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LABVIEW Based Data Acquisition and Automation

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Abstract— LabVIEW short for Laboratory Virtual Instrument Engineering Workspace is graphical user interface programming software developed by national instruments commonly used for data acquisition, instrument control and industrial automation. Data acquisition is the process of analyzing an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound with a computer. A Data acquisition system consists of sensors, Data acquisition measurement hardware, and a computer with programmable software. Compared to traditional measurement systems, PC-based Data acquisition systems exploit the processing power, productivity, display, and connectivity capabilities of industry-standard computers providing a more powerful, flexible, and cost-effective measurement solution.By using various control systems and data acquisition hardware we introduce an automatic system with minimal or reduced human intervention.

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I. INTRODUCTION

Today, most scientists and engineers are using personal computers with PCI, PXI/compactPCI, PCMCIA, USB, ISA, for acquiring and analyzing physical phenomena such as pressure , temperature or voltage in laboratory research, test and measurement industrial automation.

LabVIEW is one software tool that can span all of your hardware components. Drivers are readily available for common hardware devices. Each hardware driver shares a similar, familiar programming model, and examples of how to use the model install directly into LabVIEW.With LabVIEW,one can use all of the hardware with a single development environment. Connectivity is made possible with driver software, which serves as the communication layer between LabVIEW and your hardware. LabVIEW driver software supplies seamless integration across multiple types of instruments, buses, and sensors, including data acquisition devices; boxed instruments; modular instruments; motion controllers and motor drives; machine vision and image processing hardware; wireless sensors. In the rare event that a LabVIEW driver doesn't already exist, you also can import drivers from other programming languages or use low-level communication to implement your own driver.

Data acquisition based on LabVIEW is a good, inexpensive and easy to use solution for Radiation Detection and Measurement in the industries, power plants, hospitals or in laboratories.

The radio activity of particles is measured by a Scintillator detector. Every radioactive particle radiates energy. One needs to convert this energy into voltage in order to detect the radio activity. For this purpose Scintillator detector is used. It gives us pulses which is a function of radioactivity of that particle. The more pulse a particle generates at a given time the more radioactive the particle is. For example, if particle A gives 10 pulses in 1 hour and particle B gives 1000 pulses in 1 hour, then particle B is 100 times more radioactive than particle A. The pulse from Scintillator detector is then connected to DAQ card NI USB 6341, which is installed in our PC. After that

LabVIEW program is used to make interface between DAQ card and PC to measure radio activity. It measures the pulses for peak. Then it counts the number of peaks for a given time and stores it in the PC.

The radio activity of a material is proportional to the number of pulses it generates at a given time. Then recorded radio activity data can be observed at a given month from LabVIEW code and it can also be stored in the PC.

Modern software applied in nuclear instrumentation plays a key role for their safe operation and execution of commands in a user friendly manner. Correct data handling and transfer has to be ensured. Additional features such as data visualization, interfacing to PC for control and data storage are often included.

LabVIEW is used so that development of sophisticated measurement and control instruments using intuitive graphical icons and connecting wires resemble a flowchart. LabVIEW also offers powerful integration with hardware devices for analysis and data visualization.

Fig 1:BLOCK DIAGRAM

II. RADIOACTIVE MATERIALS

There are number of radioactive materials accessible, for example, Uranium, thorium, plutonium and so on. Alpha, beta, gamma are discharged by these radioactive materials and can be detected by three distinctive sorts of indicators to be specific strong state, gas filled and glimmer finders and proselyte them into a comparable electrical sign to be broke down.

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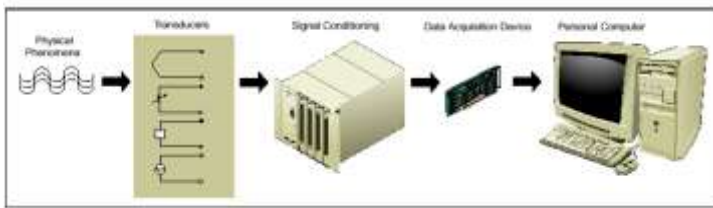## III.   DATA ACQUISITION (DAQ)

Fig 2: PC based DAQ system

A PC based DAQ system depends on the following system elements

- Transducer/Detectors
- Signal conditioning
- DAQ hardware
- Software
- Personal computer

IV.   TRANSDUCERS/DETECTORS

Transducers are devices that convert one type of physical phenomena such as voltage, temperature, pressure or light into another. For radioactivity there exist three types of detectors that convert radiation into its equivalent voltage.These 3 detectors are:

- SOLID STATE DETECTOR

  A solid state detector is a solid material like crystal,glass or plastic which are exposed to nuclear radiation. Due to the radiation electron-hole pairs are created in the detector which in turn is connected a battery so that the electron-hole pairs are attracted towards their respective terminals of the battery causing current to flow. This current flow is then examined microscopically.

- SCINTILLATION DETECTOR

  The basic principle behind this instrument is the use of a special material which glows or "scintillates" when radiation interacts with it. The most common type of material is a type of salt called sodium-iodide. The light produced from the scintillation process is reflected through a clear window where it interacts with device called a photomultiplier tube (PMT).

  Features of scintillation detectors:

  1. High conversion efficiency
  2. Color of emitted light match spectral sensitivity of the light receptor.
  3. Rugged, unaffected by moisture, and inexpensive to manufacture.

- GASEOUS DETECTORS

  A gas-filled detector consists of a volume of gas between two electrodes, with an electrical potential difference (voltage) applied between the electrodes. In this detector, ionizing radiation produces ion pairs in the gas. Positive ions (cations) attracted to negative electrode (cathode) and electrons or anions attracted to positive electrode (anode). In most detectors, cathode is the wall of the container that holds the gas and anode is a wire inside the container.

V.   SIGNAL CONDITIONING

The electrical signs created by the transducers must be improved for the info scope of the DAQ board for which this equipment is utilized. Signal molding adornments can increase low level signs, and afterward confine and channel them for more exact estimations. Moreover, a few transducers require voltage or current excitation to produce a voltage yield. Some sign molding equipment frameworks are SC-207X, AMUX-64T, SCXI.

Enhancement the most well-known sort of molding is intensification. Low level signs ought to be opened up to expand the determination and decrease commotion. For the most noteworthy conceivable precision, the sign ought to be enhanced so that the greatest voltage scope of the molded sign equivalents the most extreme information scope of the simple to computerized converter.

Separation another normal application for sign molding is to seclude the transducer signals from the PC for wellbeing reason. The framework being checked may contain high voltage transient that could harm the PC.

Multiplexing-signal molding gadgets give measuring of a few signs with a solitary measuring gadget accomplishing multiplexing. It gives numerous channels where signs are tested in every channel. SCXI modules for simple signs utilize multiplexing so that the greatest number of as signs can be measured with one DAQ board.

Sifting the reason for channel is to expel undesirable sign from the wanted sign to be measured. Different channels are given by sign molding frill, for example, antialiasing channel which acts like a lowpass channel.

Excitation-signal molding extras give outside force supply to some inactive transducers like RTDs.

VI.   DAQ HARDWARE/DAQ BOARD

DAQ performs the task such as sampling, quantization and multiplexing.

It specifies the number of channels, sampling rate, resolution and input range of the signal to be measured. Sampling is the process of converting an analog signal into a discrete signal. The sampling rate should be greater than or equal to the Nyquist rate (greater than twice the frequency of the signal to be measured) so that signal is properly acquired. Quantization is the process of converting these discrete analog samples into corresponding digital bits. Resolution-the number of bits that the ADC uses to represent the analog signal is the resolution.

VII.   COMPUTER SOFTWARE:

LabVIEW programming changes the pc and DAQ equipment into a complete DAQ, examination and presentation framework. Driver programming shrouds the low-level, confused points of interest of equipment programming, giving the client a straightforward interface.

LabVIEW:
LabVIEW (short for Laboratory virtual Instrument workspace) is graphical client interface programming. It varies from conventional programming like C, C++, or Java, in which client composes the system with content.

System is executed by the structure of a graphical piece chart (the LabVIEW-source code) on which the software engineer interfaces distinctive capacity hubs by drawing wires.

Interfacing to Devices:
zLabVIEW incorporates broad backing for interfacing to gadgets, instruments, cameras, and different gadgets. Clients interface to equipment by either composing direct transport charges (USB, GPIB, and Serial) or utilizing abnormal state, gadget particular, drivers that give local LabVIEW capacity hubs to controlling the gadget.

LabVIEW additionally gives estimation and mechanization adventurer to giving the data about the gadgets associated with the PC with their reproduction and testing.

Applications of LabVIEW:

LabVIEW allows the system to connect to nearly any instrument over any interface. It provides seamless integration to provide an instrument control system. Furthermore user can visualize the result using custom user interfaces and to choose how to store or report a data so that we can view it later for future purposes.
LabVIEW saves a lot of time since the codes for the program don't need to be started from scratch. It also provides simulations for many programs and systems so that user can view his/her faults.
Programs that require precise timings like event driven programming are accurately executed in LabVIEW.
It can be used for many applications like real time operating system, signal processing, Image processing etc.

Implementation of data acquisition through LabVIEW
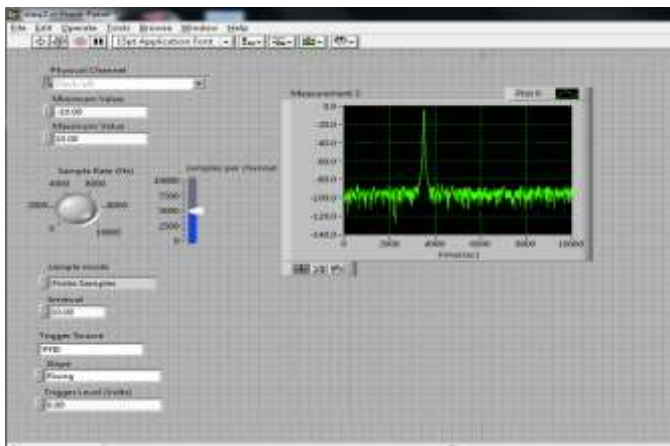

Fig 3: FRONT PANEL

Fig 4: PROGRAM BLOCK DIAGRAM

CONCLUSIONS

It is clear that LabVIEW is the most suitable software for data acquisition as it provides graphical user interface programming, it's capability to interface with other hardwares with flexibility and it's speed to communicate with them. Signal conditioning makes it easier to analyze the acquired signal with reduced noise and other interruptions with desired amplification. Hence acquiring data like radiation and for automatic report generation with least human intervention the method provided in this paper is most suitable for Data acquisition.

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