TRAINING COMPLEX FOR REMOTE STUDY OF MICROCONTROLLERS

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Abstract: This paper describes the use of technology of satellite and mobile communication for remote study of mictocontrollers.

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ACM Classification Keywords: H.4.3. Communications Applications

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Introduction

The microcontrollers (MC) are computers executed on one microchip intensively take root practically into all spheres of human activity. They are intended for management of various electronic devices and realization of interaction between them according to the program, incorporated in the microcontroller. As against microprocessors, which are used in personal computers, the microcontrollers contain the built-in additional devices. These devices carry out the tasks under the control of a microprocessor nucleus of the microcontroller.

The most widespread built-in devices are devices of memory and ports of input/output (I/O), interfaces of connections, timers and system hours. The devices of memory include operative memory RAM (Random Access Memory), constant remembering devices ROM (Read Only Memory), reprogrammed EPROM (Erasable Programmable Read-Only Memory), reprogrammed EEPROM (Electrically Erasable Programmable Read-Only Memory). The timers include hours of real time and timers of interruptions. The means of input/output (I/O) include serial ports of connection, parallel ports (I/O of a line), analog to digital converter (ADC), digital to analog converter (DAC), drivers of the liquid crystal display (LCD) or drivers of the vacuum fluorescent display (VFD). The built-in devices have increased reliability, as they are mounted on one microchip and do not require any external electrical circuits.

The increased demand on microcontroller systems requires better preparation of the experts, which can project such systems. Therefore, this report is devoted to development of technology, which raises efficiency of the expert's preparation in the field of microcontroller systems designing. This technology is based on using of a remote training complex, which can improve of education quality thanks to more effective contact of students with teachers.

This educational technology is applied to all forms of training, but in particular, to correspondence and remote forms, because such students have not stable contact with teachers, because, as usually, they are located on large distances from an educational institution. However, the stable contacts of students with the teachers determine quality of received education. The technology is based on the use of satellite and mobile communication systems. The described technology is implemented at the Information Systems and Technologies Department of the Kiev State University of Economics and Transport Technologies.

General principles of the training complex using in educational process

This technology is based on the using of the remote training complex. It allows to carry out study of the discipline «Designing of microcontroller systems» in stationary and remote modes, that especially is useful for the students of a correspondence college. The general view of the training complex is shown on Fig.1.

The general structure of the training complex is shown on Fig.2.

Fig.1.The general view of the training complex.

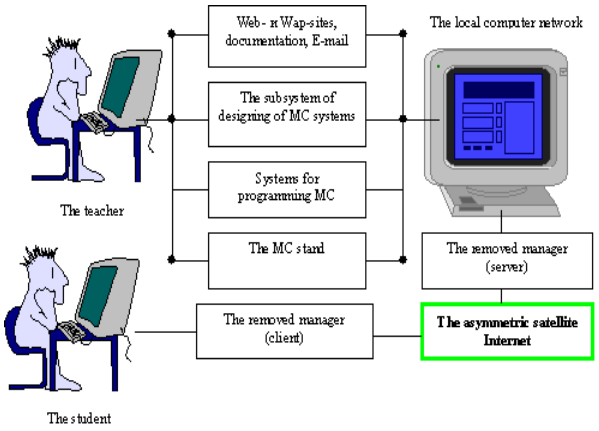

Fig. 2. General structure of the training complex.

As it is visible from Fig.2, the training complex consists of a number of subsystems, each of which forms the certain technological element. The technology of work with the training complex is given on Fig.3.

After study of the theoretical material about the microcontrollers AVR using, the student receives the tasks of growing complexity. These tasks will allow students to receive professional skills in microcontroller systems designing. These tasks are formulated in ten laboratory works, which allow to comprehend majority of the most important aspects of microcontroller systems design.

The student receives a task on designing. He develops the basic scheme of the projected device using the core ISIS of the Suit Proteus Professional Version 7.2 (firm Labcenter Electronics). Further the student develops the program for the microcontroller with the help of integrated environment of designing CodeVisionAVR Version 1.25.3 (firm HP Info Tech). This program ensures the solution of necessary tasks in the projected microcontroller system. The program is connected to the microcontroller project in the core ISIS of the Suit Proteus Professional, and it is carried out modeling of projected system. If the functioning of model does not correspond to the technical requirements, the student comes back to a design of the basic scheme of the microcontroller project or on a development of the program for the microcontroller and carries out necessary updating. The considered process repeats so long as the functioning of model of the project will not meet the technical requirements of the project.

Further projected system is realized on the stand with the real equipment and it is investigated the quality of its functioning. If the project works not adequately to the requirements specification, it is carried out the transition to the described above design stages, where it is carried out the updating of the scheme, the changes in the program, modeling the project.

After successful final test of the project, it is necessary to design the printed-circuit board of the project. The trace of the printed-circuit board will be carried out with the help of the core ARES of the Suite Proteus Professional, in which the scheme designed in the core ISIS is transferred. Development of the project is completed on this stage.

However, the realization of the designed project is possible on the subsequent levels of teaching (course project designing or bachelor degree project designing).

The considered technology is intended not only for the students of the stationary form of training directly working in laboratory, but also for remote training, that especially is important for the students of the correspondence form of training.

The remote mode training is provided by Remote Administrator 2.2, which allows to the students, using the modern high-speed Internet, to work with the remote computer of laboratory connected with the microcontroller stand. Thus, the student can develop project of microcontroller system and create program for microcontroller on the remote computer of laboratory. Further, he can write down the program in the microcontroller on the laboratory stand in remote mode. The results of microcontroller system functioning are displayed on the display of

the computer, by which the microcontroller stand is connected through COM-port. These results can be seen and to analyzed by the student, which works on the computer, taking place outside laboratory. For effective work in a remote mode It is used the asymmetric satellite Internet [Bondarenko, 2007-1,2], which is shown on Fig.4.

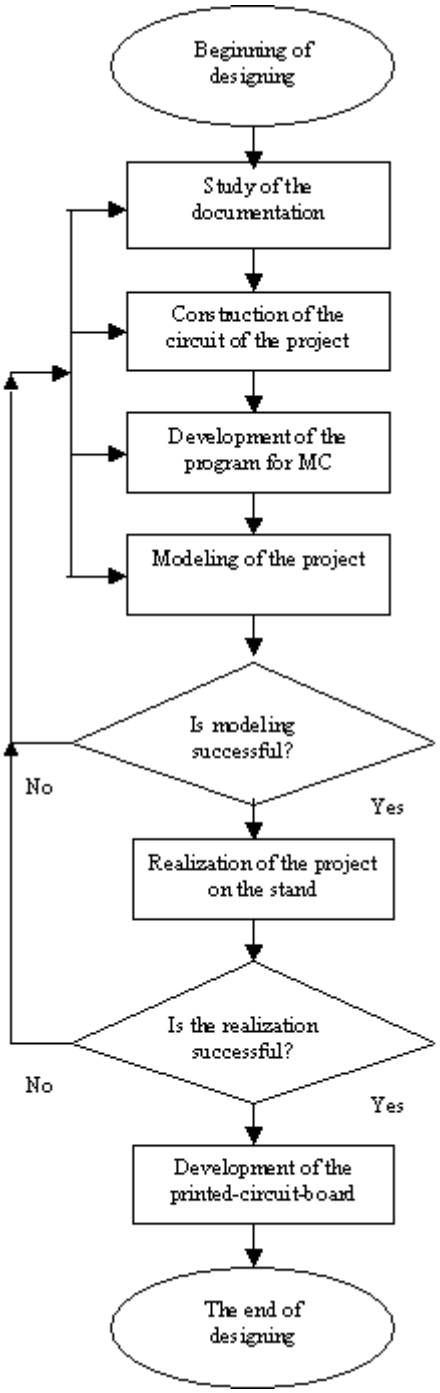

Fig.3. Technology of work with the training complex.

The satellite Internet is a unique means of access to educational Internet-resources in towns and villages, where the connection to the Internet through switched telephone channels, dedicated channel or using ADSL-technologies is inconvenient. The satellite channel provides the same fast and reliable transfer of the data, as well as the dedicated channel - up to several Megabit per one second, that enables to receive to the students large volume of the educational information, for example, multimedia textbooks, volume of which is measured in hundreds megabytes.

The technology of the using of the asymmetric satellite Internet in educational process is shown in Fig.4. A student install the complete set of equipment for the satellite communication (the satellite dish, the converter, the DVB-card), with which student can receive all entering data from the Internet, for example, access to educational sites, files, remote access to laboratory computers, E-mail, consultation in the on-line mode. The student's query for receiving of necessary information is sent on the server with the help of another Internet-channel. Usually such Internet channel is the mobile telephone, which works on GPRS-technology if the access to cheaper means of the data transfer is absent. Alternatively, it is possible to use the Internet-channel based on the dial-up modem use, if the student can use stationary telephone communication channels. The satellite antenna and stationary or mobile telephone can work in pair, not creating any difficulties, as volume of the outgoing information is usually small (dialogue in forums, ICQ, E-mail).

The satellite «NSS-6» resource is used for organization of satellite communication channels.

Working in a remote mode, the student requires intensive information interchange with the teacher. As means of such exchange it is possible to use Web- and Wap-sites, E-mail, teleconference, multimedia-training courses on CD and DVD disks, the means of which development were considered in [Bondarenko, 2007-1,2].

It is possible to describe information flows in the system as follows: the user (teacher, student) has a complete set of the equipment for reception of signals from the geostationary satellite and some ground connection with the Internet. When the student asks about any information in the Internet, his query is directed to the Internet provider or mobile communication operator. The information, which was asked by student, is sent to him not directly and at first, it goes to the satellite provider. The satellite provider directs this information on the satellite, and already satellite relays this information to the user. The user receives the information with the help of the satellite antenna and the

DVB-card inserted in PCI slot of the computer. The satellite access to the Internet uses the DVB-standards and technologies, which are used for modern digital TV. This explains an opportunity of using of the same equipment for satellite access in the Internet and for the viewing of the digital satellite television programs and listening of qualitative digital broadcasting, which also can be used in the educational purposes.

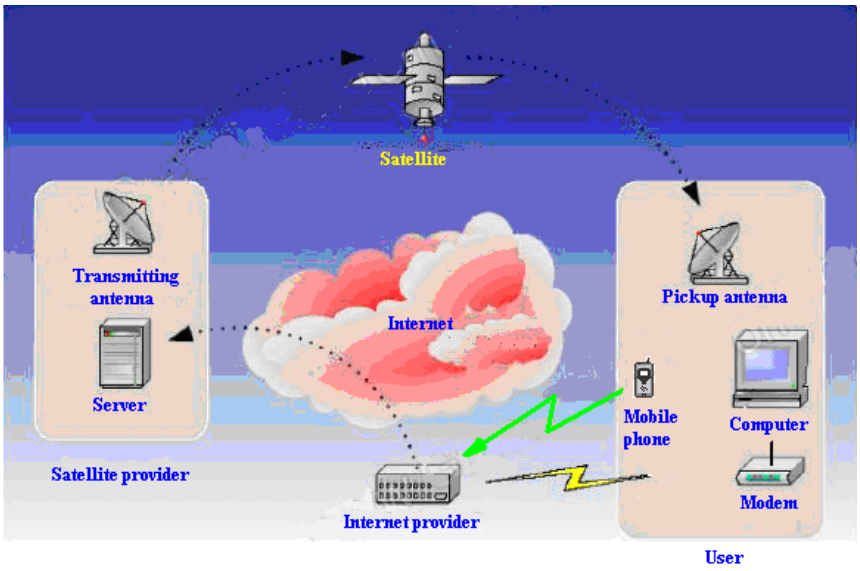

Fig.4. The general scheme of information flows in the Internet during using of the training complex.

Conclusion

The described above technology of remote organization of educational process of the discipline «Designing of microcontroller systems» is successfully developed at the Information Systems and Technologies Department of the Kiev State University of Economicsc and Transport Technologies. The implementation of this technology is carried out in parts and in the future it is planned inclusion of the more powerful possibilities. This technology is used for preparation of the specialists of the various forms of training. However, it is observed greatest efficiency of the technology in the student's preparation process of the correspondence form of training, because such students have not stable possibilities of direct communication with the teacher and this technology makes such communication more active.

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