REMOTE ACCESS TO ATOMTEX 1125A INSTRUMENT

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In this paper, basic requirements for designing of a web Laboratory were given briefly. Proposed requirements are flexible and independent of hardware used, software, scalability, and area of application, *i. e.* of the type of experiment. System enables access to the experiment using web browser, experimental parameters setup, start of the experiment in the real time and review of the obtained results in numerical and graphical form. Besides, original software for remote access and control of Atomtex AT1125A instrument is presented in the paper. The software enables that data measured by Atomtex AT1125A to be given in the format which is suitable for further processing and also enables that activities such as reading, collecting, and processing data to be carried out automatically or manually, according to the given algorithm (time of reading, alarm for the given dose level, statistical error). Remote access to Atomtex 1125A instrument, realized through web application, enables radiation safety of personnel during long, risky, and difficult conditions of measurements.

Key words: Atomtex AT1125A instrument, remote access, radiation safety

INTRODUCTION

In last few decades, development of information technologies and computing systems affected to a great extent all fields of human activities. Development of web based virtual labs enables users to access lab equipment and carry out experimental work on the real devices at any time from any place. Many universities own a web laboratory (microelectronics weblab), Chalmers University of Technology in Sweden, Chemical Engineering Department at Cambridge University, University of Illinois (Integrated Remote Laboratory Environment) [1]. In the last few years author, with a group of his co-workers, developed several web applications, starting from a simple web experiment [2, 3] up to remote control and supervision of complex technical systems.

Measuring instruments have an important place in web labs. Possibility of remote control or access of these instruments is becoming a new model of work with all advantages which web designed labs offer.

In this paper original software, in the form of Windows and web application, which enables better user interface and remote access to Atomtex AT1125A device is presented.

DESIGNING OF WEB BASED LABORATORY

When designing a web lab, [4-7] it is needed to design appropriate software and hardware architecture.

Software architecture consists of two parts: the first part controls physical processes (on server side – Local control server) and the second part generates user's interface and defines user's access (which also manages the other part of Learning environment) and which is orientated towards user's server (web server), fig. 1. On the Local control server we need to implement software module experimental interface, which performs algorithm of management and communicate with web server. Client's side is based on one of the technologies for creating dynamic web pages. All experiments' data, users' access and other information connected with Learning environment are in the data bases.

Modern computing technology enables work of the web lab by using standard hardware and software of general purpose, programmable devices and network technologies which are used for the Internet. Generally speaking, architecture of the system for carrying out web experiments consists of three basic lay-

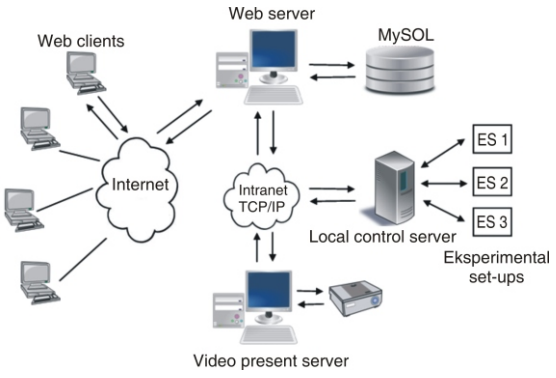

Figure 1. System architecture

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ers in unified modeling language (UML) diagram of classes [8]. Each class corresponds one layer of the system for carrying out web experiments. There are three layers: Web user interface, Experiment and Programmable devices. System for carrying out web experiments is designed, developed and implemented with the basic aim to enable remote access to experimental equipment.

This configuration among other things can provide Remote management and control of work of different measuring devices. Work of these devices is autonomous, but the work of some of them supported by computer. Possibility of managing these instruments is becoming new modality in work with all advantages which web based labs offer.

REMOTE MEASURING BY RADIATION INSTRUMENT ATOMEX 1125A

Radiation instrument Atomex AT 1125A is a device which is intended to provide: radiation monitoring at nuclear and isotope facilities; measurements of specific activity of ^{137}Cs in foodstuff, other solid, liquid and raw samples; provide alpha and beta radiation surface contamination measurements; provide beta and gamma radiation contamination measurements of foodstuff, water and soil; search for rapidly ionizing radiation sources and radioactive materials. Instrument is intended for measuring [9]:

– dose and dose rate of surrounding gamma radiation,
– density of the flux and fluency alpha and beta radiation, and
– specific activities of ^{137}Cs in food, water, and soil.

Function of the instrument is based on a highly sensitive NaI 25 mm 40 mm scintillation dosimeter and photo multiplication tube. Device can work in spectrometric mode in which energy scope is divided into 256 channels. In dosimetric mode channels are grouped in 12 windows. Operational algorithm enables continual measuring by calculating middle value. Algorithm enables statistic data processing together with evaluation of statistic fluctuations with fast adjustment on sudden changes of radiation level. When the instrument measures ambient X-ray or gamma radiation, dose is in the range of 10 nSv-10 Sv, and dose rate is in the range of 0.03 nSv/h-100 mSv/h.

Radiation monitor design

The radiation monitor AT1125A is made equally as functionally complete installments. The general radiation monitor view is shown in fig. 2.

All radiation monitor electronics are placed into watertight aluminum box with polymer cover. On the radiation monitor front panel there are the control panel with a membrane keypad (1) and LCD (2). Instrument is connected with computer through a serial

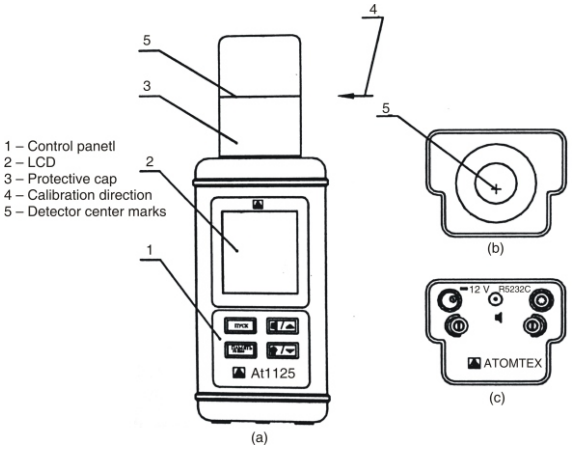

Figure 2. General radiation monitor view
(a) front view, (b) top view, and (c) bottom view

port and supplied with a 12 V battery. On the top end lid there is a screwed protective aluminum cap, which has the same serial number as the instrument.

Operational mode

The instrument has two operational modes. Dosimetric (for measurement of gamma radiation, dose and dose rate) and Radiometric mode (for measurement of specific activity). Both modes possess several sub modes.

When the instrument starts the measurements of the current dose rate value, dose rate measurement unit and statistical error are shown on the display. Measurement is a continuous process with constantly updating dose rate value and relevant statistical error, from 99% to 1%, on the display. A measurement result outputs on the analog scale. When the radiation surrounding is changed, the instrument starts a new measurement cycle. If the dose rate measuring range is overflowed a continuous audible alarm sounds. The instrument AT1125A measures gamma radiation dose rate up to 100 mSv/h.

Data transfer from Atomtex AT1125A instrument to computer is enabled within dosimetric mode. Data transfer is performed by the interface RS 232 upon request given by computer.

In order to make connection between detector and computer, it is needed to:

– install software which enables data transfer from Atomtex AT 1125 instrument to the computer, and
– connect free serial port on the computer with a socket RS 232 at the output of a detector by using a cable.

PROGRAM PACKAGE ATOMTEX AT 1125A

Program package Atomtex AT1125A which is developed and implemented in this work consists of the following interconnected applications:

– licensed software "Atexch" which comes on the CD with purchased device AtomTexAT1125A,
– auxiliary software "AutomaticLink",
– software module "Coordinate",
– windows application "AtomTex AT1125A", and
– web application "AtomTexAT1125A".

Original software is given on web address http://www.pmf.kg.ac.rs/radijacionafizika/Products.html,

In the following chapter the purpose and the way of using Windows and web applications will be described in details.

Licensed software Atexch

Licensed software Atexch, was delivered with the instrument and installed on Local control server (fig. 1) where it is executing. Program is used in dosimetric mode and enables the following: measurements of dose rate with statistical error, dose, counting rate with statistical error and displaying of their threshold. Measuring period could be changed by the installed software in the field "Measuring interval". Minimum time for measuring interval is 1 second. It is possible to save measurement results with measurement time in a file, which can be opened and printed in preset time not less than 1 minute. The data are saved in a textual file 'MassIzm.txt'. Figure 3 shows standard layout of the file in which obtained data are shown, that is: dose rate, maximum dose rate, and dose read at a certain moment. Data can be obtained by standard procedure of saving files.

The disadvantage of the existing software, delivered by the producer, is a simple interface which limits interactivity of the user with an instrument.

Data obtained by this procedure are given in the form of textual file and as such can only be shown or printed. During the measurements, the current data are shown on the instrument itself and on the computer as well.

In order to overcome the disadvantage of the existing software an original software is developed in the form of Windows (better interface), and web application which enables remote access of Atomtex AT1125A device.

Auxiliary software AutomaticLink

When current measuring results are placed in the textual file 'MassIzm.txt', they are processed in the way that targeted strings are taken out and the measured data can be adjusted for requested form (windows or web).

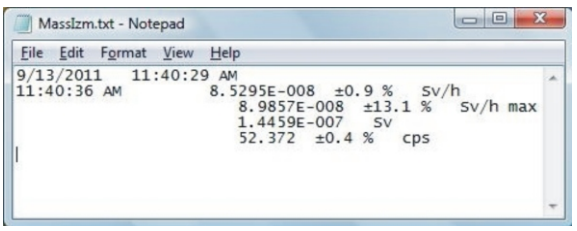

Figure 3. Textual file

Software AutomaticLink is a transparent form which is automatically started, minimized and placed in taskbar when the program is run for the first time. It works by using the command Cursor.Position (where the position is defined with the program Software module 'Coordinate' and WinApi.Mouse.SendDoubleClick for automatic click of the mouse. Program AutomaticLink is an auxiliary program and its execution establishes the link with program Atexch.

For the operations which are performed manually in the work regime of the program Atexch on the local control server, the task of the program is to carry them out automatically at preset time. This operation is performed with the help of preset coordinates which it withdraws out from textual file coordinate.txt (StreamReader class is used).

Thus, the conditions for accurate/correct/regular work of auxiliary program is setting preset determined position of coordinates, (Software module "Coordinate") and that procedure is to be done only once for a certain monitor. Probably different monitors carry different coordinates of button positions on them. Time recording can be set arbitrary in the code of auxiliary program "AutomaticLink". The assumed time of recording is set to 28 minutes (1680000 ms).

Windows application AtomTex AT1125A

Windows application is installed on Local Control Server (fig. 1) where it is executing. Within Windows form of application Atomtex AT1125A measured data of dose rate are shown, as well as maximum dose value. Together with these two values, a relative error, when measuring, is also shown. Date and time of reading are shown in all forms of user interface.

The values of dose and of surrounding dose rate, maximum dose rate, as well as date and time of measurement are taken over from textual file and shown within controls in the Windows form. Properties of all Windows form controls are given in ReadOnly so that data cannot be deleted or changed and it is only possible to read them. Depending on the needs and measuring conditions, manipulation of these data is possible. Application gives the possibility for updating data in any time. Default value for updating data is after 30 minutes. This period for updating data is chosen as optimal for standard measurement conditions. Within installment procedure and preparation for use there is a possibility for its change depending on measurement needs.

Web application Atomtex AT1125A

Web application Atomtex AT1125A is developed at Visual studio 2010 in developing environment as

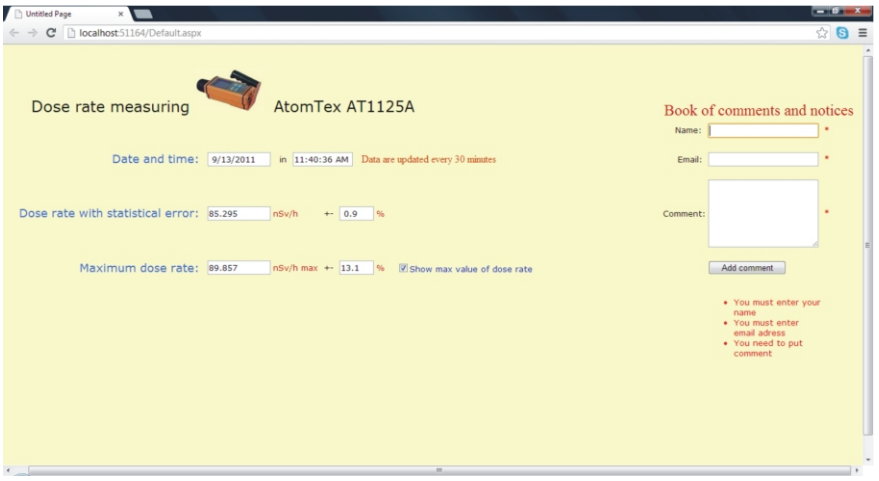

Figure 4. One of the forms of web application

ASP.NET web application. It presents a dynamic web page, created with the help of Visual web developer 2010 tools, written in Visual C# program language. A web application Atomtex AT1125A is designed similarly to Windows application. The difference is that here page updating is done automatically after a specified period of time when new measured data from textual file are tagged/drawn on the web form. Web application is tested on Localhost, but it can be executed on Microsoft IIS.

User interface of the created web application is shown in fig. 4.

Apart from the main part of web page where instant measurement results are shown, there is a part called *Book of comments and notices* which presents a part of web form where it is possible to enter and see comments of the visitors to the web application. It is customary that *Book of comments and notices* has visitors' names, their email addresses, comments as well as dates and names of the locations where the measurements took place and when the impressions were written.

Transferring and saving of the relevant data in the web application are carried out in the data base Podaci.dbo automatically after 30 minutes, or it could be done manually by the user at any time. This data base with appropriate charts is created using SQL server management studio 2008 R2 application. There is no protected access and anyone can access the data base. With small amendments, it is possible to create different accounts as admin, guest or user, and limit access, if it is necessary.

ANALYSES OF THE OBTAINED RESULTS

Results of all the measurements are kept in date base Podaci.dbo. Data are periodically registered, after every 30 minutes, after updating of instantaneous values stored in the base, thus enabling insight into all

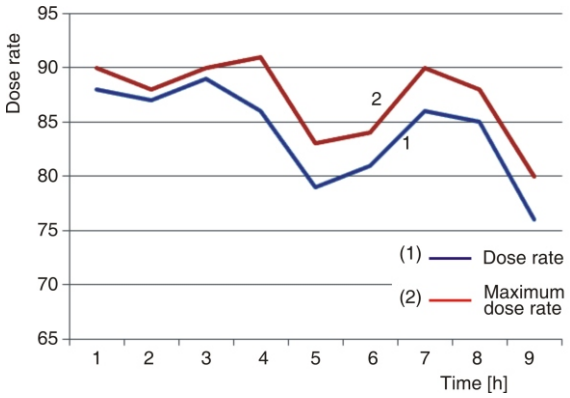

Figure 5. Results of a standard measurement. Dose rate and maximum values of dose rate for the period of five hours

the measurements (backup data). Data from the *Book of comments and notices* from the web page AtomTex AT1125A are also stored in data base Podaci.dbo. Stored data from the data base can be used for reviewing the values in different periods (on weekly, monthly or yearly basis), for showing average value of dose rate for particular place, at a certain time, as well as for graphical presentation of measurement results. Web based access enables unlimited time-space approach to the measuring installation and facilities as it was shown in [10]. Application enables activating certain mechanisms during measuring (alarm, cease of measuring, changing of the period of measuring, *etc*.) when dose overcomes certain pre-determined levels.

In fig. 5 results of a standard measurement are shown, dose rate and maximum values of dose rate for the given period.

CONCLUSIONS

According to basic requirements, which have to be done on designing of a web Laboratory, original software for remote access and control of Atomtex

AT1125A measuring device was developed. Program package Atomtex AT1125A which is developed and implemented in this work was created at Visual studio 2010 in developing environment as ASP.NET web application. It presents a dynamic web page, created with the help of Visual Web Developer 2010 tools, written in Visual C# programming language.

Software enables that activities such as reading, collecting and processing data can be carried out automatically, according to the given algorithm (time of the reading, alarm for the given dose level, counting rate, and statistical error). Regardless to the way of collecting, data are recorded in the data basis throughout measuring. Data saved in this way, marked by the date and time for the given period can be processed later, shown graphically or be ready for data backup.

Remote access and control, realized through win and web application, enables radiation safety of personnel during long time measurements at locations with elevated radioactivity level, at places which are difficult to access (such as mines) or during some risky operation as re-packing of strong radioactive sources *etc*.

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Владе УРОШЕВИЋ

ДАЉИНСКО УПРАВЉАЊЕ ИНСТРУМЕНТОМ ATOMTEX AT1125A

У раду су дати захтеви које треба испунити при пројектовању веб лабораторије, који су независни од коришћеног хардвера, софтвера, области примене и од врсте експеримента. Систем омогућава приступ експерименту, подешавање параметера система, покретање експеримента у реалном времену и добијање резултата у нумеричкој или графичкој форми коришћењем веб претраживача. Приказан је оригинални софтвер који омогућава даљинско управљање инструментом Atomtex AT1125A. Софтвер омогућава да подаци који су измерени уређајем Atomtex AT1125A у дозиметријском моду буду дати у формату који је погодан за даљу обраду и да се активности читања, прикупљања и обраде података врше аутоматски, по задатом алгоритму (време очитавања, аларм за дати ниво дозе, статистичка грешка). Даљински приступ Инструменту Atomtex AT1125A који се остварује веб апликацијом, олакшава и омогућава безбедност лица при дуготрајним и отежаним условима мерења.

Кључне речи: инструмент Atomtex AT1125A, даљински приступ, радијациона сигурност