

# VIRTUAL REALITY AS A TOOL IN THE EDUCATION

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## ABSTRACT

The virtual reality is being more and more used in the education, enabling the student to find out, to explore and to build his own knowledge. This paper presents an Educational Software for presence or distance education, for subjects of Formal Language, where the student can manipulate virtually the target that must be explored, analyzed and studied. With a simple interface, with easy comprehension and using, this paper presents an educational software where the student manipulates the objects that will be studied in 3D, getting easier the study of concepts and theories about Automaton, Regular Expressions and Minimization of Automaton interacting directly with the object in 3D. To the design of the automaton, the software uses tools in 3D, as the Blender and the VRML (Virtual Reality Modeling Language) and to the publishing of a page on the internet it is integrated the Program Language PHP (Hypertext Pre Processor). The results reached with the use of the developed software show the attributes that make the ideal Virtual Reality for situations of research and learning taking the discipline as a reference of the classroom to the computer labs and making more interesting to the student, making the learning easy.

## KEYWORDS

Virtual Reality, Educational Software, Formal Languages, 3D, Blender, VRML.

## 1. INTRODUCTION

The constant evolution of the technology is taking the education to new ways, much more attractive to the students, making possible the use of new tools, taking to an evolution on the teaching process. The Virtual Reality takes an important place in this evolution.

Several are the definitions about the virtual reality, but in general, they refer to the an immersive and interactive experience based on graphic images in 3D generated in real time by computer, in other words, it is a simulation generated by a computer, about a real or just an imaginary world. Another definition, more specific is: virtual reality is a computer interface that permits the user to interact in real time, in a tridimensional space generated by a computer, using their feelings, through special devices (Kimer, 2012). The user can notice the virtual world, through a window built by the monitor screen or by projection screen or it can be inserted in the real world through a helmet (HMD) or multi projections rooms (caves) and interaction devices (Kimer, 2012).

The education can be seen as a discovery, exploration and observation process, besides the eternal construction of the knowledge. With this, the specific characteristics of the virtual reality can transform it on a mighty tool in service for everybody who seeks for an education evolution. Many things that until short time ago were dreams, nowadays, with the current technological advances became reality.

With the virtual reality acting in the education we can discover, explore and build knowledge about places and situations that we could never explore. The great potential of the virtual reality is exactly on these possibilities, not only through classes or physical objects, but also through the virtual manipulation of the target to be explored, analyzed and studied.

We can understand as Formal Language Theory and of the automaton, the study of the math models that enable the specifications and the language recognizing (in the wide sense of the word), their classifications, structures, priorities, characteristics and inter-relationships (Furtado, 2012). The importance of this Theory in Computer Science is double: it supports as the other theoretical aspects of the Computer Science, as it justifies several computer applications such as language processing, pattern recognizing, modeling systems (Furtado, 2012).

The proposed educational software has as a purpose to help students and teachers to have a more complete and interesting view about the automations and about the changes occurred on their minimization. It also has as a purpose to make the subject more interesting to the students, making the learning simpler. We intend to make the student more participative, making the learning interactive. Through the software developed it's also possible to evaluate the learning of the students on the distance modality, making easier the teacher's work who receives in his registered electronic address the result of the exercises done by the students on the 3D software.

## **2. VIRTUAL REALITY**

Virtual reality, augmented reality and their variations represent computer interface techniques that take into account the tridimensional space. In this space, the user acts in a multi sensorial way, exploring aspects of this space through the viewing, hearing and tact. According to the available technology it's also possible to explore the smell and the taste. Body perceptions, like cold, heat and pressure, are included in the tact, through the skin (Kimer, 2011).

Virtual reality is characterized by three basic ideas: (Pinho, 2004)

- Immersion: the user has the real sensation of being inside the virtual world of the computer. Devices that make this sensation: digital helmets and digital cave.
- Interaction: the user manipulates virtual objects. Devices that make this sensation: digital gloves.
- Involvement: exploring of a virtual environment, it's as if the user took part of the virtual world and he can interfere directly in result of the application, the user can navigate on the virtual environment in a passive or active way.

### **2.1 Virtual Reality in the Education**

The technological revolution has been permitting the use of new approaches in the teaching-learning process. One of the conductive technologies to the building of innovative tools for the education is the Virtual reality, which offers tridimensional computer environments with advanced forms of interaction that can provide more motivation to the learning process.

A very short time ago, we could consider that the great potential of VR use was in small groups placed in large urban centers and in teaching and researching institutions. However, the integration VR-VRML democratized its access, expanding more and more its potential and using fields (BARILLI et al, 2012).

With the help of resources of some modeling and animation programs as the Blender 3D, for example, the VR use can help students in the comprehension and assimilation of concepts, coming up as a valid alternative to get good results. Other benefits are observed with the use of Virtual Reality in the education.

According to Clark (2006) the Virtual Reality can be used to make the learning more interesting and fun with the purpose of improving the motivation and attention, decreasing costs when using the objective and the real environment no matter how expensive the simulation is. It also makes possible that situations that were impossible to explored in the real world can be done, for example: exploring a planet like Mars, traveling inside the human body, doing submarines explorations or inside caves, visiting very small places to be seen (molecules) or very expensive or very far away, or yet because this place is in the past (historical places).

## **3. FORMAL LANGUAGES**

The Formal Languages were developed in 1950 with a purpose of developing theories related to the natural languages. (Menezes, 2005) But soon it was checked that the formal languages were ideal to the languages study in the Computer Science area. In the languages study two kinds of problems to be solved and treated were found, the syntactic and the semantic. The syntax treats about the grammatical checking of the programs, the free properties of the language, as the meaning of a program.

The study of the Regular Languages is done starting from three formalisms (Menezes, 2012):

- Finite automaton: it's the recognizer formalism, being a set of states of a finite system;
- Regular expression: it's the denotational formalism, it defines how to build the words of the language, it's a basic set of language operation;
- Regular grammar: it's the generator formalism that corresponds to the production rules.

A finite Automaton is a system of sequential finite states that represent a model of Computer Science, widely used in the Formal and Compiler Languages, being used to studies of Formal Languages theory in Computer Science. A Finite Automaton can be deterministic, non-deterministic or with empty movements (Menezes, 2012).

#### 4. SOFTWARE DEVELOPMENT METHODOLOGY

The educational software developed is based on the Virtual Reality oriented to the Formal Language subject, having as a target the study of Automaton's Minimization. To the mounting of this software a Blender modeler was used, enabling the building of images in 3D of the automaton's.

The Blender modeler permits to explore its files to the VRML 2.0 language that is a language used to the descriptions of virtual worlds enabling this way that corrections on the images be done using the command lines.

It's also necessary that the Plug-in Cortona be installed on the computer where the software will be used. The Plug-in opens the navigator with controls that permit that the user to visualize the images by different angles, enabling thus, the interaction of the student with the objects to be studied.

The Blender modeler used to the building of the Automaton's images don't permit that letters and numbers be exported, so it's necessary that the letters and numbers, as for example: q1, q2, a, b, and 0 be placed on the images through the VRML Language.

The software is available through a webpage on the internet, where the students have access to the initial page.

Through the initial page the users will be able to access the Menu of the page that shows the study option, it presents to the student the possibility of downloading the Plug-in Cortona and it also leaves available some links for reading.

The software will be available through pages built using the PHP program language. The student will be able to choose to answer questions about regular expressions before performing the Automaton's Minimization.

The automaton's minimization is done on a screen where the user visualizes the Automaton's design in 3D and he must insert some state that is necessary ant to use the table and the lists to find the equivalent states that can be removed. When the user finds the equivalent states, he will be able to visualize the minimized Automaton in 3D. If the student doesn't get the right equivalent states, the page will advertize him about the error and the student will be able to repeat the exercise.

The page presents exercises with multiple choices, where the student is going to answer the questions and check if the chosen answers were correct, this way the student will be able to test his theoretical knowledge. The page advertises the student when the options done in the questions of multiple choices are the correct ones and the student will have the option of repeating these wrong questions.

The page presents a Material for Reading that is destined to explain doubts about Regular Expressions and Automaton's Minimizations. This page can also be used by educators in their presence or virtual classes. The page also presents a help material that explains how to use the pages with the Minimization exercises. This help is available through the Menu of Minimization.

If the material for reading doesn't solve all the doubts, some links that were used in the work are also available in a web page. The answers of the questions of Minimization are also available in the page of the subject, and they can be accessed through the Help page. This page is to help teachers and students, if some problems about solving these exercises happen.

Using the system above with a package of distribution apache with PHP provider that owns the phpMyAdmin toll, a bank of data was created to store the login and the students' password to do the evaluation. The student's login must be the email that he desires to receive his evaluation, and the teacher will receive in an email that is already defined in the program. To facilitate the use, the bank will be exported and it must be imported by the teacher who wants to use the system.

Then it has done a checking to check if the answers are correct. When all the exercises are done the student will send the results and the grade automatically to the email address registered in the beginning like a login and to the teacher's email, so this way the evaluation is done automatically.

## 5. CONCLUSION

The educational software helped to take the Formal Language Subject from classrooms to the computer labs, making the teaching/learning process more interesting and pleasant to the students, facilitating the teacher's work during the evaluation performance too.

The Virtual Reality presents an opportunity of learning with a real situation, but artificially created, facilitating the visualization and the interaction sensation with the study focus. When we can't have the real experiences, the Virtual Reality is irreplaceable. The simulation in the VR also permits us to be in hard and dangerous situations, which aren't usually accessible in the real world. Furthermore, the VR permits to take to the students complex themes of hard learning and sometimes impossible to show.

The software presented was used during a year in the Formal Language Subject, at the X University, where it was found a better appropriation of the concepts and a bigger facility in the activities performance with automatons' minimization, resulting thus in an improvement in the students' evaluation who used this software with VR.

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