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ANALYSIS OF OPERATION AND POSSIBILITIES OF IMPROVING E-LEARNING SYSTEM IN TRAFFIC ENGINEERING

ABSTRACT

Since the Faculty of Transport and Traffic Sciences was connected to CARNet academic network, new information and communication technologies are constantly being introduced and the old ones updated with the aim of improving the quality of studying, from the introduction of WEBCT application to complete design, development and implementation of one's own solution of e-learning. A complete e-Learning system has been developed, named e-Student which consists of several program modules called SAN, DMS, SMSCentar, etc. Since the introduction of the system, the students and the teaching staff have shown great interest for the system for the reasons of easier monitoring of the students' activities, through seminar papers and tasks, exercises and throug h solving of various knowledge tests. The work provides graphical illustrations and statistical data which analyze the operation of the system and the exploitation characteristics. The obtained results indicate the increase in the interest of the teaching staff and students which indicates further need to upgrade the system in order to increase the safety and speed of information transfer.

KEY WORDS

internet, e-Learning, Web, sms, gsm

1. INTRODUCTION

Since the connection of the Faculty of Transport and Traffic Sciences (FPZ) to CARNet network, information and communication technologies (IT) and the Internet/intranet technologies are being introduced into the scientific and teaching activities, as well as other activities such as publishing, financial services, etc. The educational process has been modernized by the access to information using Web, presentation and processing of teaching materials and the electronic communication among learning process participants. The final aim is to introduce as many ICT technologies in the education and scientific-research work as possible.

Before the introduction of the e-Learning system that has been described in the paper, in cooperation with CARNet, through the project of Design of interactive FPZ WEB page for the subject of Information systems in postal traffic, the WEBCT[1] application had been applied, recommended by CARNet, which provided the initial interactivity of the educational process, with certain restrictions in application. Due to the restrictions of the WEBCT tools and problems in its implementation, such as bad experiences with the registration of new users, incentive was given to one's own development of the tools for controlling the contents and the documents and processes (CMS – Content Management System and DMS – Document Management System) which are the basis for the e-Learning system operation at the Faculty. In the development and work, advanced ICT technologies have been applied which provide the necessary interactivity of all the participants in the educational process.

Essential drawbacks of the existing tools applicable as the e-Learning system include the necessity of adjusting the teaching and non-teaching processes of the Faculty to the operation of this system. By developing our own solution the system is adapted to the teaching and non-teaching processes of the Faculty, thus achieving that the processes within the system are identical to the Faculty processes. The development of our own e-Learning system has provided very fast and accurate implementation of the system into the work of the Faculty, as well as easy and fast upgrading of the system and possible elimination of errors in the operation of this system.

The own developed software at the Faculty of Transport and Traffic Sciences enables raising of

quality of the study by introducing information technology into the services such as: submitting of seminar papers via Internet, automated tests to check knowledge, availability of teaching materials used at lectures and instructions and tasks for practical work. The realized advantages for the students are reflected in the availability of the teaching materials, transparent and reviewed base of the students' papers as potential source for further expansion of knowledge, easier communication between the teaching staff and students, and the possibility of automated pre-testing of knowledge through program modules e-Test, e-Kviz and e-Blic. By authorization of the student, the teaching staff has easier control of the students' work done. The program module smsCRM includes care of the users (Customer Relation Management – CRM).

2. INFORMATION-COMMUNICATION INFRASTRUCTURE OF E-LEARNING SYSTEM OF FPZ

By using the following information technologies and applications, up to now several program systems have been developed and implemented and together they form the e-Learning system of FPZ:

- Operating systems: Microsoft Windows 2003 Server, Windows 2000 and Windows XP
- Database: Microsoft SQL Server 2000

For the development of "*desktop*" applications (SAN Server, SAN App, SAN Klijent, smsCRM, SMSCentar and FPZBrowser) the following program tools and technologies have been used:

- Microsoft Visual Basic 6
- Borland Delphi 7
- Active Directory
- Roaming profiles

For the development of "*web*" applications (DMS, e-Student, SANAdmin, SANWeb) the following technologies and applications have been used:

- IIS (Internet Information Services) 6.0
- ASP (Active Server Pages)
- VBScript and JavaScript
- Macromedia Dreamweaver
- Adobe Photoshop 8

All "*desktop*" applications have been developed for the work with the Microsoft Windows platform and therefore IBM PC compatible computers are used. Communication infrastructure (Figure 1) is based on CARNet network and intranet of FPZ. The location of Kušlanova is connected with location in Vukelićeva by a leased cable of the T-Com operator of 2Mbit/s capacity. The services of mobile communication systems applied in e-Learning system are based on the services of T-Mobile operator's mobile network.

3. DEVELOPED APPLICATIONS AND MODULES

The authorization and control system (Cro: SAN) is a set of technologies and applications which enable control of students work on computers in the computer classrooms at FPZ and personalization of the working environment in the Windows operating system, regardless of the computer on which the student is working. SAN system consists of 6 modules (SAN Server, SAN Aplikacija, SAN Klijent, SAN Administracija, SAN Web and FPZBrowser) which currently control three computer classrooms and the public computers at the Faculty premises.

DMS (Document Management System) is a system of managing documentation and processes which is used for authorized access for the Faculty staff to the modules: control of the work of computer laboratories (checking access to exercises, etc.), administration of e-Learning system (publishing of teaching materials, control and assessment of seminar papers, etc.) and the module for managing documents and processes within the Faculty (ordering equipment, reporting defects, updated online directory, etc.).

E-Student system allows authorized access of students to the teaching materials, tasks, exercises and instructions. Apart from the mentioned, the system provides support to the application and submission of seminar papers and various forms of testing knowledge (e-Blic, e-Test, e-Kviz), which is presented in Figure 2.

SAN system with smsCRM application (Customer Relationship Management by means of SMS service) and with assistance of SMSCentar application opens up the possibilities for an entire series of information services for students and FPZ staff, based on interactive communication by means of SMS messages. Currently the interactive services are available to students, related to PCLab, service of obtaining computer status at PCLab and the service of reserving the time of working on the computer at PCLab. Figure 3 shows the diagram of sending the computer status by SMS message.

By sending appropriate SMS message to the number of the SMSCentar, the SMSCentar forwards the request to the SAN Server module, which then returns the message to the SMSCentar containing the computer status in the desired PC lab. The message shows the location of the PC laboratory, date and time of the message, working hours for that day, total number of available computers, number of computers used by the students, number of computers free to be used,

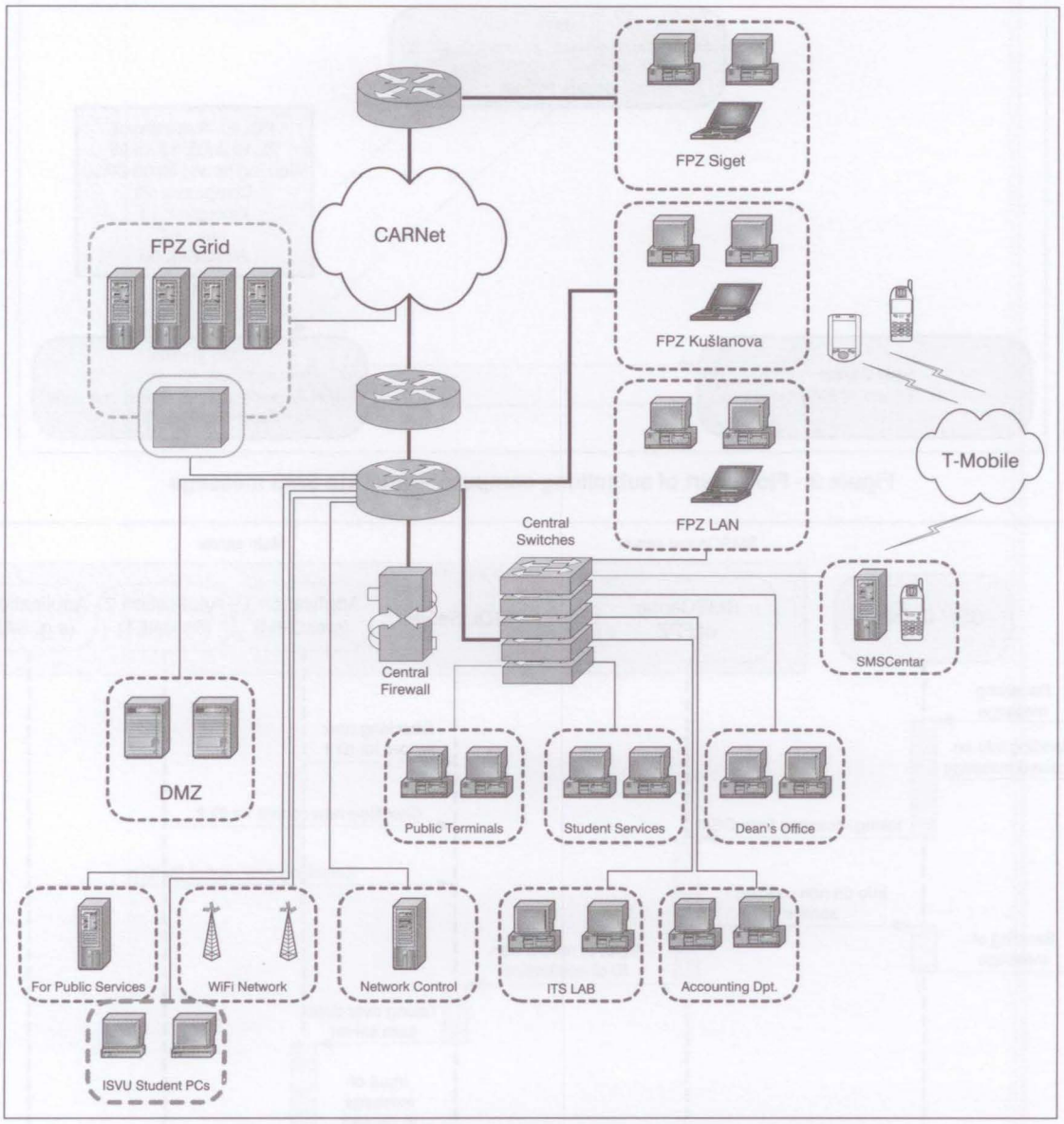

Figure 1 - Logical architecture of the communication infrastructure at the Faculty of Transport and Traffic Sciences

and the number of computers that have been reserved. The sequential presentation of the functioning of the SMSCentar application by UML notation is presented in Figure 4.

There is a number of further possible applications of SMS service in order to raise the quality and increase the speed of information of the participants in the teaching process by means, e. g., information on changes in teaching schedule and practical work, current information on the status of the seminar work, information on the exam schedule or consultations, results of exams and reporting on computer malfunctioning, etc. The modularity of the system allows fast implementation of new services according to the ideas and suggestions expressed both by the teaching and non-teaching staff, and the students.

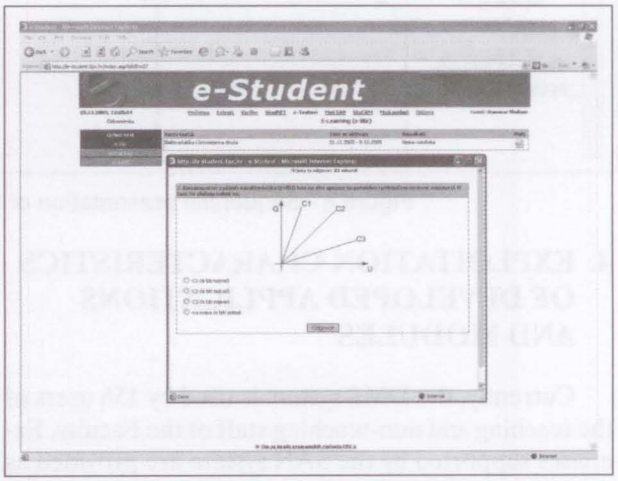

Figure 2 - Display of interface in testing knowledge by means of e-Student application

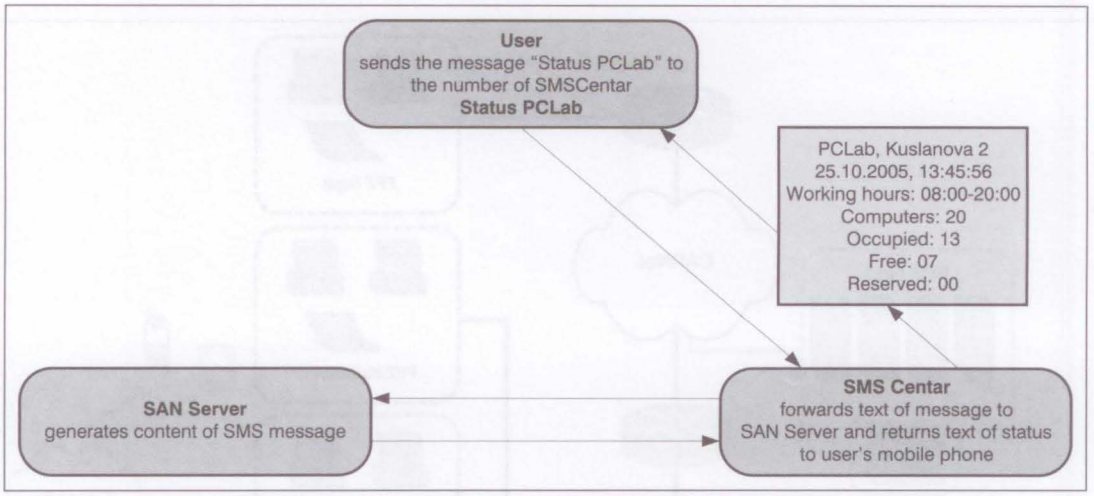

Figure 3 - Flowchart of submitting computer status via SMS message

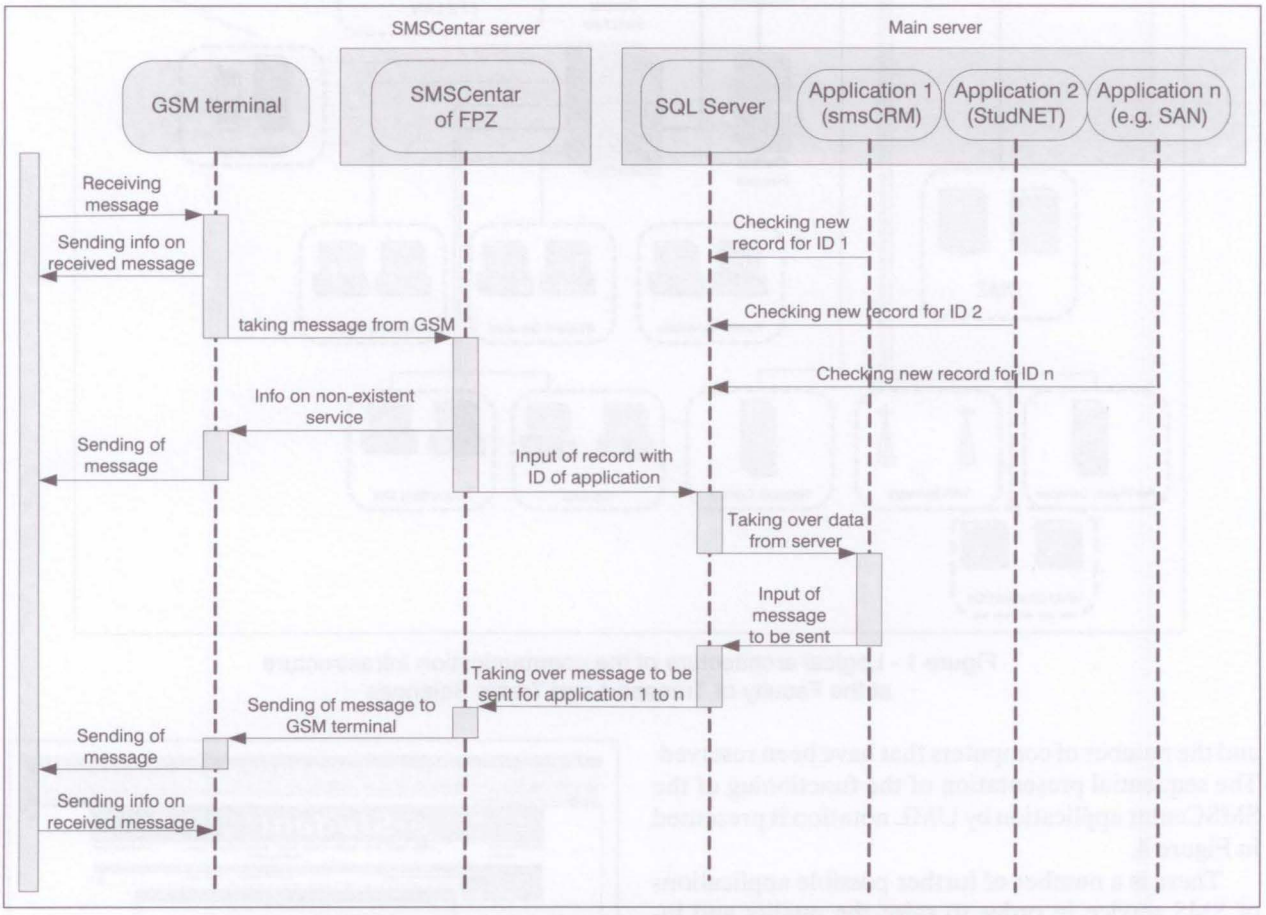

Figure 4 - Sequential presentation of the operation of SMSCentar application

4. EXPLOITATION CHARACTERISTICS OF DEVELOPED APPLICATIONS AND MODULES

Currently, the DMS system is used by 156 users of the teaching and non-teaching staff of the Faculty. Exercises supported by the SAN system are provided as part of several subjects thus realising the control over the access and performance given by the program.

The e-Learning system is used by 2975 students who, by means of SAN and e-Student system, from 9 Nov. 2004 to 21 Jan. 2006 made 32,850 accesses, with a drastic increase in the number of visits in 2006. In the first month only, in the year 2006, there were 14,565 visits, which is only 2000 fewer than the number of visits during the entire 2005 and as many as 12,382 visits more than during the entire year 2004. The number of visits per months is presented in Diagram 1.

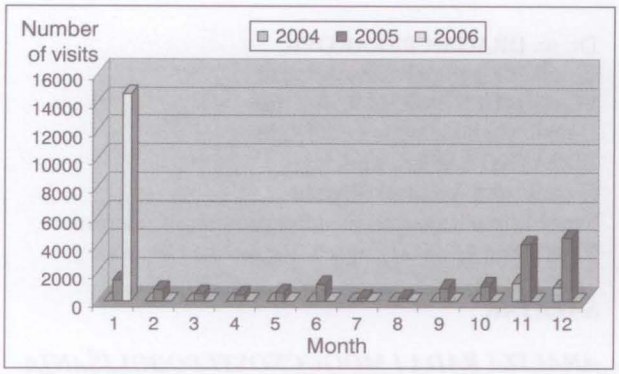

Diagram 1 - Number of visits per months in a period of three years

The reason for the very large number of visits during the first month of 2006 (clearly seen in Diagram 1) can be explained by the usual behaviour of students completing their obligations in writing the seminar paper at the end of the semester. One should also take into consideration the fact that the number of subjects using e-Learning system has increased by 7. When the e-Learning system was used by 16 subjects, an average of 1138 visits were realized monthly, i. e. 44 visits daily. With the introduction of 7 new subjects in the e-Learning system, the number of visits increased by as many as 14,565 visits monthly which yields a high average of 540 visits daily, whereas on some days the number of visits exceeds the number 1000. The number of daily visits from 1 January 2006 to 27 January 2006 is given in Diagram 2.

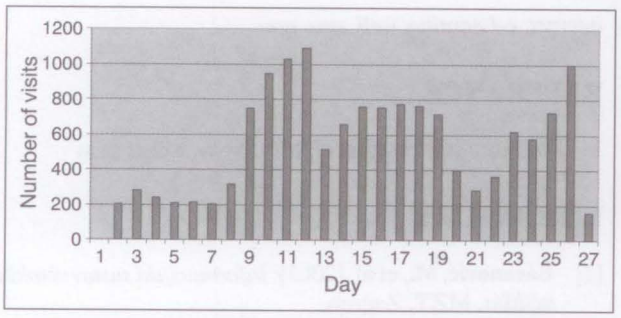

Diagram 2 - Number of visits per days in January 2006

Until 27 Jan. 2006 there were 1621 topics taken for seminar tasks, out of which as many as 620 papers were sent in the first month of 2006 which is 186 papers more than in the entire 2005 and 412 papers more than in the entire year 2004. The number of submitted seminar papers in the last three years is presented in Diagram 3.

The average number of submitted seminar papers has increase from 17 papers monthly in 2004 to over 36 papers monthly in 2005, to 620 papers in the first month in 2006 which amounts to an average of 23 seminar papers daily submitted in the first month of 2006. Until 9 Nov. 2005 there were 613 seminar papers submitted, and until 27 Jan. 2006 the number of seminar papers increased to 1262 papers which is an increase of 48% in only 3 months. In one day (15 Jan. 2006)

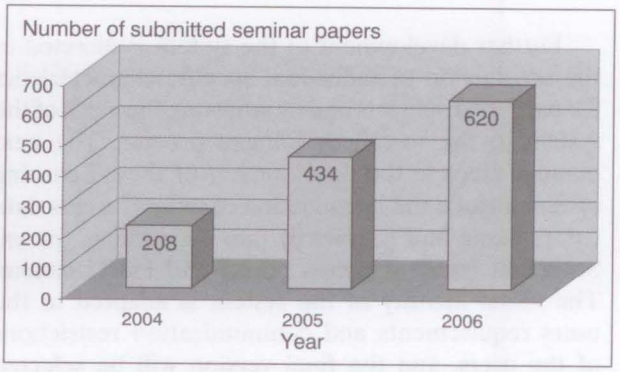

Diagram 3 - Number of submitted seminar papers

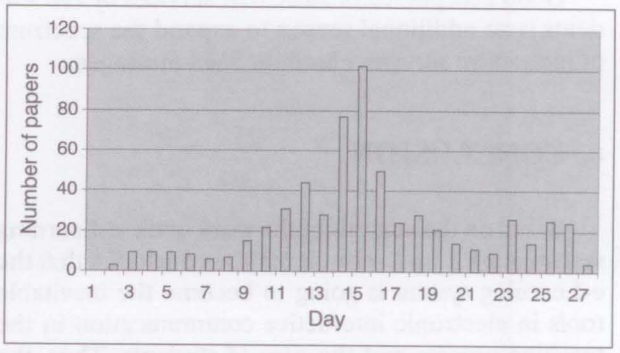

Diagram 4 - Number of submitted papers in January 2006

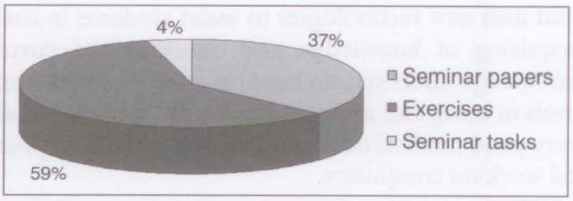

Diagram 5 - Work of the students saved on the server

more than 100 submitted papers have been recorded, which is a half of the total seminar papers sent in 2004. Statistical indicators of the submitted papers in the first 27 days of the first month in 2006 are presented in Diagram 4.

Considering the volume of data sent by the users to the server, the increase in the volume of sent data has increased by 40.8% in the period from 9 Nov. 2005 to 27 January 2006, i. e. the increase is from 252Mb to 617Mb.

With the sent seminar tasks and program tasks that have to be done during work at computer laboratories, the total volume of data (students' works) amounts to 1709Mb (Diagram 5).

5. PROSPECTS OF FURTHER DEVELOPMENT

Positive effects of implementing the module of e-Learning system at FPZ result in the satisfaction of all the system users, and increase in the usage by an increasing number of subjects.

Further development of the system is directed to the satisfaction of individual specific characteristics for particular subjects and by adjusting the work of the system to the so-called Bologna process. The next planned steps in the development of the e-Learning system include the introduction of unique access data (users name and password) into e-Learning system, Studomat (student access point) and ISVU system. The visual identity of the system is adapted to the users requirements and communication restrictions of the users, and the final version will be selected through users' surveys and voting.

Good acceptance of smsCRM services by the students is an additional reason to expand the spectrum of interactive services based on SMS messages.

6. CONCLUSION

Based on the analysis of the work of the e-Learning system at FPZ up to now, it may be concluded that the e-Learning system is going to become the inevitable tools in electronic interactive communication in the teaching process and the care of students. Thus, the Faculty of Transport and Traffic Sciences has become one of the first faculties in the Republic of Croatia that uses new technologies to assist students in easier acquiring of knowledge and checking the current knowledge. SAN system has proven to be a very useful tools in using and maintaining the PC laboratory, as a very good method of organizing and providing practical work on computers.

The modularity of the e-Learning system allows expansion and upgrading by new functions. The examples are the DMS and e-Student systems that partly use the functionality of SAN system as well as vice versa.

Judging by the carried out surveys among the students of the Faculty of Transport and Traffic Sciences, it is obvious that the interest for working and using the system is at a very high level. The students and users have accepted very well the previously developed functions and want and expect further expansion and development of new possibilities of the system. Further development of the e-Learning system is conditioned by the expected increase in the number of subjects, including the drastic increase in the number of users, which leads to the necessity of changing location and replacement of the existing server.

The greatest value of this system is that it has been completely developed at the Faculty of Transport and Traffic Sciences and by the Faculty students in coordination with the teaching staff. In this way the students can improve their knowledge and skills by using new information and communication technologies and program tools working as part of a team on projects for the information systems development.

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SAŽETAK

ANALIZA RADA I MOGUĆNOSTI POBOLJŠANJA SUSTAVA E-LEARNING U PROMETNOM INŽENJERSTVU

Od priključenja Fakulteta prometnih znanosti na CARNet akademsku mrežu konstantno se uvode nove i nadograduju stare informacijsko-komunikacijske tehnologije u cilju poboljšanja kvalitete studiranja, od uvođenja WEBCT aplikacije do potpunog dizajna, razvoja i implementacije vlastitog rješenja učenja na daljinu. Razvijen je cjelovit sustav e-Learning nazvan e-Student koji se sastoji od nekoliko programskih modula nazvanih SAN, DMS, SMSCentar, itd. Od uvođenja sustava studenti i nastavno osoblje pokazali su velik interes za sustav iz razloga jednostavnijeg praćenja rada studenata kroz seminarske radove i zadatke, vježbe te kroz rješavanje raznih provjera znanja. U radu je grafičkim prikazima i statističkim podacima analiziran rad sustava i eksploatacijske značajke. Dobiveni rezultati ukazuju na porast interesa nastavnog osoblja i studenata što ukazuje na potrebno daljnje nadogradnje sustava radi povećanja sigurnosti i brzine prijenosa informacija.

KLJUČNE RIJEČI

internet, e-Learning, web, sms, gsm

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