Temperature Measurement Using PmodTMP3

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Abstract - Students and educators need to have some understanding of the LabVIEW environment before attempting tasks like building a real-time application or customizing an FPGA. To help develop this knowledge, NI designed this hands-on workshop for those who have no LabVIEW experience. However, it is not a substitute for actual training — it does not cover every context menu, button or function in LabVIEW. LabVIEW is a graphical programming environment that students can use to quickly develop applications that scale across multiple platforms and operating systems. The power of LabVIEW is in its ability to interface with thousands of devices and instruments using hundreds of built-in function libraries to help you accelerate development time and quickly acquire, analyze, and present data. Applications in LabVIEW mimic the appearance of real instruments. So they are called virtual instruments or VIs. Every LabVIEW application has a front panel, an icon/connector pane and a block diagram. The front panel serves as the imitation of the realworld user interface of the device that the VI is defining. Programmers can leverage the flexibility of using multiple forms of representation for the data the instrument is analyzing. The icon/connector pane is analogous to terminals or plugs on a real-world instrument that allow it to be connected to other devices. Due to this key difference, execution control is handled by a set of rules for data flow rather than sequentially. Wires connecting the nodes (coding elements) and VIs on the block diagram determine code execution order. In summary, LabVIEW VIs are graphical, driven by dataflow and event-based programming, and are multi-target and multiplatform capable.

Keywords - LabVIEW, Virtual Instruments, Platform, Graphical Programming, Data.

I. INTRODUCTION

The NI myRIO embedded student design device was created for students to “do real-world engineering” in one semester. It features a 667 MHz dual-core ARM Cortex-A9 programmable processor and a customizable Xilinx field programmable gate array (FPGA) that students can use to start developing systems and solve complicated design problems faster—all in a sleek enclosure with a compact form factor. The NI myRIO device features the Zynq-7010 All Programmable system on a chip (SoCa) to unleash the power of NI LabVIEW system design software both in a real-time (RT) application and on the FPGA level. Rather than spending copious amounts of time debugging code syntax or developing user interfaces, students can use the LabVIEW graphical programming paradigm to focus on constructing their systems and solving their design problems without the added pressure of a burdensome tool. Three connectors (two NI myRIO expansion ports [MXP] and one NI miniSystems port [MSP] that is identical to the NI myDAQ connector) send and receive signals from sensors and circuitry that students need in their systems. Forty digital I/O lines overall with support for SPI, PWM out, quadrature encoder input, UART, and I2C; eight single-ended analog inputs; two differential analog inputs; four single-ended analog outputs; and two ground-referenced analog outputs allow for connectivity to countless sensors and devices and programmatic control of systems. All of this functionality is built-in and preconfigured in the default FPGA functionality, which eliminates the need for expansion boards or “shields” to add utility. Ultimately, these features allow students to do real world engineering right now-from radio-controlling vehicles to creating stand-alone medical devices

II. TEMPERATURE MEASUREMENT

Temperature measurement in today’s industrial environment encompasses a wide variety of needs and applications. To meet this wide array of needs the process controls industry has developed a large number of sensors and devices to handle this demand. In this experiment you will have an opportunity to understand the concepts and uses of many of the common transducers, and actually run an experiment using a selection of these devices. Temperature is a very critical and widely measured variable for most mechanical engineers. Many processes must have either a monitored or controlled temperature. This can range from the simple monitoring of the water temperature of an engine or load device, or as complex as the temperature of a weld in a laser welding application. More difficult measurements such as the temperature of smoke stack gas from a power generating station or blast furnace or the exhaust gas of a rocket may be need to be monitored. Much more common are the temperatures of fluids in processes or process support applications, or the temperature of solid objects such as metal plates, bearings and shafts in a piece of machinery. There are a wide variety of thermometers available on the market today. Some highly precise measurements are still done with glass thermometers. Since the properties of fluids, and in particular, mercury are well known, the only limitation to accuracy and resolution come in the form of how well you can manufacture a glass tube with a precision bore. Some manufacturers have made thermometers that have variable scales for specific uses. One such use is a process called wet viscosity. In this process it is important to know the precise temperature of the water bath. The glass thermometer is still used because of it extreme repeatability. These specialized thermometers have a bore that narrows at a particular point. In this way it can expand a two degree temperature range in the middle of its scale to approximately two inches long, allowing readings down to a fraction of a tenth of a degree C. Many of today's thermometers use fluids other than mercury due to the hazards of spilled mercury. These newer devices use other fluids that have been engineered to have specific rates of expansion. The drawback to these fluids is that they typically do not have the high temperature capabilities that mercury does. One major drawback of the glass thermometer is the limited pressure capacity of the glass. Also inserting the glass bulb into a pressurized fluid or chamber caused the accuracy of the thermometer to suffer. This led to the use of 'thermowells'.

The range of a thermometer and it reading accuracy is dependent on the size of the hole, the length of the tube and the fluid in the thermometer. Typically the smaller the reading increment, the less range it will have. As an example, a 0.1° C accuracy mercury thermometer with a range of 100°C will typically be about 600 mm long. The restrictions rest with how well the maker can fabricate a readable scale. To increase readability some manufacturers have moved to non-round thermometer bodies, The rounded corner on the reading side acts as a magnifying glass, making the liquid column show up wider, and easier to read. The round thermometer is still the standard and there are a variety of holders and seals to fit them. There are also armored sleeves to put them in that allow them to be used, but reduce the chance of breakage. The chart below lists some thermometers commercially available. These are clearly not all the thermometers available

III. RESULT AND DISCUSSION

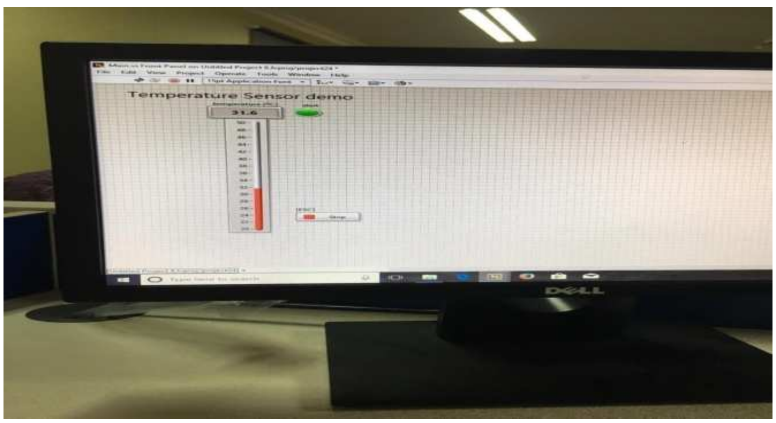

Fig. 1. Temperature obtained

Pmod devices are Digilent's line of small I/O interface boards that offer an ideal way to extend the capabilities of programmable logic and embedded control boards. They allow sensitive signal conditioning circuits and high-power drive circuits to be placed where they are most effective - near sensors and actuators. Pmod modules communicate with system boards using 6, 8, or 12-pin connectors that can carry multiple digital control signals, including SPI and other serial protocols. Pmod modules allow for more effective designs by routing analog signals and power supplies only where they are needed, and away from digital controller boards. The Pmod TMP3 is an ambient temperature sensor built around the Microchip TCN75A. Users may configure the output through I2C to up to 12 bits of resolution as well as setting a trigger to occur when a user defined temperature threshold is reached.

- Features
- Uses the Microchip TCN75A
- Ambient temperature sensor with up to 12-bit resolution
- Typical accuracy of ±1 °C
- Programmable temperature alert pin
- Multiple jumpers for eight selectable addresses
- 30ms to 240ms typical conversion times
- 2×4-pin connector with I2C interface
- Follows Digilent Pmod Interface Specification
- Small PCB size for flexible designs 1.0" × 0.8" (2.54 cm × 2.0 cm)

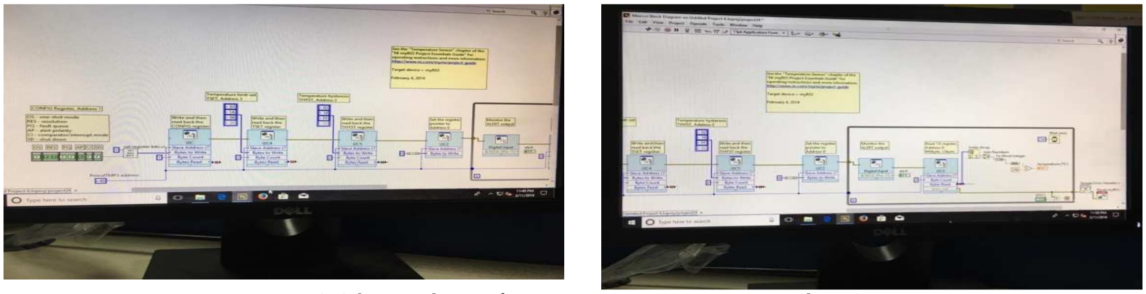

Fig. 3. Schematic diagram for measuring temperature using PmodTMP3

IV. CONCLUSION

Temperature is the most often measured environmental quantity and many biological, chemical, physical, mechanical and electronic systems are affected by temperature. Some processes work well only within a narrow range of temperatures. So proper care must be taken to monitor and protect the system. When temperature limits are exceeded, electronic components and circuits may be damaged by exposure to high temperatures. Temperature sensing helps to enhance circuit stability. By sensing the temperature inside the equipment, high temperature levels can be detected and actions can be taken to reduce system temperature, or even shut the system down to avert disasters. Several temperature sensing techniques are used currently. The most common of these are thermocouples, thermistors and sensor integrated circuits (ICs). Here we are using PmodTMP3 temperature sensor for measuring the temperature using my rio and lab view software. In this we also explained past and future of temperature measurement.

V. FUTURE SCOPE

The present work is focused around the design and development of cost effective PC based data acquisition system (DAS), both hardware's and software. The designed systems are having 12-bit resolution only. Resolution can be further increased by using high resolution external ADCs. To make the designed system more flexible with better performance, the following modifications can be made i ADC : ADC's resolution can be increased by selecting high resolution ADCs, ii Microcontroller: selection of advanced version of microcontroller for higher speed, resolution and better performance,
Sensor: selection of high quality sensors, integrated or smart sensors to get faster response speed with higher resolution and better performance, Hardware and software: hardware and software modifications to enable long distance acquisition, remote access (wired and wireless) etc., Miniaturization: Miniaturization of the designed system by using surface mount devices (SMD components). Then, the scope and applicability of the designed system will be increased. It can be used for the applications in various fields in physics, chemistry, life sciences, engineering, medical, geological applications etc.

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