

Development of a university educational software used for teaching of computer networks addressing

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Abstract

The incursion of technology into classrooms to assist the teaching and learning process nowadays becomes indispensable in all educational spheres. In particular, the use of educational software in universities has been well accepted by students. One of the areas of opportunity for the development of university educational software is in subjects considered fundamental, since its understanding by students is the basis for more advanced topics. This paper describes an educational software developed in Blender, used as a tool to support students in learning the theme of addressing of computer networks. Finally, preliminary results about the use of the software are presented and discussed.

Keywords: *Teaching and learning process, educational software, information and communication technologies, IP Addresses, Network Addresses, Broadcast Addresses, Host Addresses.*

1. Introduction

An important line of work in today's education is to develop strategies and teaching tools that allow to improve the teaching and learning process, among which stand out multimedia resources and computer assisted teaching software. For this reason, professors of the department of computer networks of the Faculty of Mathematics (Fmat) of the Autonomous University of Yucatan (UADY) are developing the project named "Development of a graphic tool for learning network addressing", which consists of developing digital educational resources to strengthen the teaching and learning process of students attending the computer networks course.

It is known that the implementation of information and communication technologies (ICT) in university spaces promotes learning scenarios that allow effective interaction between instructor-student, student-student and student-content that encourage and enhance the development of competencies and critical thinking skills by themselves[1].

Considering that information and communication technologies allow to reach new stages of learning, educational institutions in Mexico should be more committed to bridging the digital divide based on various

strategies and techniques of learning through the use of various technological resources that are at its disposal to promote meaningful learning [2]. According to Bloom [3] even if students vary in their rhythms and modes of learning, if the teacher is able to provide enough time and appropriate learning conditions, all students could reach a high level of performance. Thus, to motivate students and ensure that their learning is significant, the programme activities must arouse curiosity and keep the interest of students towards the thematic content, without provoking anxiety and avoiding that the ludic elements interfere negatively with their learning [4]. Therefore, in teaching is noted the need to develop new digital educational resources, such as educational software, which help to improve the learning process, favoring the evolution of intuitive insights in students. Educational software becomes today a teaching material created to facilitate learning and are a good example of the type of resource that can be used to exploit education to the full, including the virtual one [5].

This paper presents the development of an educational software which aims to complement the actions carried out in the classroom, with regard to the issue of addressing to reinforce the learning of students with ludic activities that they find motivating and rewarding, since the issue of addressing is essential for anyone wishing to start the study of computer networks.

2. Educational Software

The learning process is a complex cognitive task that can be very imposing in students, since it requires motivation and much effort from them. Therefore, as benefit of education is to create educational software that is interesting and stimulating for students, especially because when using this type of software students are required to use one or more technological devices, which today are commonly found as tools used by students [6].

Educational Software is defined as the technological product designed to support educational processes, within which is conceived as one of the means used by who teaches and who learns, to achieve certain purposes. This can also be defined as a means of presentation and development of educational content, with its own system of codes, expressive format and narrative sequence [7].

Educational software is designed to achieve different purposes in the field of education, from databases to didactic support programs for exposure of some thematic content or some subject.

The characteristics that an educational software must have are [7]:

- That takes into account the characteristics of the target population.
- To adjust itself to the differentiated proficiency levels of users.
- That has the ability to fill conceptual gaps, detecting them and taking the way to satisfy users.
- That has the capability to develop abilities, knowledge, and circumstantial skills in the achievement of the learning objectives.
- That exploits its own technical and of interaction potentialities.
- That promotes the active participation of the users in the search, generation, appropriation and reconstruction of knowledge.
- That allows users to live and reconstruct experiences, which would be difficult or impossible to achieve through other means.

However, educational softwares do not necessarily have all the previous features, since each software is developed with specific purposes and characteristics; on the other hand it should be mentioned that their technological support will surely correspond to what at that time was on the market.

2. Types of IP addresses

IP addresses of layer three, also known as logical addresses, are hierarchical addresses. This hierarchy first defines networks and then devices that belong to those networks. An example for understanding what it is a hierarchical address would be a phone number, in which first it is defined the country code, then the State and finally the user's number [8].

In each IPv4 network there are three types of addresses: the network address, which is a special address that refers to the network; the broadcast address is a special address which is used to send data to all hosts on the network, and host address, which is an address of unicast assigned to end devices in the network [9].

Within each network, the network address and the broadcast address are two addresses that cannot be assigned to individual devices. To such devices it is assigned a host address.

The network address is a standard way of referring to a network and can not be assigned to a device, so it can not be used as an address for communication on the network. Within the range of IPv4 addresses of a network, the lowest address is reserved for the network address.

The IPv4 broadcast address within a network is a directed broadcast address, and is used to communicate with all hosts on a network. Broadcast address use the higher direction of the network range.

The host address is the one that can be assigned to devices on a network and is comprised between the network address and the broadcast address.

When a network address is examined, a prefix length is required to know how many bits of the address represents the network portion and how many the host portion. The prefix length is the number of bits of the address that contains the network address, and is written in a format of slash. For example, to the address 172.16.4.0/25, "/25" is the prefix length, which indicates that the first 25 bits are the network address and the remaining 7 bits (of the last octet), is the portion of the host.

As example of the types of addresses can be said that for the IPv4 address 172.16.4.0/26, the network address is 172.16.4.0; the broadcast address is 172.16.4.63; and finally addresses that can be assigned to the host starts with the address 172.16.4.1 and end with the address 172.16.4.62. Another example can be seen in table 1.

Table 1. Network-Host-Broadcast address

Network: 192.168.1.0/24	
192.168.1.0	Network Address
192.168.1.1	Host Addresses
192.168.1.2	
192.168.1.3	
.....	
192.168.1.252	
192.168.1.253	
192.168.1.254	
192.168.1.255	Broadcast Address

3. Network-Host-Broadcast

The proposed educational software consists of a game (named Network-Host-Broadcast) and is part of a set of four games that integrate the video game Network Casino, this being the fourth game. Without losing the approach to the concept of the video game Network Casino, the interface created to Network-Host-Broadcast was one of a pool table where to the player is presented an IP address and then he must choose between three options (Network, Host or Broadcast) hitting the ball with the cue to put it in one of the three holes of the table.

The game must be chosen from a main menu, as can be seen in Figure 1, this menu also handles the concept of the billiard game by using a ball to represent the various options; similarly the interface of this software has the shape of a pool table. (Figure 2).



Fig. 1. Menu of the game Network-Host-Broadcast



Fig. 2. Interface of the game Network-Host-Broadcast

Blender (Figure 3) was used as a design tool, the first thing modeled was the table using cubes for both the edge and the base on which it rests, a plane surface for the background and cylinders which were applied Boolean operators to form the pockets. Upon completion of the distinct objects a texture was added to give them realism and to make the interface attractive. Likewise, the Blender option GLSL Materials was activated and lights were added to obtain the desired realism.



Fig. 3. The tool Blender.

It was used a sphere, a cylinder and Bezier curves for the modeling of each one of the objects which were placed on the table. The cue was also modeled and planes were added to form the walls and floor, finally the IP address was added with a proper size at the top of the table so that the player can view it (see Figure 4).



Fig. 4. Game with the address

Colors and textures were added to the employed images to make them more showy, transparencies were applied to some objects to simulate the material, a normal texture were applied to the walls for realism. In order to make everything look better and well-lit lamps were added that helped to look realistic.

With the finished design it was implemented the algorithm coded in Blender to know if the presented IP address is of network, host or broadcast. The functionality of the game was accomplished with a script with the implemented algorithm and other additional routines that handle the objects.

3.1 Description of the proposed software

The game works in the following way; once presented the menu the user can choose one of four options:

- Game
- Help
- About
- Exit

Selecting the option *game* leads directly to play and the Enter key is selected to display an IP address, to what the user must move the cue using the arrow keys to aim to the left ball if the address deployed is of network, to aim the ball to the center if the address deployed is of host, and to aim the cue to the right ball if the address deployed is of broadcast, once made this a sign of *correct or incorrect* appears, then the user has the option to continue playing or to return to the menu. In Figure 5 is presented the result of having selected the choice of Host and Network for the same address, the results are right and wrong respectively.

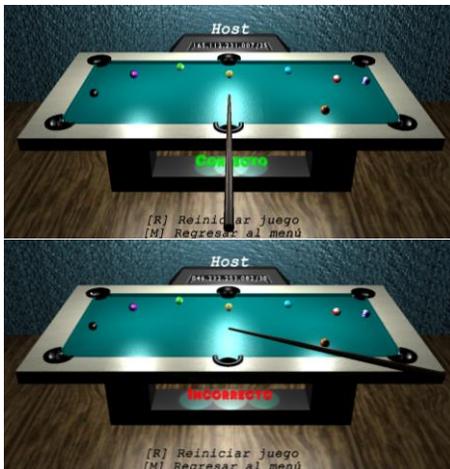


Fig. 5. Option *Game* with an address

The option of *Help* display concepts that we need to know in order to play. See Figure 6.

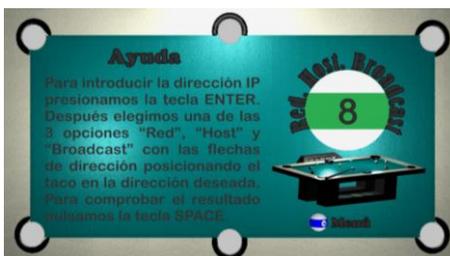


Fig. 6. Option of *Help*.

The option *About* displays data from the developers of the application.

The option *Exit* allows the user to leave the game.

4. Preliminary tests

This educational software was provided to a group of students who were enrolled in the computer networks course. In general, the students were fascinated with the idea of having a game in the classroom. Regarding the interface of the tool, students commented that they found it friendly and liked the presentation of the game since they considered that it allowed a better understanding of the subject due to the practice with different IP addresses presented randomly, since the game graded their answer immediately. However, this game is intended to be distributed among a greater number of students to determine if it contributes to their learning.

On the other hand, students commented that although the software can be used outside of the classroom, to use it in an activity within the class would make the class more

dynamic and then they would understand the theme in a timely manner.

5. Conclusions

The integration of the technologies of information and communication in the education sector, has promoted the transformation of the teacher and student roles to major actors of the teaching-learning process, demanding to the first ones the achievement of professional competencies that impact on new teaching practices and in the creation of learning environments where students enhance their life competencies. As part of the creation of such learning environments, professors of the department of computer networks of the Faculty of Mathematics of the Autonomous University of Yucatan, have put special attention on the themes of the computer networks course to impart them to students taking into account that they already come from a generation accustomed to the use of technology, and that they find traditional teaching tedious. For this reason, the task of developing a tool of technological innovation that contributes in the learning of networks addressing was performed, for students to improve their knowledge and skills through ICT. The developed game is the fourth in the video game Network Casino, students found it useful and wanted to use it into the class activities.

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