

An Approach of Application Development for the Virtual Laboratory Access

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Abstract – Continuous development and implementation of information and telecommunication technologies based on Internet, as a global network, and on multimedia notes brings us to the new results in the field of measurement as the science discipline. A model used in realization of a measurement laboratory for remote experiments is described in this paper. A way and realization of user access to the measurement system through the Internet is explained into detail.

Keywords – Virtual laboratory, Internet application, remote access.

I. INTRODUCTION

Process control and management are permanent needs in all technic and technical processes. Measurements are usually not located at the same place and it is necessary to acquire them from the different locations, put them in the same database, process and analyze, or use them in the next measurement process. In that case, we can define the measurement system as an set of the measuring features connected in one functional entirety, used for the data acquisition.

Beside the indispensable software, in the modern measuring systems it is necessary to receive the measuring data in digital form. Low price of microprocessor's components and systems, made possible the realization of the systems with distributed data processing. Those systems usually have the autocalibration and electric isolation.

The development of information technologies has opened new possibilities in realization of measurement data acquisition systems. Described measurement systems present the conception in the field of remote measurement laboratories. The laboratory heart usually consists of a group of measuring instruments, connected to the Internet through the appropriate network equipment. Possibility of the data acquisition and their storing into the databases, enable the easy communication between the laboratories which are on geographically distant places.

Distributed architecture of the remote measurement laboratory is described in paper [1]. System is realized as a

hierarchical structure on few levels. Clients can access through application level. Those realization can be classified as a client / server architecture, where the user's computers are clients, and the computers in the measuring laboratories [2] are servers. Basic components of this architecture are: main server, connection with measurement systems (laboratories) and measurement instruments which perform the laboratory.

II. INTERNET APPLICATION AS A PART OF THE LABORATORY SOFTWARE SOLUTION

Laboratory is realized by program language LabVIEW [3], i.e. the LabVIEW application, through which clients can access measuring instruments and acquire data, is realized. It is needed to have input parameters for each measuring instrument in that virtual laboratory in order to carry out the desired measurement by virtual instruments. Input parameters are the parameters which set the start values of the measuring instruments. When the measurement equipment is connected to the computer and all parameters are set, the LabVIEW application carries out the data acquisition and generates the output file. Digitalized values of the acquired data are placed into the output file.

Software solution, which connects the user and the appropriate LabVIEW application, is realized by standard procedure languages. The Internet part of the software solution is written by using the ASP [4] (Active Server Pages) technology in Java Script language and by using the CGI [5] (Common Gate Interface) scripts. The pages for the measuring laboratory access are realized in the same technology. In order to access the laboratory the user has to be logged in. When the user's identification data are checked by the application, the user can access the laboratory recourses. ASP technology allows the work with SQL, which presents the language for the database queries. SQL server is on the main computer in the measurement laboratory. All information about the users who may access the laboratory, and all information about measurements which are made (including the measurement parameters and results) are placed in the database (Fig. 1).

Depending on chosen measuring experiment, the ASP page with the appropriate fields for the start value inputs will appear on the screen. When the user input parameters for the desired measurement, the appropriate CGI script starts (Fig. 2).

All scripts are written in C++ program language. This technology enables a data exchange between the web pages and the classic applications, which are written in standard

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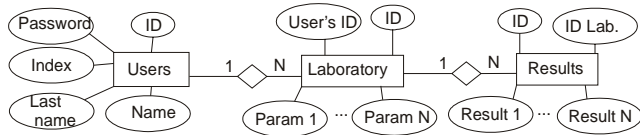


Fig. 1. Virtual laboratory database model

program languages. In that way, the extended functionalities of the web applications up to the real possibilities of the classic applications has been achieved. Through the Internet pages the data, which are needed to make the measurements, are gathered by these scripts. All the data are collected into the input text file in appropriate format demanded by LabVIEW standard. Important functionality of all standard programming languages is a possibility to make an external call of the another program application on the computer. This functionality is used here for the calls of a appropriate LabVIEW application. When the input file is created, the CGI script goes into a waiting state, while the appropriate LabVIEW application is running and the output file is not created. Then, a HTML file is created and transferred to the user.

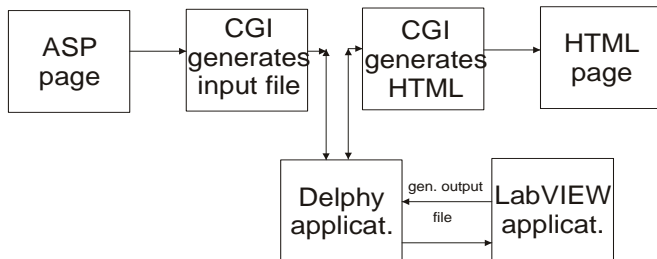


Fig. 2. Virtual laboratory application structure

The beginning of the next phase of this application is a moment when a measurement is done and the data should be collected and showed to the user. This moment is not possible to detect by the CGI script. In another hand, a CGI script generates a HTML page which will be presented to a user as a resulted one. Input file for the LabVIEW application is generated by the CGI script. An application which controls the execution of the appropriate LabVIEW application, as well as it's shut down when a measurement is over and an output file is created, is developed in programming language Delphi [6]. In other words, this application has a position of a trigger of the real physical measurement process for the current equipment configuration. Once a CGI script creates an input file for the appropriate LabVIEW application, the Delphi application detects that input file and starts up a LabVIEW application. When the measurement is done and the output file is created, the Delphi application shuts down the LabVIEW application in order to fulfill demands for the next measurement. In the meanwhile, the CGI script is blocked in the while loop which is aborted when the output file is created and there are no other constraints, and then the HTML file can be created.

In system like this, the concurrence of more measuring requirements on the same measuring system at the same time appears. The first solution of this problem was solved in a trivial manner by not allowing the access to anyone while the

laboratory is occupied by the user who is already logged. New solution is to put all logged clients in a queue and the CGI script does not create an input file for the user until that user is not the next one who should get into the laboratory. In this way, increase of users number increases the waiting time (with linear dependency) in the queue, but it is equal for everyone who is in order to login.

III. CONCLUSION

Nowadays, a computer is an essential tool in a number of areas. They became irreplaceable in the process monitoring, product quality checking, automation, process control and management, realization of the measurement systems, etc. The development of information technologies has opened new possibilities in realisation of measurement data acquisition systems.

Remote measurement system is often accessed through the global Internet network. The laboratory heart consists of a group of specialised and/or general instruments, connected to the Internet through the PC. Within a remote measurement laboratory, clients can cooperate to each other and use all laboratory resources, even they are on geographically distant places.

Suggested system is based on client-server architecture, it is easy to expand and it makes possibilities for distant clients to access the instruments. CGI scripts, written in C++ program language, generate the measurement input file based on the data achieved from the current user's Internet page. Laboratory, which is realized in LabVIEW, is started by application written in program language Delphi, immediately after the input file is created. Delphi application terminates the LabVIEW application when the measurement experiment is done and an output file with the measured data is created. Then, a CGI script generates a HTML file with the results for the user. System expanding can be shown with the increasing number of laboratories, which are connected to the system. Every laboratory needs a different LabVIEW virtual instrument. In the case of increasing the number of connected laboratories, the application has good bases for further development, which is related to easy handling and to the possibility of easy upgrading and interface changing.

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