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Interfacing myRIO to Control Various Sensors in Electrical Applications

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Abstract: This study deal with interfacing myRIO with various sensors and control using LabVIEW. Different types of sensors are considered to control various quantities. The sensors are seven segment display, discrete LED, push button, DIP switches, relay, potentiometer, thermistor, photocell, microphone, speaker, motor, rotary encoder, photo interrupter, Hall effect sensor, Piezo electric sensor, Servo, IR range finder, Sonic range finder, accelerometer, gyroscope, compass, ambient light sensor. The sensors are essential components in measurement and control. LabVIEW provides an interface for visualizing the signal, measurement and control of various physical parameters. Such are deals with the control of stepper motor using NI myRIO because it is less complex to research with LabVIEW programming which is very simple. The pulse required to run the stepper motor is generated using NI myRIO and interfaced with LabVIEW with the help of code generated in the system. The supply voltage is applied to the motor through a voltage driver circuit and the motor speed is controlled by varying the time delay in the LabVIEW program simulation specifications. This mechanical motion obtained using the stepper motor can be used in various industrial and real time applications as well.

Key words: myRIO, LabVIEW, various sensors, mechanical motion, simulation specifications, supply voltage

INTRODUCTION

Temperature controller for myRIO provides code to build a fully functioning temperature controller for various applications requiring regulated temperature. The same control algorithm can be used for any temperature control task. The controller uses two AC circuits to control both a heating and cooling system which could also be used for cooking. Temperature controller for myRIO provides code to build a fully functioning. Temperature controller for various applications requiring regulated temperature. Off-the-shelf temperature controllers could be used to close the loop. These controllers range in complexity from simple analog modules to advanced digital modules. However, by implementing all of the same features on a myRIO, the application can be used much more broadly. This application includes wireless interface to the control parameters and the sensor readings but also includes logging to show temperature trends over time (Lee *et al*., 2009).

This study deals with interfacing various sensors to LabVIEW. Each and every sensor is interfaced and the output is recorded and every sensor is made to research using LabVIEW (Bonen, 1997). Different examples of different sensors are considered to show interfacing with LabVIEW. The scope of this study is to interface any sensor using graphical programming. LabVIEW is used primarily for system prototyping testing and monitoring. Multiple setups are available using LabVIEW for the different products to control their control systems.

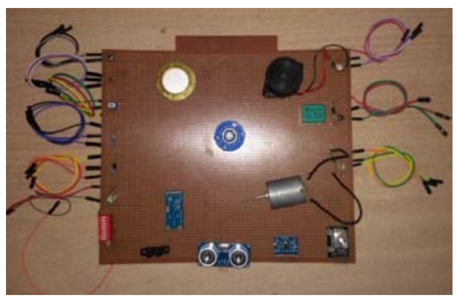

Fig. 1: Hardware implementation

Hardware implementation: myRIO can be connected to of various sensors through analog inputs. The analog inputs can range from 0 to +10 or -10 to +10 (Petryk and Buehler, 1996). There are many sensors which may give this type of voltage range. Some sensors as the case may be give digital output. It can accept sensors like potentiometers, thermisters, photo cells, photo interrupters, Hall effect sensors, infrared range finders, ultra sonic range finders, accelerometers, etc. It is how the data from the sensors is acquired, recorded and processed (Regtien, 1990) (Fig. 1 and 2).

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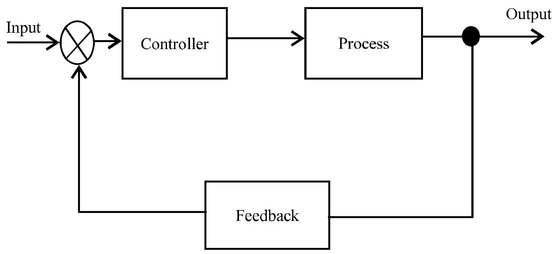

Fig. 2: Block diagram representation of LabVIEW based control system

Software implementation: After the programs is written, it was tested, involving execution the programs with selected inputs called test inputs, the performance of the system to test.

MATERIALS AND METHODS

Programming language: Graphical programming models are well suited control data flow model implemented in languages such as LabVIEW.

Because of this approach, applications written in block diagram format have inherent limitations when parallel hardware is controlled. In contrast with a graphical programming model, nodes on a block diagram are inter connected to express the logical flow and they can be used to implement parallel. When a block diagram node receives all inputs, it produces output data and passes it to the next node in the graphical program path. The flow of data through nodes decides the execution speed of the functions on the block diagram (Singla and Yadav, 2014).

Description of LabVIEW programs: LabVIEW programs consist of two windows. One is called front panel and the other is block diagram. The front panel is similar to the front pone of any control panel. It consists of switches, controls, displays, etc. The block diagram actually consists of the programming code to process the inputs and produce the outputs.

RESULTS AND DISCUSSION

System testing and integration: After the design and implementation phase, the system built has to be tested for durability and effectiveness and also ascertain if there is need to modify the design. The system was first assembled using breadboard, all the component were properly soldered to the printed circuit board from whence some test were carried out at various stage to ensure proper functioning of component expected data, the component were tested using a Digital MultiMeter

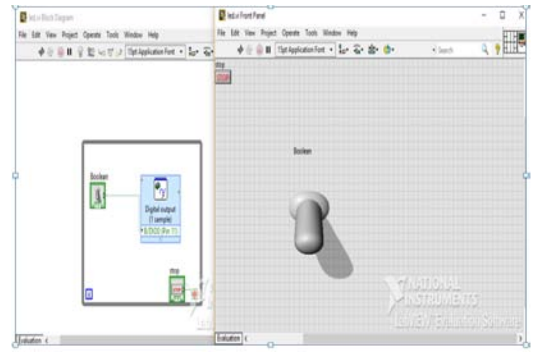

Fig. 3: LED sensor output

Table 1: Tests for transistors

Test	Black probe	Red probe
1st test on pins	Collector	Base
2nd test on pins	Emitter	Base

(DMM). Resistors were tested to ensure that there within the tolerance value. Faulty resistor was discarded.

Test plane and test data: This study entails the overall system testing of integrated design of voltage measurement device. The testing and integration is done to ensure that the design is functioning properly as expected there by enabling one or even intended users for which the project was targeted for, appreciate its implementation and equally approaches used in the design and integration of various modules of the study. However, this involves checks made to ensure that all the various unite and subsystem function adequately also there has to be good interface existing between the output/input unite subsystem. When the totality of the modules was integrated together, the system was created and all modules and sections responded to as specified in the design through the power supply delivering into the system designed.

Component test: Similar component like resistor were packed together. The other components include switch, resistor, transistor, relays, etc. Reference was made to color coding data sheet to ascertain the expected value of resistors used. Each resistor was tested and the value read and recorded. Also for transistor test the DIMM was switched to the diode range. The collector, base, emitter junctions were tested in the following order. The collector, emitter and base pins were gotten from the data analysis on power transistor (Table 1).

Figure 3-13 describes the simulation programs of various sensors. The responses of LED, photocell, seven segment display, buzzer, Hall effect, photo interrupter, potentiometer, relay, push buttons, thermistors and motor are presented in Fig. 4-7 simultaneously.

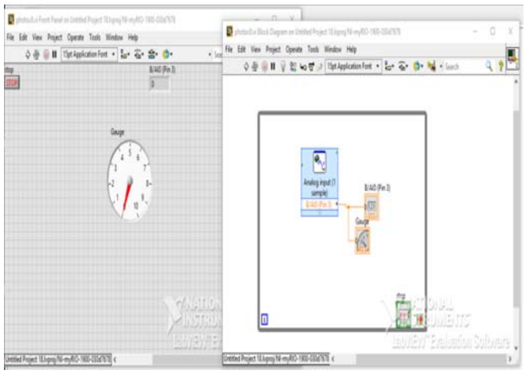

Fig. 4: Photo cell sensor output

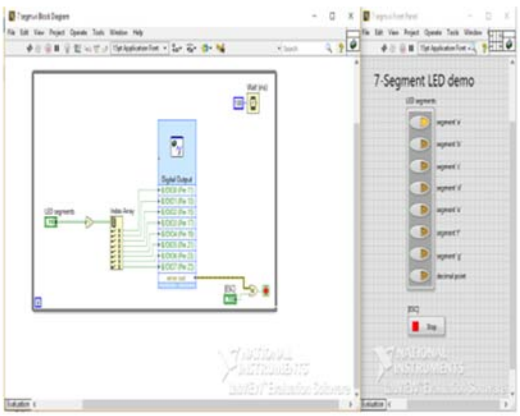

Fig. 5: Seven segment display sensor output

LED: Figure 3 shows a simple program n which on LED is connected to one of the digital outputs of the myRIO. The switch on the front panel is a binary input device the software. By clicking on the switch it can be made on, the digital output of myRIO becomes high and switches the LED, ON.

Photo cell: Figure 4 shows a simple program for interfacing a photocell to the myRIO. Photocell consists of light energy to voltage which is connected to analog input of myRIO. This voltage is displayed on the front panel by the meter calibrated for 0-10 V.

Seven segment display: Figure 5 shows a simple LabVIEW program for interfacing a seven segment display. This has seven line segments arranged in the shape of numerical eight. By switching certain segments ON or OFF, decimal numbers zero through nine can be displayed.

Buzzer: Figure 6 shows a simple program to switch on a buzzer to generate alarm sound. The boolean input on the

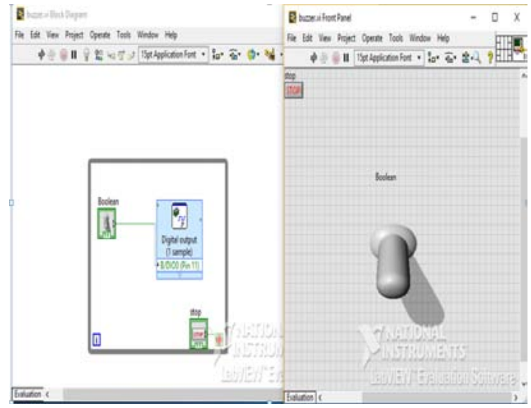

Fig. 6: Buzzer sensor output

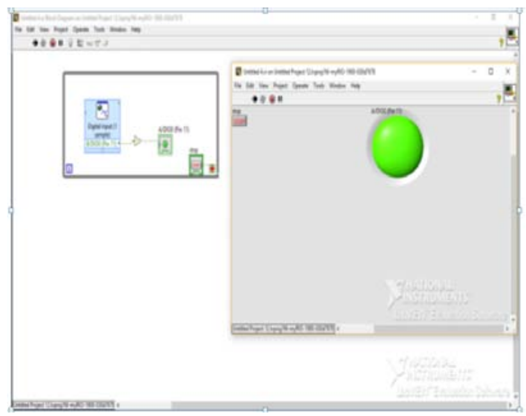

Fig. 7: Hall effect sensor output

front panel can be clicked to make it ON and a HIGH logic is passed on to the specified digital output causing the buzzer to sound alarm.

Hall effect sensor: Figure 7 depicts interface to a Hall effect sensor. Hall effect sensor produces a digital high output when North pole of a magnet is brought great it. This causes an LED on the front panel to get lighted up.

Photo interrupter: Figure 8 shows interface to a photo interrupter which is also known as gap detector. It has an LED which units light. A photo transistor receives the light and produces LOW output. When the lightrey is interrupted the phototransistor produces a logical HIGH output.

Potentiometer: Figure 9 shows interface to a potential O meter which is connected to 10 V on one side and ground to the other side. The variable point is connected to the analog input. The analog input is displayed on the front panel using gauge.

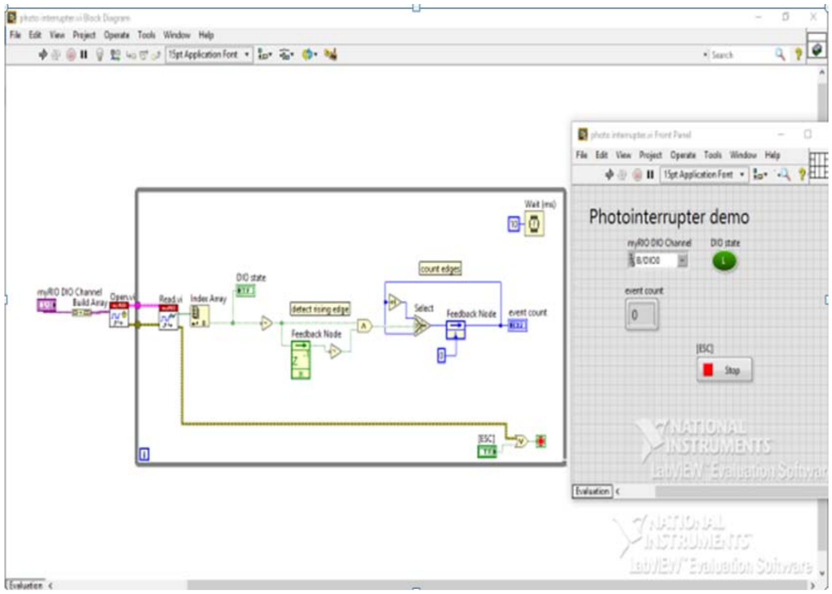

Fig. 8: Photo interrupter sensor output

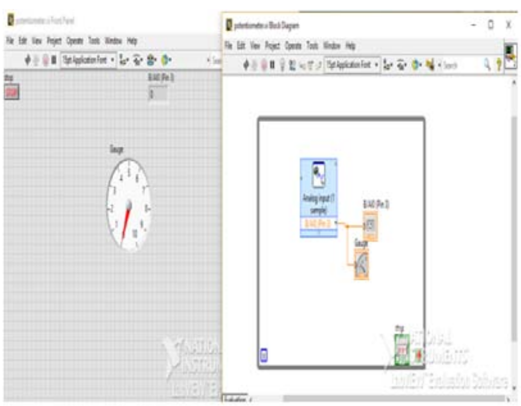

Fig. 9: Potentiometer sensor output

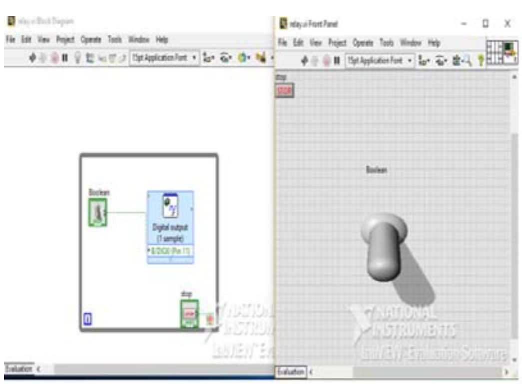

Fig. 10: Relay sensor output

Relay: Figure 10 shows interface to a relay. A 5 V relay is connected to a digital output. Other and

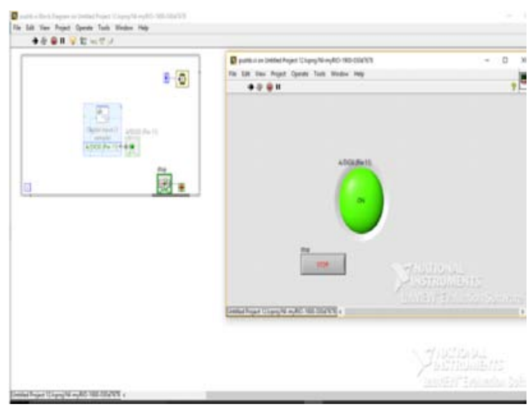

Fig. 11: Push button sensor output

of it coil is grounded. The relay can be made ON or OFF using Boolean input on the front panel.

Push button: Figure 11 shows interface with a push button. One terminal is connected to +5 V. The other is connected to digital input LED on front panel can be turned ON using push button.

Thermistor: Figure 12 shows interface to thermistor. Thermistor is sensitive to temperature and the voltage output is connected to the analog input. The value is displayed on the front panel.

Motor: Figure 13 shows motor being made ON/OFF using myRIO.

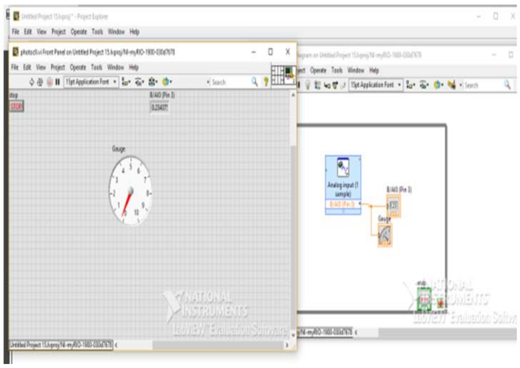

Fig. 12: Thermistor sensor output

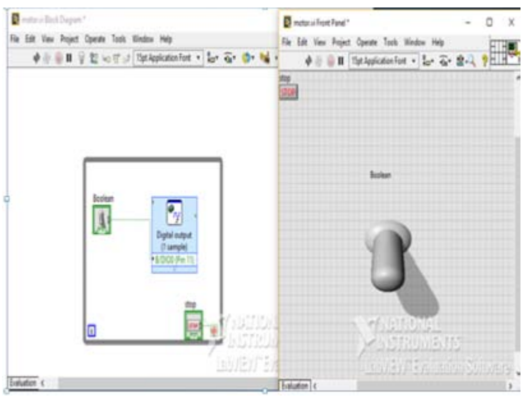

Fig. 13: Motor sensor output

CONCLUSION

In this study, interfacing of various sensors is done using NI myRIO they are controlled using LabVIEW programming. The 23 different sensors are interfaced using myRIO in which some components were meant for display, one was temperature control, one of them was light intensity measurement component, one was for measuring distance, one was relay to open and close the load, one was buzzer to sound alarm, other was photo interrupter which detects light path of light getting obstructed, one was motor for driving mechanical loads, robotic arm sets and many more, one is sonic range finder which is used to measure the distance, few were switches which were used to open and close the circuit, one was push button in which there was digital output, one was Hall effect sensor which senses the magnetic field around it. In IR Range finder it measures the infrared intensity of light. Not only these sensors different sensors and projects can be interfaced using LabVIEW. Some of the LabVIEW programs were depicted in the accompanying figures.

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