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APPLICATION OF THE NI LABVIEW IN THE VERIFICATION OF ANALOG MEASURING INSTRUMENTS

This paper is an attempt to summarise and systematisation of the NI hardware and software functionality of the NI LabVIEW for verification of measurement instruments. The mentioned possibilities of the software make it suitable for verification of measurement instruments with analog indication. The report offer modern solution for verification of measurement instruments.

***Keywords**: Verification, LabVIEW.*

Application of virtual measurement technology for verification of measuring instruments

According to the definition of the American company National Instruments "Virtual instrument is a combination of hardware and software solutions, which under the management of the personal computer have the functionality of the classic measuring instrument".

Virtual instruments in addition for to the control, collection and processing of the data, offered by means of in the development of specific software applications. They are convenient to use an interactive graphical user interface.

It is known that of ensuring the metrological traceability of the results obtained by different means of measurement most-often used activities such as verification and calibration [1, 2].

The goal of this work is to offer modern and metrologically accurate solution for verification of analog measurement instruments. For the attainment of the objective provides for the development of a virtual system, realized on the basis of specialized software, LabVIEW Academic Standard Suite hardware module NI PCIe-8231 Gigabit Ethernet interface based on the Intel 82572EI gigabit controller, helps to get the most performance from GigE Vision camera (IEEE 1394 Camera or NI 1764 Smart Camera), as well as a PC. This system will be used for verification of ammeter or voltmeters with non-high class of accuracy and which do not support the standard interfaces for communication, such as GPIB, USB, RS232, etc. for the interchange and processing of information in real time[5]. The proposed system will allow flexible reconfiguration in terms of type and eliminates the human factor.

The main point in the system is the NI Vision Development Module – a library, part of the software package LabVIEW, with multiple algorithms for image processing and functions for improving them, checking for the presence of inaccuracy, detection feature, the identification of sites for measuring elements and others. Part of this module is NI Vision Assistant is software for acquiring, displaying, and monitoring images from multiple types of cameras.

Structure, algorithm and implementation of workplace for verification of measuring instruments

Virtual system for verification of measuring instruments is an automated system and is from closed type. It therefore excludes any physical human intervention in the process of verification and calibration. Example block diagram of the proposed workstation is shown in Fig. 1.

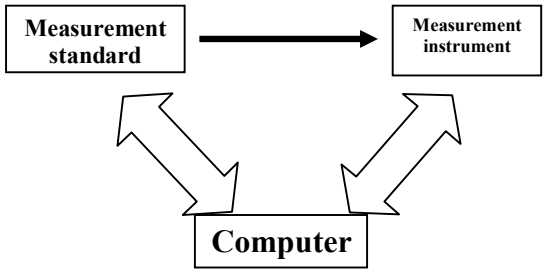

Fig. 1. Block diagram of automated system for verification and calibration of measuring instruments

Processes of verification in this case are controlled by a PC as a standard and instrument exchange data with computer. Through computer are determines when and what values to apply from standard to the instrument, to set moment of measuring the number of measurements for each specific value, and the sequence of operations related to verification. Using a computer can be performing following processing of measurement results and preparation of relevant reports.

The relationship between measurement standard and measuring instruments with computer is through various communication interfaces. The most common are GPIB (IEEE 488.2) and RS232 interfaces, and in recent years and the USB interface. There is a huge range of digital measuring devices without a PC interface, which is an obstacle to building an automated system for verification

[3]. An approach with the ability to automate is proposed, described and implemented in this paper. The approach is based on the idea of the human eye can be replaced by a camera that connected to the proper configuration to capture measurement data (the value of on-screen on the instrument). Recognition of the image on the screen or scale is performed by appropriate software.

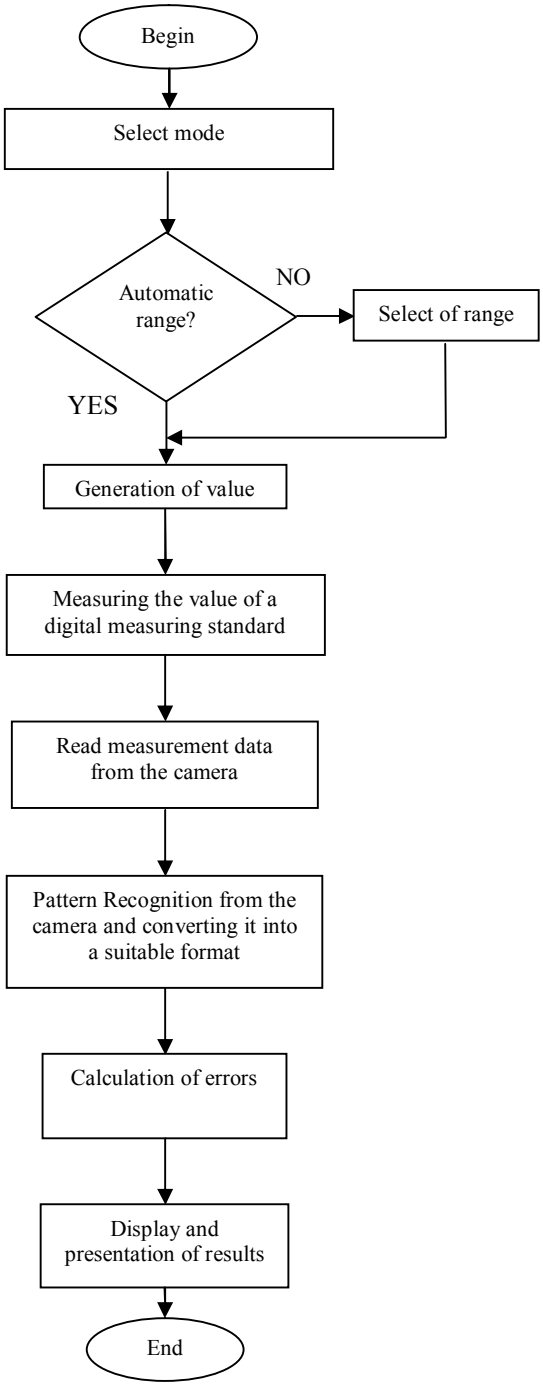

Fig. 2. Algorithm for an automated system for verification of measuring instruments with analog pattern recognition

For correct and optimal development was synthesized algorithm for control of automated system for verification of measuring instruments with analog pattern recognition (Fig. 2).

In the implementation was used software package of the National Instruments LabVIEW Academic Standard Suit. The package includes a full set of standard modules of LabVIEW virtual instruments for measurement, control, signal processing and communication applications. Important part in the implementation was assigned to the Vision Development Module, which contains a hugeness library with a large number of algorithms for image processing and features to improve them, make checks for the presence of non-compliance, identifying characteristics and identification of objects. Vision Development Module can generate LabVIEW code to using a virtual instrument of high hierarchical level with Vision Assistant (Fig. 3). It supports image processing from analog and digital cameras, also is compatible with USB, IP cameras and modern Smart cameras (Fig. 4) [4].

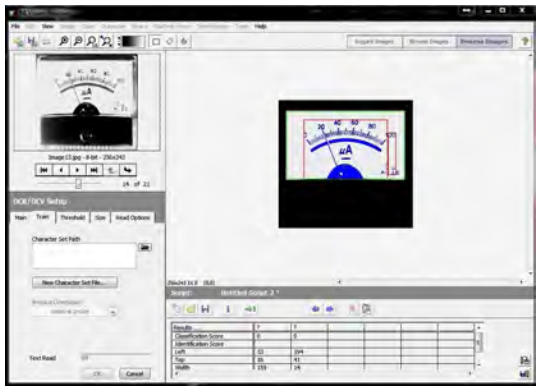

Fig. 3 Vision Assistant for recognizing images from an analog measuring instrument

Fig. 4 NI 1764 Smart Camera

Fig. 5 NI PCIe-8231 Gigabit Ethernet interface IEEE 1394

NI provides an interface for communication NI PCIe-8231 with the camera, which processes the received signals and images (Fig. 5).

Recognition of digital images using pre-trained library of images. Upon learning of this library is going through several stages. It should be choose a device which will receive the images. Then using the function Match Label, to find regions of gray images that correspond a predetermined pattern. Pattern matching can be found despite poor lighting, noise, movement and rotation of the template. After many functions related with the construction of the coordinate system, comparing the areas of image.

Virtual instruments for recognizing data from analog measurement instrument

Recognition of the image is needed to carry out preliminary training of the software used. To draw a line on the needle starting from the tip to the base (Initial position – 0), after that – a line on the needle (Range position) [6]. The number of required images needed to recognize indications of instrument is determined during the work. In the Block diagram (Fig. 6) in the working image is remain of the steps work, anytime can be returned to each step and specific and change settings or to be deleted [6].

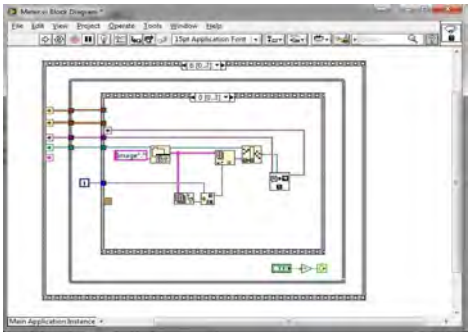

Fig. 6. Sequence of steps for processing an image

The main point in recognition of indications from a analog display is to be set correctly beginning and control point of scale. Fig. 7 is an example NI virtual instrument for measuring with analog instrument. in the proposed Virtual Instrument analog instrument can't be used for verification of analog instruments [6].

Conclusion

Typical examples of processing on analog data from the virtual instruments are metrology activities such as verification and calibration [3]. In addition with opportunities offered by software is possible that these activities are performed in real time with results from real measurements.

The proposed virtual system for verification of measuring devices can be realized and examined in AC/DC voltage/current mode.

In development this measurement standard can be use devices with different accuracy and performance.

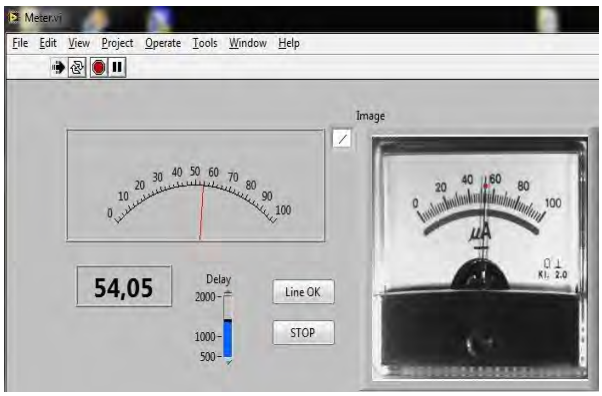

Fig. 7. Virtual instrument
for measuring an analog instrument

The established algorithm can be use to develop system, namely:

• System, which includes PC, METRIX CX1651 (measurement standard), analog instrument NI PCIe-8231 Gigabit Ethernet interface IEEE 1394 Camera or NI 1764 Smart Camera,

In described an automated mobile virtual system for verification of measuring instruments with analog pattern recognition, the main problems will be related to processing of information from the camera.

References

1. ISO IEC 17025. General requirements for the competence of testing and calibration laboratories.

2. БДС 17397:1998 Метрология. Речник на основни и общи термини по метрология.

3. Slavov V. Computer Based System for Automated Calibration of Measuring Devices / V. Slavov, P. Tzvetkov, N. Gurov.// Proceedings of 5th international scientific conference COMPUTER SCIENCE' 2009, part II. – Sofia, Bulgaria, November 5–6, 2009. – P. 267-272.

4. [Електронний ресурс]. – Режим доступу до ресурсу: http://zone.ni.com/devzone/cda/tut/p/id/3470.

5. [Електронний ресурс]. – Режим доступу до ресурсу: http://www.ni.com/vision.

6. [Електронний ресурс]. – Режим доступу до ресурсу:http://www.ni.com.

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ЗАСТОСУВАННЯ NI LABVIEW ПРИ ПОВІРЦІ АНАЛОГОВИХ ВИМІРЮВАЛЬНИХ ПРИЛАДІВ

К.С. Галабов

Дана стаття є спробою узагальнення та систематизації застосування апаратного та програмного забезпечення NI LabVIEW для повірки засобів вимірювань. Згадані можливості програмного забезпечення роблять його придатним для повірки вимірювальних приладів з аналоговою індикацією. Стаття пропонує сучасне рішення для повірки засобів вимірювань.

Ключові слова: *повірка, LabVIEW.*

ПРИМЕНЕНИЕ NI LABVIEW ПРИ ПОВЕРКЕ АНАЛОГОВЫХ ИЗМЕРИТЕЛЬНЫХ ПРИБОРОВ

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Данная статья является попыткой обобщения и систематизации применения аппаратного и программного обеспечения NI LabVIEW для поверки средств измерений. Упомянутые возможности программного обеспечения делают его пригодным для поверки измерительных приборов с аналоговой индикацией. Статья предлагает современное решение для поверки средств измерений.

Ключевые слова: *поверка, LabVIEW.*