Ecopedological Laboratory Using LabView

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Abstract: - These days' computer and virtual scenes is of course in laboratory works on engineering disciplines and beyond. This paper aims at presenting the steps of performing work in biology. In biology laboratory will place a virtual reality pilot station for the teacher to be able to combine elements of real lab with virtual lab.

Key-Words: - *LabView, bio indicators, virtual laboratory, virtual learning, microscope*

1 Introduction

The concept of virtual instrumentation, was introduced about 20 years ago by National Instruments with the launch programming language *LabView*, is based on the idea of allowing the user to build a tool for their needs, rather than adapt existing tools needs. [1]

A virtual instrument (Virtual Instrument-VI) consists of a standard industrial PC or a workstation equipped with powerful software, hardware suitable in terms of cost (plug-in cards and drivers related) which together perform functions of traditional tools.

The emergence of virtual instruments has made a significant shift from hardware-centered instrumentation systems to software-centered ones, facilities using computers; productivity and interface interconnect capabilities of desktop computers and workstations. [2]

The computer takes data measurements made via plug-in cards (that plugs into a slot on the computer's motherboard) or standalone instruments, performs data processing and provides user interface.

The computing platform used is provided by IBM compatible PC, but other development tools like Macintosh platforms, platforms based on VME and Unix systems. [3]

Today there is various software environments used to build virtual instruments such as:

- LabVIEW from National Instruments;
- different versions of Basic (including Visual Basic, QuickBasic and others)
- other languages and software environments (such as C, C^{++}, ActiveX, Java, etc.).

The software illustrates the most important component of a virtual instrument. Using suitable software tool engineers, scientists and teachers can create their own applications, designing and integrating routines that a process requires. They can also create a corresponding user interface, and the appropriate application that will interact with the tool, define how and when will the data acquisition device used as process, manipulate and store information and how the results of user. [4]

Virtual instruments actually more than replace existing systems improve process control. Through the Internet has opened a new era in data sharing and virtual instruments brought about new features networking and tele working.

Virtual instruments can use the advantages of the Internet, being able to publish data on the web directly from the device control measurements and view the data on a PDA (personal digital assistant) or even mobile phone. [6]

In the last decade there has been some commercial software to develop virtual instrumentation systems using only graphical programming methods. Each of these products provides users who are not professional programmers generally a „graphical development environment" to achieve a system of ordinary virtual instrumentation.

Usually, the user presents a development environment of „desktop" that looks similar to Windows-based graphics applications, where a variety of software options and utilities are available in toolbars and dialog boxes and pull-down menus can be accessed using the mouse cursor. [7]

The above older software packages for the development of virtual instrumentation systems using graphical programming resources providing users with tools to develop diagrams „data stream".

The user of this software must place on the desktop icons representing the components you want and then make connections between them. To

make data flow diagram corresponding functional measurement system, the user must have detailed knowledge about specific data flows and combinations of elements necessary to achieve the objectives of the user.

User developed systems that use this type of software is prone to errors because they allow the user to interconnect components which, functionally, are incompatible. Field applications may be subject to a system of instrumentation covers the human activity.

Therefore, a software development system that aims to provide a representative part of potential users, tools to develop their own specific instrumentation systems, should provide the user a wide range of options and development tools, including some that may in a given application may be incompatible.

Ideally, such a system should also include software tools to organize, in a manner allowing the user to easily select individual tools that are most appropriate application, and to guide the user in selecting the configuration.

Older software packages have included building protection systems inoperable combinations of components and provides inadequate guidance intuitive user trying to develop a measurement application.

An important objective in developing newer instrumentation software package is to guide intuitive user to choose items that are appropriate project build system and automatically prevents selecting elements that are incompatible.

2 Problem Formulation

Programming language from National Instruments LabVIEW is a graphical development environment for creating flexible and affordable rapid application design, control and testing at minimal cost.

With NI LabVIEW engineers, scientists and teachers interface with real-world signals, analyze data for meaningful information, and share results obtained by intuitive display modes, reports and Web.

Regardless of the user experience with LabVIEW applications can be developed quickly and easily. In many areas of industry all over the world, such as automotive, communications, aerospace, semiconductor, electronics, engineering and environment using LabVIEW to increase productivity.

Applications cover all phases of product development: research and testing, production and maintenance.

LabVIEW is a graphical programming language complete with all the standard features of a general purpose programming environment such as data structures, iterative structures and processing events.

LabVIEW programming language has included a compiler that reproduces all codes while editing. Unlike other general-purpose programming languages, LabVIEW is designed for engineers and scientists and has included tools to solve their problems.

These high-level functions, facilities and utilities assistance make LabVIEW is much more than a programming language. LabVIEW is available for both PCs with Windows XP/2000 operating systems and those with Mac OS and Linux [8].

Virtual Instrumentation Package from National Instruments for Educational Laboratories (NI ELVIS - National Instruments Educational Laboratory Virtual Instrumentation Suite) is a language software development and prototyping based on LabVIEW for university science and engineering laboratories.

NI ELVIS consists of LabVIEW-based virtual instruments in multifunction data acquisition device, a workstation and a plate designed specifically for prototyping. (figure 1)
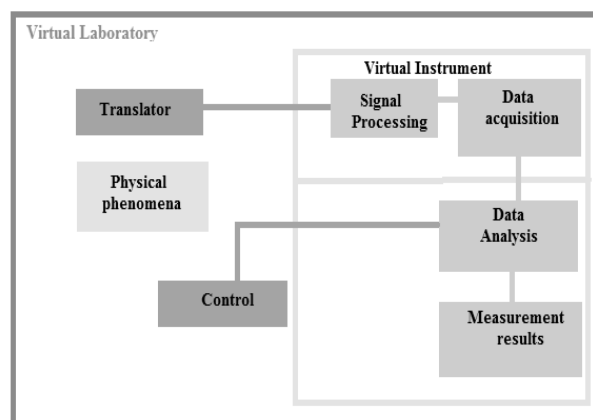

Figure 1. Virtual Laboratory

Through the combination provides a complete package of tools that are normally in all educational laboratories.

As is based on LabVIEW and provides complete data acquisition possibilities and prototyping, the system is ideal for undergraduate courses, from low level to the high level of difficulty.

Laboratory work in engineering curricula includes revegetation works, analysis of environmental factors, and studies bio indicators of environmental quality control, instrumentation and data acquisition. [9]

3 Problem Solution

Increased performance for scientific and higher education system compatible with the requirements of a knowledge-based society requires, in addition to the creation and funding of advanced interdisciplinary research centers and universities access to a range of advanced technologies including virtual education:

- transmission of knowledge through the use of modern technologies and synchronous asynchronous e-learning.

- simulation processes and methods specific engineering disciplines and environmental protection industry.

- experiencing specific situations that you will find graduates of engineering and environmental education in practice.

These requirements imply the existence of competing facilities in ICT (Information and Communication Technology) as a prerequisite for alignment with European standards and international standards in the following contexts:

- reducing costs of education by using e-learning technologies for synchronous and asynchronous.

- limiting the number of experiments on samples collected from environmental factors, using modern methods of simulation and virtual modeling normal processes and pollution.

- experiencing specific situations that you will find graduates of engineering and environmental education into practice through the use of environmental knowledge base (Environmental knowledge management system).

- environmental expert systems and technologies such as „virtual environment".

Develop the virtual learning laboratory project assumes the following:

- virtual microscopy laboratory with work rooms equipped with workstations integrated into the institution's intranet, rooms located in the subjects that concern the study: ecological, pedological, ecological restoration, cell biology, microbiology,bioindicators of air pollution, air depollution of the Faculty of Mines, respectively disciplines of botany, cell biology, ecology, pedology and air remediation.

Say that a large part of learning engineering solutions and virtual environment that we intend to use the university's intranet, and through online Internet access are free solutions for the academic community (many of them under Open Source - Open Source).

✓ **Virtual laboratory ecopedological**

To make teaching at European level, particularly if fundamental, engineering and environment, the modern approach is needed that takes into account the huge advances made in digital technology in recent years.

Therefore, we propose a new approach, at least for our university, to conduct practical activities with students from the Faculty of Mine: implementation of interactive examination of microscopic preparations, the bio indicators of air pollution in an electronic virtual, in other words a virtual laboratory eco pedological.

This model is multidisciplinary, applied to all subjects that concern the study: ecological, pedological, ecological restoration, cell biology, microbiology, bio indicators of air pollution, air remediation at school me and botanical subjects, cell biology, ecology, pedology and air remediation.

To achieve this goal requires the following devices:

- slide scanner
- storing images
- individual workstations for students.
- further processing station designed graphic images intended for the specialized teaching materials.

✓ **The advantages of such a system**

A slide scanner is a tool purchase digital images from slides microscopic microscope. Its basic principle is digital scan of histological slides and image storage to be used later.

The main advantages over a classical system (microscope + camera) is that due to high resolution, the images are sharp and may be increased/decreased to simulate various objective examination, eliminating the need to capture multiple images of the same slide.

This system is very practical in the current teaching activity, making it easier than demonstration and explanation of the various histological structures or effects of pollution on plant and animal tissues and cells.

To be used for teaching purposes, it is necessary to connect to a storage server (file server) or equipping of rooms with workstations connected to the server.

Through workstations, students will be able to study individual virtual preparations included in work practice, and review system while allowing all collections studied hitherto in order to enhance knowledge.

By using this system with a solution of LMS (Learning Management System) such as IBM, there is the possibility to verify knowledge through online

tests. Given that such a system is more manageable, students will be able to plant biology laboratories, ecology, pedology and air remediation and outside office hours to review the preparations.

Implementing such a modern system will also help to increase the impact of engineering disciplines among students, contributing significantly to increased interest in the first years of study disciplines of engineering and environmental protection. Such a system helps to facilitate the teacher's work, having the opportunity to demonstrate various structures interactive material, and also to examine how students participate in the practical work.

The system facilitates the development of various teaching materials with application both in universities and in the post: electronic or paper atlases classic courses of practical guides, PowerPoint presentations supporting courses or conferences.

Other advantages, not insignificant, are related to the material aspect. Replacing all optical microscopes equipped fundamental disciplines would be investing an amount higher than that which would allow support of this project. Regular maintenance of these microscopes and spare parts are also expensive.

On the other hand will significantly reduce procurement costs, of reagents and process for obtaining specific substances blades.

At the same time it eliminates variations due to differences in quality between classic dishes, ensuring uniformity in teaching. It also will not show differences inherent to date, the preparations studied during the year and those reserved for the practical exam.

Being a modular system based on technology in the future it can grow by adding new components useful both in teaching and in the assessment of knowledge.

The system that we propose addresses the needs of several disciplines: cell biology, ecology, soil science, and microbiology and air remediation.

We propose to pilot this project discipline is the discipline of biology, and then this system will be extended to all disciplines mentioned above.

List of equipment required for the first phase of the project:

1. Sistem Nikon Coolscope; Buc. 1
Technical Specifications:

Samples Observable: 1 slide glass preparation (up to 1.7 mm total thickness including slide glass and specimen).

Observation Method: Transmitted bright field.

Observable Area: Entire area of slide glass (26mmx76mm)

Image Display Mode: Macro (full slide glass preparation area) and micro images (partial enlargement)

Optics: CF corrected infinity optics

Illumination: White LED

Focusing: Autofocus and manual

Magnification Changeover: Motorized on CCD, 5x, 10x, 20x, 40x (micro image)

Electronic Zoom: 1.4x, 2x, 2.8x, 4x, 16x (micro image)

Image correction: White balance (method of setting color balance)

Equipment setting: Auto and manual

Image size: 2560x1920 pixels or 1280x960 pixels

Image file format: BMP, JPEG compliant (3 compression rates selectable)

Recording media: CompactFlash card (type I and II)

Network: Ethernet (10/110Base-TX), HTTP Server, Telnet Server, FTP Server, FTP Client

Interface: USB1.1 host port (USB mouse, USB keyboard)

Power source: AC 100-240v, 50/60 Hz.

Power consumption: 120VA

Description of functionality: Nikon slide scanner is a digital Coolscope encompassing classic analog functions of a microscope, of a digital camera cameras and a computer in a single device.

Allows viewing by transmitted light microscopic preparations in a quick and easy, with self-aligning, motorized change targets, controls for aperture diaphragm intensity light and color balance, and also motorized table.

The user loads the machine blade, which immediately generates an image macro for guidance. Surfing the blade is simple, using the mouse for watching any area of the specimen, either by continuous scroll or frame.

Position is marked on the macro picture. Can be stored up to 10 coordinated allow users live with one stored image change at any time. The system includes 4 objectives – 5x, 10x, 20x and 40x. Position of aligning and camera settings can be stored and quickly changed via GUI.

Coolscope module integrates a LED lighting system (for constant color temperature), a digital camera with a resolution of 5 megapixels that provides accurate images in SXGA format. High resolution images can have sizes up to 2560x1920 pixels in BMP or JPEG compatible.

In addition, Coolscope can be integrated into a LAN, using TCP / IP protocol, for storing images on

a server or to allow remote viewing of images (tele-microscopy). Also Coolscope can be connected to a projector.

*2. **Graphic Station***; Buc. 1

Technical Specifications: Processor: AMD64 3700+, 2 GB RAM, video card ATI Radeon X1600 series minim 128 MB RAM, HDD 200 GB SATA2, 4 USB, 1 RJ-45 10/100/1000 MBps, 1xFirewire (1394), DVD±RW, Monitor 19 SXGA LCD TFT 4 ms; operating system MS Windows XP.

Functional description: Station is dedicated to post-processing graphics microscopic images captured with Nikon Coolscope system using free software / Open Source GIMP Image Tool or type to achieve educational materials in electronic format.

*3. **Workstations;** Buc. 25*

Technical Specifications: Processor: minim AMD64 3400+ or Intel PIV 3 GHz, 1 GB RAM, video card minim 128 MB RAM, HDD 120 GB SATA2, DVD±RW, 4 USB, 1 RJ-45 10/100/1000 MBps, Monitor 17 XGA LCD TFT 8 ms; operating system MS Windows XP.

Description of functionality: Workstations will enable students to pursue real-time professor teaching material through standard solution „*remote teaching and monitoring*" NetOpSchool using microscopic images captured with Nikon system and stored on the fileserver Coolscope Virtual Learning Center.

Also, students can download the desired blades fileserver can analyze them, being constantly monitored by the teacher using the same solutions. The system allows the teacher to do real-time annotations and temporary marking a certain image to facilitate acquisition of material taught to students.

*4. **NetOp School - Remote teaching and monitoring software, e-learning sincron***

Technical Specifications:

1 module Teacher + 30 modules Student

Description of functionality: Software "remote teaching and monitoring" provides a synchronous *teaching environment* using *virtual classrooms,* ensuring teacher one or more of the following features: „*remote broadcast screen*" - which runs the computer teacher „teacher" is displayed simultaneously in real time on screens students; „*remote control*" – teacher can complete remote control of a computer-student either full screen or in a normal window, *"remote monitoring"* - teacher can monitor simultaneously, what happens on computers to all students and can occur at any time,

„*remote lock / unlock*" - the teacher can lock / unlock, simultaneously or in turn, student computers.

The system allows the teacher to do real-time annotations and temporary marking student screens or a specific file (microscopic picture) to facilitate acquisition of material taught to students. There is also the possibility that the teacher distributes all/some students a series of files (images microscopic) and collect on student workstations desired files, transparently to them. The solution enables facilities audio/video and chat between teacher and students.

*5. **Active network components -***Switch 48 ports 10/100/1000 Mbps

Technical Specifications:

GigaX2048 ASUS 48 Ports Layer 2 Managed 48p-10/100 RJ-45 +2p-10/100/1000 RJ-45+2 SFP slot, BROADCOM Up to 8000 MAC Addresses 256 VLAN groups Switch Fabric Capacity 8.0 Gbps Forwarding rate 10.1 Mpps

Description of functionality: Active network equipment is intended to ensure communication with virtual learning center work room, or the rest of the IT infrastructure of the University. Excess number of ports took into account the possible future expansion of the network.

4 Conclusion

By creating this virtual laboratory is necessary to have a virtual microscopy laboratory, work rooms equipped with workstations integrated into the institution's intranet, rooms located on the subjects that concern the study ecology, soil science, environmental restoration, cell biology, microbiology, bio-indicators of air pollution, air remediation.

Also, the following devices:
- slide scanner,
- server storing images,
- individual workstations for students
- further processing station designed graphic images intended for the specialized teaching materials.

Virtual laboratory to be created is suitable technical infrastructure (network computers) already present in the laboratory ecopedological, reducing hardware costs.

This gives participants the opportunity to test mode or interactive teaching and learning, through equipment, applications or content used in a traditional layout class space.

Virtual laboratory is a flexible ecopedological allowing a modern education can have multiple uses, without additional costs.

Activities include study and research using a microscope, notebook or data recording device, skills related to problem solving and programming using various tools, including robots.

Also, this lab focuses on individual bidirectional communication, both between teacher and student and between two or more students. It also allows simultaneous transmission of multiple audio and video.

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