, numerous versions of UNIX, Linux, and Mac OS X. The newest version of LabVIEW is LabVIEW 2014, released in August 2014.

Today's engineering students are being asked to not only master the fundamental elements of engineering, but to develop an appreciation for a complete system. To ensure that they graduate prepared to engage in modern engineering, students need to be immersed in real-world system design well in advance of graduation using the same technology they will see in their careers.

NI myRIO is the innovatory instrument that resides the influence of the LabVIEW RIO structure, a universally accepted, industry recognized hardware/software scheme method, in the hands of learners. With a steady method to culture progressive notions in embedded and FPGA programming, learners can create learning this technology at a level suitable for them while educationalists increase the buoyancy that this instrument can convoy learners from preliminary to progressive developments[5]. NI myRIO provides the powerful hardware and software technology required for learners to comprehensive significant projects in a single term while being guaranteed that they are learning on an instrument that formulates them for their careers as skilled engineers.

II. HARDWARE TOOLS

The control and interfacing of motor with NI-MYRIO using NI-LabVIEW requires the following components. They are ordered in terms of their specifications and usage as follows:

(1) Personal Computer with NI-LabVIEW installed.
(2) DC Motor.
(3) NI-MYRIO.
(4) Relay Circuit.

A. Personal Computer with NI-LabVIEW:

One can be able to control the motor using either a desktop or laptop computers with NI-LabVIEW software installed in it. In recent times National Instruments introduced latest version of LabVIEW software i.e. NI-LabVIEW 2014. The latest upgraded version has more additional features and advanced technologies such as NI-MYRIO driver software, vision and motion and robotics toolkit etc.

Fig. 1: Personal Computer Installed With LabVIEW

B. DC MOTOR:

In this experiment we are using 12 volt DC motor to provide free motion with load. Motor converts the Electrical energy into Mechanical energy by the principle of electromagnetism. When the Conductor is placed in the Electric field, and when excitation is given to the Magnets, due to attraction, the Conductor rotates thus produces a mechanical force.

Fig. 2: 12V DC MOTOR

C. NI-MYRIO:

The word "RIO" stands for Reconfigurable Input Output. NI-MYRIO is one of the best products of National Instruments which can able to do the process of Image Processing programs, Hardware interfacing programs such as motors, gears and levers etc. NI-MYRIO has Xilinx which is thereby a combination of Dual Core ARM Cortex A-9 Processor and FPGA embedded on it. It has Integrated WIFI, Analog I/O ports and Digital I/O ports and many others as described in the following figure.

Fig. 3: NI-MYRIO

D. Relay Circuit:

Since 15V ports of NI-MYRIO are less (i.e. +/-15port only available), it is not enough to drive 12V DC Motor pairs. Hence a 12V Relay Circuits with 5V excitation pulse are used to drive the Motors (for example 4 Motors of a Toy Car). NI-MYRIO has 4 Ports to produce 5V DC Supply to Relay Circuits which can be used to provide 12V from a Battery to a DC Motor. The Relay Circuit with 8 Relays is shown below.

Fig. 4: An 8-Relay Circuit

III. LABVIEW PROGRAMMING FOR MOTOR INTERFACING

The main three components of VI in NI-LabVIEW are Front Panel, Block Diagram and Connector Panel. The Block Diagram has many Functional Blocks which are helpful for the development of program whereas a Front Panel is the one which is used for Displaying and controlling functions. The Connector Panel is used for connecting a VI with other VIs and SubVIs.

A. Block Diagram:

As discussed earlier, the Block Diagram consists of several functional blocks which are used for programming. The Block Diagram is the one which connects the controls, and indicators with the series of functions such as Structures, Clusters, Arrays, Vision Assistant, Data Acquisition and much more. The program for the control of DC motor consists of the following Block Diagram.

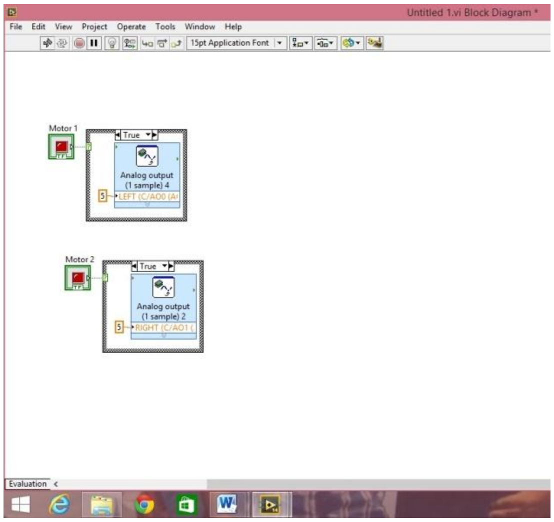

Fig. 5: Block Diagram - True Case

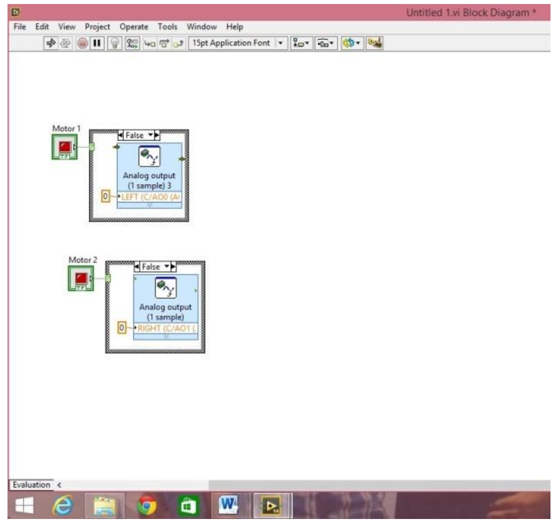

Fig. 6: Block Diagram - False Case

The Block Diagram consists of Boolean inputs namely Motor 1, Motor 2 which represents ON-OFF inputs to the motor. The case structure is used to select between the True and False cases. In true case 5 volts is given as a constant to the NI-MYRIO Analog output port as shown in the true case Block Diagram (Figure 5). Similarly, In false case 0 volt is given as a constant to the NI-MYRIO Analog output port as shown in the true case Block Diagram (Figure 6).

When Boolean Motor 1/Motor 2 switch is ON, NI-MYRIO generates 5 volts to the relay circuit in which Motor 1/Motor 2 is connected thereby switching ON the relay circuit. Similarly, When Boolean Motor 1/Motor 2 switch is OFF, NI-MYRIO generates 0 volt to the relay circuit in which Motor 1/Motor 2 is connected thereby switching OFF the relay circuit.

B. Front Panel:

The front panel is used for the purpose of controlling and displaying. In this motor control, the Front panel consists of two Boolean controls for ON/OFF of the motor. These Boolean controls are given to the corresponding case structure in order to ON/OFF the motor.

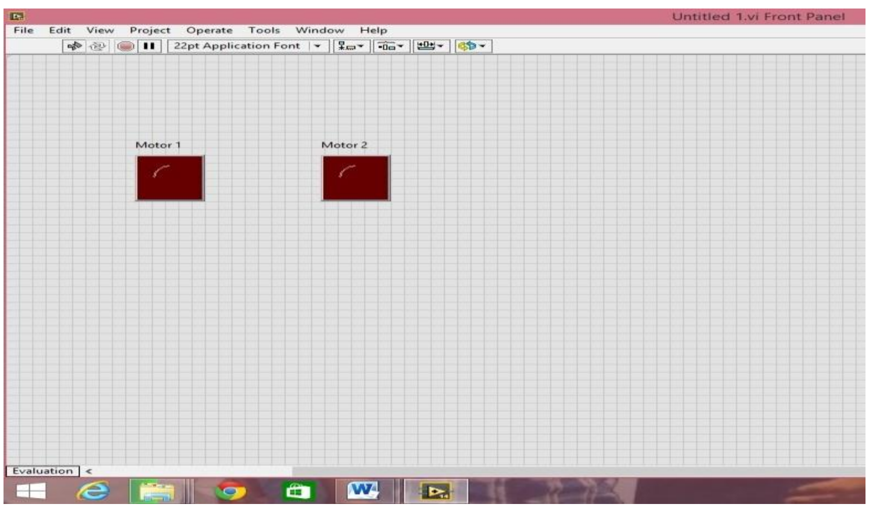

Fig. 6: Front Panel of Motor Interfacing

IV. NI-MYRIO IMPLEMENTATION

The 5V supply to the Relay circuit can be given with the help of NI-MYRIO using NI-LabVIEW program. Since these are Virtual Instruments, they are very easy to program and deploy. To do this, basic configuration should be known and that will be given by the following diagram once the NI-MYRIO is launched and configured.

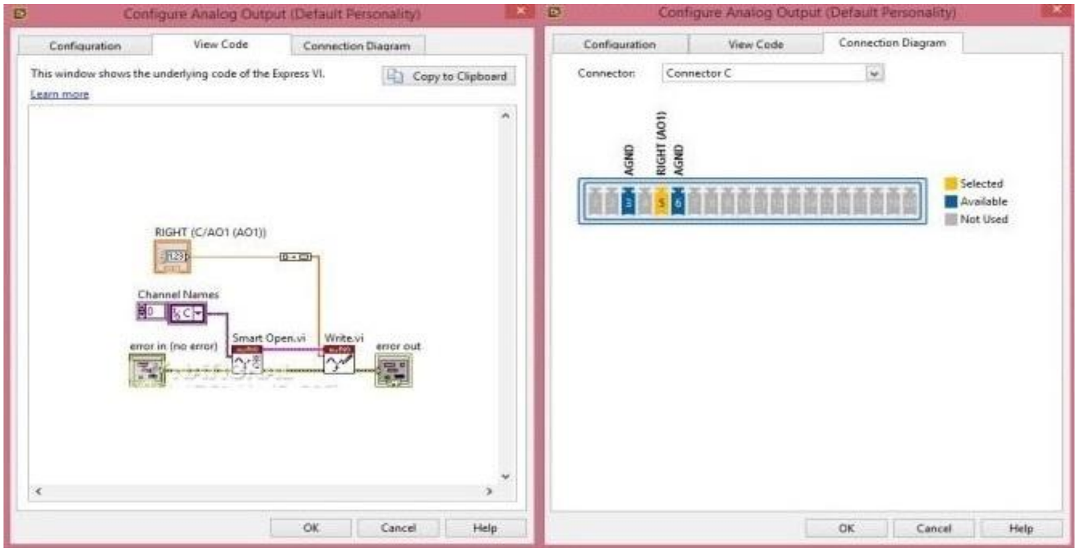

Fig. 7: NI-MYRIO Connection Code and Diagram

The channels which are mentioned in the figure are used for the necessary supply of 5V to the Relay Circuit. This is based on the program that is done on the Block Diagram side of VI for the corresponding channels (LEFT and RIGHT) as shown in Figure 6. Proper grounding at the AGND terminal should be given for the safe use of Instruments and Motors.

V. RESULT AND CONCLUSION

The NI-MYRIO controlled Motors running capability will be based on the condition that when Boolean Controls Motor1/Motor2 is turned ON/OFF there is a Delay of 1second for the response of change in controls in motor and the Delay is also for the Turning ON and OFF of the entire Motor System. This minimum delay is always present due to transfer of control pulse from PC to Motor via NI-MYRIO and Relay circuit since these are controlled virtually through the Computer.

NI-MYRIO has inbuilt Analog and Digital signal Ports which provide necessary voltage and current to drive or to give excitation to a medium/high voltage dc or ac circuit. Relay Circuits require 5V signal from NI-MYRIO to provide 12V input for the DC Motor. Hence, NI-MYRIO is interfaced with motors and PC installed with LabVIEW 2014, then with the help of PC or a Smartphone we thus controlled the movements of the DC Motor [FORWARD, LEFT and RIGHT].

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