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Educational Software with Speech Recognition for Primary Education

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Abstract

This article presents an educational software developed using images, videos and speech recognition. The thematic used in the development of this software focuses on concepts related to the states of the Mexican Republic (Mexico), and it was made in a special way to give support to teachers and students of elementary school, particularly fourth and fifth grade (which is when the cited thematic is covered). The software "Map of the Mexican Republic" was made bearing in mind that it could be used by a teacher to make his or her class more dynamic, attractive and consistent with the current technological age, and on the other hand, that it can be used for the student to achieve a meaningful learning.

Keywords: *Speech Recognition, Educational Software, Information and Communications Technology, Software Map of the Mexican Republic.*

1. Introduction

Globalization has one of its more relevant manifestations in the so-called Information and Communication Technologies (ICT), which have allowed to bring global access to the world of communication, facilitating the interconnection among people and institutions worldwide, and eliminating spatial and temporal barriers. ICTs are the set of technologies that enable the acquisition, production, storage, treatment, communication, registration and presentation of information, in the form of voice, images and data contained in signs of nature acoustic, optical or electromagnetic [1].

Nowadays it is taking place a speeding up of the continuous increase that has been occurring in the need for users to daily interact with computer systems. Every day becomes more necessary to interact with different interfaces: ATMs, travel information consultations, consultations of maps, search for information, education, etc. This in turn implies to consider in the design of software interfaces that these must be more accessible, usable and useful, since this can make the difference between an application and another, especially if they will be used for educational purposes.

Learning is an activity that is intrinsically associated with human development. Begins with birth, when we learn to behave, how to walk, etc. After those early years, the educational system begins to instruct people so that they can acquire experiences, through a learning that can be called traditional, in a continuous interaction of the person with their environment [2]. ICTs have come to occupy an important place in our lives and they are found in nearly every human activity as when going to a store, in the car, at work, at home and in educational institutions, where they play a role as auxiliaries in teaching activities.

Currently the educational process must play an important role in the training for abilities and skills necessary to use ICTs, using strategies that enable students to be active. These modalities leads to new conceptions of the process of teaching and learning which emphasizes the importance of the active involvement of students; the attention to the emotional and intellectual skills at different levels; the preparation of young people to take on responsibilities in a world in rapid and constant change, and the flexibility of students to enter in a job market which requires continuous education throughout life [3]. One of the ways that contributes to obtain good achievements in the process of teaching-learning is the use of educational software by the professor.

Guillermo Cardona [4] says, "This will be the century of knowledge, more precisely the century of scientific and technological rationality", this due to the fact that technology has reached a large part of the activities that surround us, as the jobs, where it is necessary to be competent in the technologies that arise. A change in the roles of teachers and students is presented along with the presence of technology in education. Professors in the teaching-learning process stop being providers of knowledge, now becoming facilitators, advisors, motivators and consultants of the student's learning, for which must not only exists a personal interaction, but also a virtual one. Their function is to design, implement, and evaluate learning situations so that the student reach specific achievements [5]. On the other hand, we must bear in mind that new generations of what we might call the digital age are living with a multitude of technologies since a very early age. Therefore, the channels through which children and adolescents tend to receive information have changed, as well as their way of interacting with the world [6]. The

student ceases to be the passive recipient of knowledge and becomes an autonomous person for their own learning [4]. Taking into account the above, we decided to develop an educational software that helps teachers of basic education to teach students a topic in the subject of geography, and at the same time, that such software can be used with pleasure by students using a digital tool. Specifically, in this work we proposed to develop an Educational Software to be used as a tool to aid in the teaching of the states and capitals of the Mexican Republic for elementary school students. It was decided that this software would address the issue in an entertaining way, through pictures, videos and speech recognition.

2. Educational Software

An educational software is any computer program that is developed for the specific purpose of being used as a didactic resource in the teaching and learning processes, as well as any computer program performed with the objective to be used as a facilitator in the same processes [7]. Hand in hand with the above, educational software have some particular characteristics such as [8]:

- They are materials elaborated with a didactic purpose.
- They use computers as mediums in which students perform the activities that they propose.
- They are interactive, immediately respond to the actions of students, and allow a dialogue and an exchange of information between the computer and the learner.
- They individualize the work of learners.
- They can adapt their activities according to the performance of the students.
- They are easy to use.

The educational software used today as an important complement in the teaching-learning process had their first attempts of development at the end of the 60s with the emergence of programmed instruction systems, but the real boom occurred in the 80s. At first instance, with the production of languages for learning, then with the development of authoring tools for the production of educational software, and more specifically with the development of software of tutorials, of drill and practice, of calculation and of simulation [9].

There is a wide variety of educational software developed to facilitate the teaching-learning process. In [10] it is described a prototype of educational software for the teaching of English vocabulary for children, which comes as part of an educational project that integrates the work of professionals in education and computer science. In [11] it is mentioned about the design of a multimedia educational software, which serves as support in the teaching-learning process for children with Down syndrome, to help them to develop their reading skills, making use of information and communication technologies. In [12] it is described the development of UTVocabulary 1.0, an interactive didactic tool for teaching and learning the English language whose distinctive feature is the capacity to update its collection of words, besides its features of user friendly interface and practical exercises that facilitate the learning of the vocabulary. In [13] it is described the design of an educational software to help first year students of the Bachelor of Veterinary and Zootechnist Medicine, at the University of Guadalajara, Mexico. The majority of developed educational software have given good results in the process of teaching and learning, according to their own developers.

3. Speech Recognition Systems

Speech is the greatest medium of communication that humans have, and can be defined according to its use as a medium unique, alternative, or of support: as a unique medium, is the case where there is no other means of communication; as an alternative medium, it is where there are other means of communication and if at some point they cannot be used, then speech is used; finally, as a medium of support, it is where besides the main communication medium speech can be used as complement.

A speech recognition system, also known as automatic speech recognition is the means by which a computer recognizes what a person says.

Despite there are major advances in the use of speech recognition, e.g. in mobile devices (cell phones, electronic tablets, etc.), there are still challenges that must be worked on as linguistic variability, user variability, channel variability, co-articulation, to mention a few examples [14]. Since the first attempts to build machines that performs speech recognition labors, it has been sought that the human-machine interaction go reaching a greater number of applications, whether for the purposes of research, education, entertainment or other [15].

In recent years they have been developed and continue in development works in the area of speech recognition, which have been developed for specific languages such as for example, a continuous corpus for British English recorded at the University of Cambridge [16] or multilingual systems which have different applications in different areas. As well as multilingual systems which have several applications in multiple areas. There are systems developed for specific users: the speaker-dependent systems; and those whose purpose is to be used for any talker without additional training: the speaker-independent systems. An example of speaker-independent system is "A Game of Gravity with Speech Recognition for Children with Language Problems" which was developed in the Autonomous University of

Yucatan to stimulate children affected with language problems [17].

Similarly works have been done where the interaction simulates a conversation with the user, as shown in the work done by Espejo [18], and if to this application were added a speech recognition system, it could facilitate the interaction, even more when this application is used for children who are not accustomed to use computers. Therefore, one of the options to continue investigating and working is to develop applications that use speech as a means of interaction. Example of this are companies that already offer products that can be exploited in enterprises using speech as means of interaction, as it is offered by LumenVox [19]

4. Software Map of the Mexican Republic

This section describes the software Map of the Mexican Republic (Mexico). When running this software, a screen with the image of the Mexican Republic is presented, with some indicators on each of the 31 states and the Federal District. The interaction with the software can be performed in two different ways: the first one is using the indicators, by clicking on them, the second one is activating the speech mode and pronouncing the name of the state whose information is desired. These actions can be seen in figures 1 and 2.

Fig. 1. Software Map of the Mexican Republic ready to be used by clicking on the indicators that are displayed on the map.

Fig. 2. Software Map of the Mexican Republic ready to be used by speech commands.

Once selected a state by either of the two ways mentioned above, a typical song of the state is played and a screen with information of the desired state is displayed, that includes:

- Name of the state.
- Capital.
- Population.
- Land area in Km2.
- Gentilicio (term referring to the natives or inhabitants of a particular place).
- Coat of arms of the state.
- Image allusive to the state.
- Image of the republic to locate the state.
- The buttons to play and pause the typical song of the state are displayed.

Information of the State of Yucatan and of the State of Mexico are shown in figures 3 and 4 respectively.

Fig. 3. Information of the State of Yucatán.

Fig. 4. Information of the State of México.

In figures 3 and 4 it is observed a space identified as "Click on the Map", selecting this will show an enlarged image of the desired state, it is similar to that shown in figure 5.

Fig. 5. Enlarged image of the State of Yucatan and of the State of Chihuahua.

On the same images 3 and 4 are located the buttons Play/Stop, the same appreciated in figure 6. These are intended to play / pause the representative music of the selected state; it is worth to mention that this action can also be performed by means of speech commands using the words "play" and "stop". Furthermore, this window can be closed using the speech command "close".

Fig. 6. Buttons Play/Stop.

The software also has a "help" which through videos gives instructions on the use of the same (See figure 7).

Fig. 7. Help screen.

4. Tests and Results

The software described above was developed in the Multidisciplinary Unit Tizimin (UMT) of the Autonomous University of Yucatan (UADY). As part of the project "One

Day of Science and Technology in your School" of the same UMT, testing has begun in the following manner: the software has been taken to 10 elementary schools in the eastern part of the State of Yucatan and the results of its use have been encouraging.

The software has been used by children in the fourth and fifth grade of elementary school and by the teachers of the same grades at the 10 schools mentioned above, opinions have always been favorable in the sense that they like the animation presented, colors, music and information generated; we noticed that the feature of being able to be handled through speech commands motivates them, makes them more vigilant to the signs and more ready to pay attention.

On the other hand, the developer group has noticed that one of the main drawbacks of the program is that the environments in which it has been tested are not suitable to use the software by means of speech, due to all the external noise which has affected its proper functioning, so this is an area to work and correct. On the other hand, the manipulation of the software without the use of speech is completely adequate.

6. Conclusions

This paper presented a support tool for teachers of elementary schools that wants to use innovative technological tools in the process of teaching their students. In this sense a software was created keeping in mind the idea to help these teachers in the subject of geography. The developed software Map of the Mexican Republic deals with the topics of states and capitals, information on number of inhabitants, land area, regional music as well as the terms to refer to the inhabitants of a particular state, among others. The concept of speech recognition is described, and it is the same used in the described software, since some of its aspects can be manipulated through speech commands, such as to play / pause the music, as well as to select a state for which its information is desired, among others.

Some tests has begun to be performed, by taking the software to several elementary schools in the east of the State of Yucatan, and to the date encouraging results have been obtained with respect to the use of the software.

This article also includes a description of the process of execution of the software.

The next step is to methodically test the usability of the software and work on all the points that could be found as weaknesses.

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