WEB Education Support of Sensors and Control Devices Laboratories

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ABSTRACT: *Paper deals with concept of specialized laboratory intranet portal, which provides actual learning information for students. There are data about arrangement of experimental stands from the Measurement and Sensors Laboratory and Control Devices Laboratory on the Department of Control Systems and Instrumentation of VŠB-TUO.*

As other information there are the instructions about laboratory exercises, other suitable text documents, and e-learning textbooks and instructions in hypertext form. Important part there is possibility to remote laboratory stands access from the WEB environment, which allows realizing the elements of virtual WEB technologies for SCADA/MMI tasks. Remote monitoring and supervisory operating of real laboratory stands shown other possibilities of virtual approaches included mobile wireless systems. The paper also describes laboratory advanced equipment, such as web cam monitoring, module of task remote switching and the online application of the attendance and evaluation.

1 INTRODUCTION

The *Sensor and Measurement Laboratory* (SaM) is a basic experimental laboratory for students of bachelor and master level study on Faculty of Mechanical Engineering. It satisfies the need for students to gain theoretical knowledge and practical experience with a variety of sensors and transducers or the measurement instrumentation of such different physical parameters as: position, proximity, displacement, speed, acceleration, temperature, pressure, liquid level, height, weight, volume and basic electronic transmitters (A/D, D/A). The *SaM Laboratory* makes use of the hardware experimental modules and lab stands, interactive multimedia software suite (on Intranet/Internet environment), a specially written programme modules for experimental data presentation and processing, hardware/PC interface, comprehensive student guides and e-textbooks.

Using a variety of combinations of the sensors, signal conditioning circuits and power supplies students can construct and investigate a wide selection of working sensor circuits. These circuits give students a practical understanding and familiarity with the use of industrial type sensors, including their associated techniques and practices, to measure different types of physical parameters and to process the raw data from the sensors. Through the production of calibration graphs judgements can be made on such sensor characteristics as: accuracy, precision, linearity, repeatability, sensitivity, dead-zone, hysteresis, drift, reliability, lag, resolution, etc. Direct and meaningful comparisons of the individual sensor performances can be made on completion of all of the experiments. Sources of possible errors may also be investigated as well as how to minimise their effect on the quality of the output signal.

The computers may be used to enhance the effectiveness of the learning experience through data acquisition and control software and also to extend its interactive capabilities through use of the Web pages supplied (special *SaM Laboratory* portal http://352lab.vsb.cz).

2 WEB CAM USING FOR MONITORING TECHNOLOGY

Web cam monitoring and security systems are increasingly enforced at many applications. There is possible to integrate these camera systems into real-time controlling. Control Web 2000 system enables to animate real-time task in depended on actual measured values, helping by delivered programming tools (draw components, multi label, meter etc.). This part of paper is dealing with possibility of web cam mounting, which together with HTTP server of Control Web 2000 system enables on-line monitoring of real-time application, without necessity of data transfer through the LAN. For actual screen generation of monitoring application is used external software dedicated for data (screen) transfer through the net. It's possible to reach the optimal configuration by suitable distribution, which won't load processors and also LAN too much.

The kernel of camera system is the video server – located on specialized PC, which is for easy deployment delivered as a compact unit containing hardware and software. This application task enables handling of camera rotator helping by buttons in the Control Web 2000 application module and internet HTML pages of HTTP server. There is chosen particularly discrete signals of parallel port for command outputs by reason of possibility to use random PC. In order to use this hardware at Control Web 2000 environment, it was created LPTx driver.

Application program module in Control Web 2000 environment, dedicated to control of rotator engine is created as individual module. It's because of possibility of module engage directly on HTTP server, where is also running Web cam application, and then we will work with compact application from local modules. Second possibility is engage on PC, where is running only application for Web cam and through the LAN is storing html pages on HTTP server. In this case we work with application composed from remote modules. The third possibility is full distribution of application through LAN, i.e. on individual PC is running HTTP server with real-time tasks, on the second PC is running „Rotator" module and for screen processing from Web camera is reserved also individual PC.

These modules have possibility of communication between themselves through the TCP/IP driver of Control Web 2000 system via LAN. Detailed information about cooperation of remote modules can we find at Control Web 2000 system datasheet.
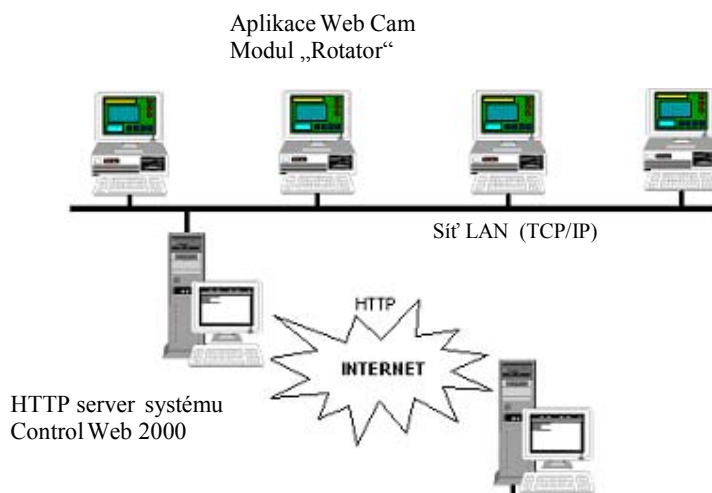

Figure 1 – Web Cam a module „Rotator" are running on the same PC, particular HTTP server is running on individual PC.

The main module enables access to control signals of rotator helping by buttons „Move Left", „Move Right" and „Rotator stands" of Control Web 2000 environment. The program for access from Intranet (Internet) was created and he is active only in movement time of rotator. There is used very useful property of Control Web 2000 system – timing by the selector. That way is possible to save a large system time, which is necessary for executing of another application (local modules) or for HTML page generating with live screen of actual scenery (Web camera handling is running on separated PC).

Figure 2 – Window of Control Web 2000 system – "Rotator" module control panel.

It was tested about ten program tools for access the actual screen scenery to internet. According to used software is possible to use various chance of access the live screen. At the final version it was chosen the „Active Web Cam" software, which enable three ways of live screen access [ŠKUTA, 2002]:

❖ using FTP server

❖ running HTTP server on any PC

❖ storing the screen on PC as html page

At the first method of access real-time screen is necessary to install FTP server, where actual screen is stored. At second way we need to execute web server, which is available through the net. The third method of real-time screen access is using in this application.

Software generates real screen in the form of web pages, directly on PC and from here are these html pages provided to HTTP server, which is created at Control Web 2000 system environment helping by HTTP component.

From the technique of connection to Control Web 2000 system is evident, that we can use for visualisation any kind of software for cooperation Web camera and PC.
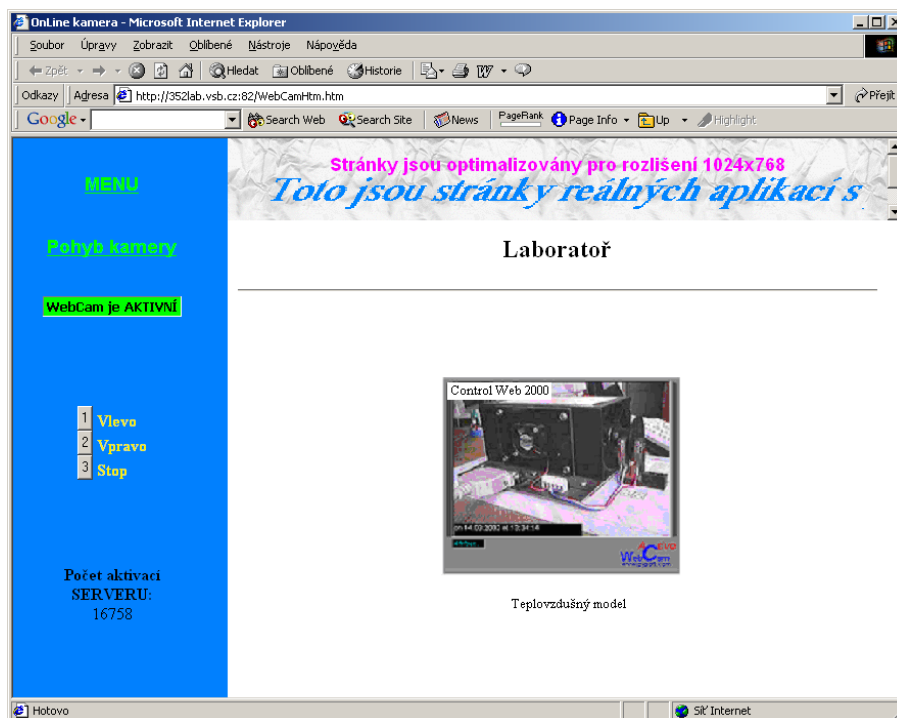

Figure 3 – Window of Web Camera service Pages.

The HTML page is composed from two parts. The first part is created by Control Web 2000 system application and into that is inserted a second part created by „Active Web Cam" software (frame with actual scenery) - see at the Figure 3.

It was used the sharing of technical means of particular computers for the realization of this projects. There is one folder on the computer, which is set apart as the main HTTP server, into that is stored data from " Active Web Cam " application using by LAN (disks sharing). The separated module is executed on this main HTTP server for communication with remote module "Rotator", which is running on the same computer as "Active Web Cam" application. The access from internet is exactly ensured by module

on the main HTTP server. From this module is possible to control Web camera moving as well as from "Rotator" module. There is also state indicator of application or so remote "Rotator" module. This information is provided to intranet or internet. The communication with server is running on the port *No.* 81.

3   WEB SUPPORT OF SENSORS LABORATORY

In *Sensors and Measurement Laboratory* proceed the educations of several subjects of corresponding area. The application for support of this education was developed on Department CSI. This application module contains description of all working place, complete with instruction and code of practice and the order plan of the measurement.

On the next Figure 4 we can see the main window of the application web module. There is panoramatic view of the *Sensors and Measurement Laboratory*. Helping by mouse movement on particularly working place are showing the concrete laboratory exercise with the title of particularly tasks. After the selection of concrete task we can see the input manual for laboratory exercise - see Figure 5. Input manual includes progress of measurement, description of using devices and schematic diagram [FARANA & SMUTNÝ, 2002].

Figure 4 – Web Education Pages for support of *Sensors and Measurement Laboratory*.

Furthermore among other thing also theoretical analysis, mathematical equation and the preparing template of the table for measured values. This application module disposed of the problems growing with distribution of manual input for students, material charges and time expenses. The mentioned application is of course variable and the able to complete and upgrade.

4   ON LINE ATTENDANCE AND EVALUATION

Another application supported the education at laboratory of sensors and measurement is application program module of attendance and evaluation. This application module removes the using of attendance list on paper and makes easy the tutor checking system of attendance and the credit giving.

This application also enables the evaluation of students during semester. Student is evaluated for delivered protocols from the exercise – measurement of particular task and credit project. Of course the evaluation listed above is possible to fill into web application [BABIUCH, 2002].
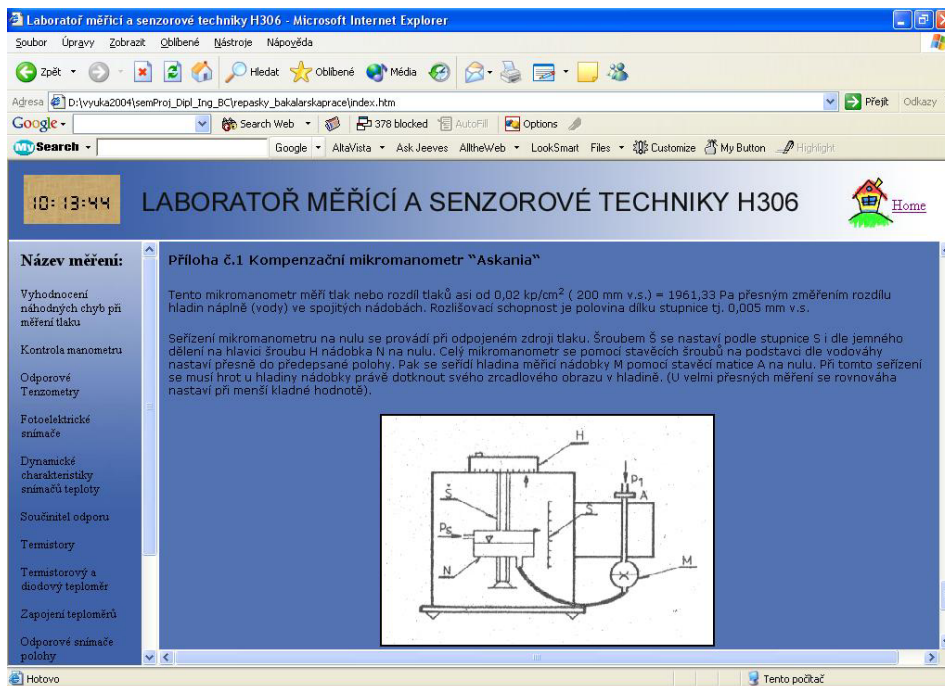
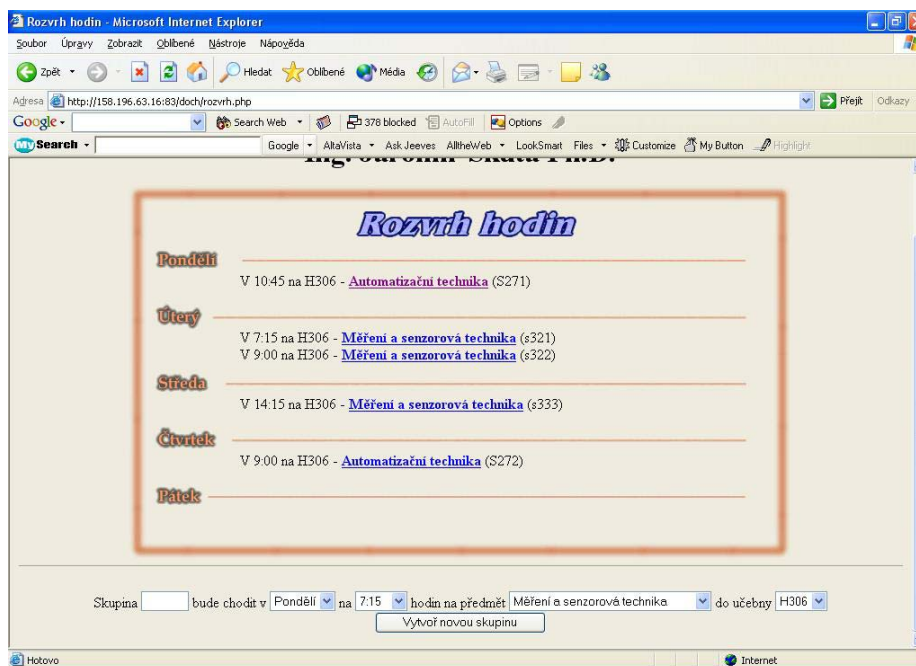Figure 5 – Web Page: Specific laboratory measurement task.

Figure 6 – Web timetable for evaluation and the attendance checking.

The administrators of this application are the tutors, which gives lessons at these laboratories. The tutor must fill appropriate web form for creating of concrete attendance list at the beginning of term. Application is user friendly and has intuitive commands. There is updated a timetable of the tutor, after the generating of attendance list. (see the Figure 6)
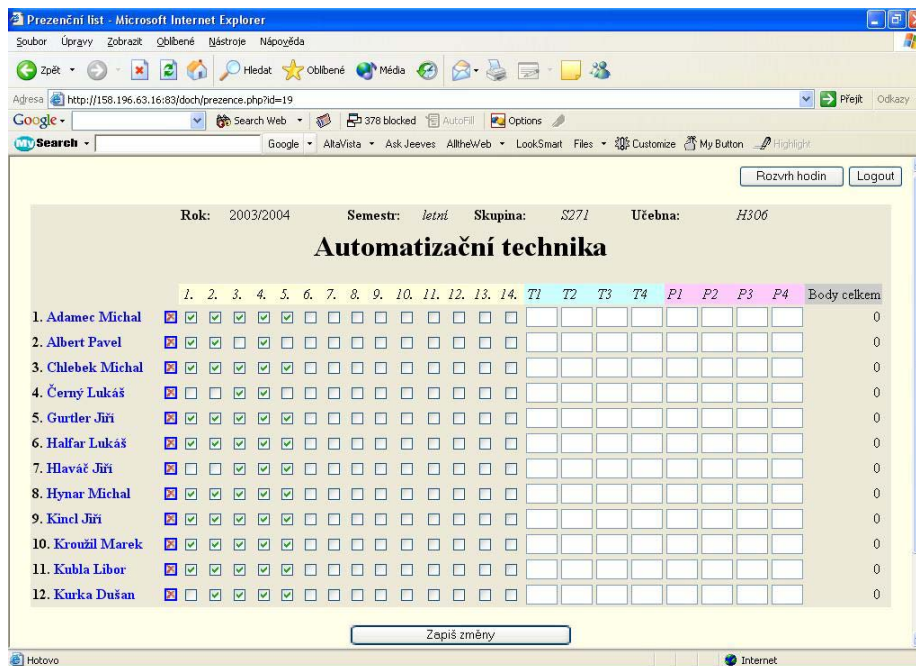
Figure 7 – Web attendance and evaluation list.

The Attendance list of study group is shown after the clicking on particular subject. The tutor of the exercise practice fills the name of students. For the attendance is prepared 14 boxes (number of weeks of the term), another boxes are available for evaluation through the term. Student's acquired points are automatically adding up, so it can be seen actual state of point's evaluation. Of course the students may watch on these pages their results (see Figure 7).

5   CONCLUSIONS

The contribution describes the web support of education at *Sensors and Measurement Laboratory*. The presented application program modules are using in every specialist subjects of practice education in laboratory. These applications were created helping by scripted languages as PHP, java scripts and database server MySQL. Monitoring application was construct using by HTTP component at Control Web system. This type of applications are designed and implemented on department of control system and measurement and there are component of diploma thesis and dissertation work. Likewise, we believe that interdisciplinary training in which students are taught the fundamentals of good practice and policy in computing, measurement, sensors and diagnostics will enhance and improve the use of this tools to advance science and engineering, thus, students need to be able to use sophisticated, real-world equipment. Students also need to have real-world-like experiences. The work described in this paper is an effort to afford our students the fruit of these beliefs.

6   ACKNOWLEDGEMENTS

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