CAMELL-AUTHOR: AN AUTHORING TOOL FOR COMPUTER-ASSISTED MULTIPLE LANGUAGE LEARNING

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Abstract

In this paper, we present an authoring tool for an intelligent tutoring system, which gives the facility to teachers with limited computer skills to author important modules of the system in a short time and with less effort. Our system incorporates some significant components. The multilingual component promotes the educational process, by affording the opportunity of simultaneous language learning, while a teacher can update the learning material. The student modeling component creates a student's profile, which ameliorates the authoring process. Finally, the authoring tool may handle the teaching material in an easy and personalized way.

Introduction

In our century, we have witnessed major improvements in the areas of transportation and telecommunications, permitting globalization, by which regional economies, societies and cultures have become integrated into a global network of people. As a result, personal, professional, social and economic considerations all point to the advantages of learning foreign languages. Considering the scientific area of Intelligent Tutoring Systems (ITSs), there is an increasing interest in the use of computer-assisted foreign language instruction. Furthermore, when these systems offer the possibility of multiple language learning at the same time, the students may further benefit from this educational process (Virvou et al., 2000). According to Chakraborty (2010), an ITS can be used as a platform for adaptive learning and produce one-to-one learning ambience for students. However, an ITS has an inherent problem in that is very difficult to change or modify its features. Performing any change requires the intervention of the system developers with programming skills (Chakraborty, 2010). Situations are quite frequent where teachers might need to modify the course structure and incorporate new learning materials. These drawbacks can be resolved by the use of an IT authoring tool.

According to Murray (1999), main goals of the authoring tools are to:

- reduce the time and cost required to build the ITSs,
- make it possible for non-programmers to build the tutors,
- provide guidelines for good principles in pedagogy,
- provide a rapid development environment for creating and testing the tutors, and
- help authors better organize their knowledge.

The need for tutoring systems that provide user interface friendliness and also individualized support to errors via student models are even greater when students are taught more than one foreign languages simultaneously. Student modeling may include modeling of students' skills and declarative knowledge and can perform individualized error diagnosis for the students.

In view of the above, we have implemented an authoring tool named CAMELL-AUTHOR (Computer-Assisted Multilingual E-Language Learning - Authoring Tool) that is based on Intelligent Tutoring Systems. The system combines an attractive multimedia interface and adaptivity to individual student needs in multiple language learning. A crucial component of our system is the authoring tool which refers to a computer based system that allows a general group of people (including non-programmers) to create educational content for intelligent tutoring systems. Towards the development of educational software, our authoring system allows non-programmers to easily create software with programming features. The programming features are built in but hidden behind sophisticated tools, so that the authors do not need to have specific programming skills. Furthermore, the system holds a student model, by keeping profiles for every student. In this way, it provides individualized help concerning the students' performance and error diagnosis for the three languages our system supports. In addition, the errors which originated from the language confusion are a matter that is deeply examined. Hence, the resulting system may promote the educational process by providing a highly sophisticated authoring tool for instructors teaching multiple languages. Efforts were taken to keep the whole authoring process low in terms of time, effort and cost and also maintain a minimum requirement of computer skills from the teachers.

The paper is organized as follows. First, we present the related work, concerning authoring tools. Then, we discuss our system's architecture. This is followed by a short overview of CAMELL-AUTHOR through screenshots. Then we visualize CAMELL-AUTHOR's procedures and blueprints by using the Unified Modeling Language. This is followed by a case study concerning our system. Finally, we discuss the usability of our system and present our next plans.

Related Work

Murray (2003) reviewed the state of the art of ITS authoring systems and elaborated the basic issues related to ITS authoring systems. Among them are

- nature of the tutors built using the authoring systems,
- feature and methods used in the system for authoring purpose, and
- evaluation of ITS authoring tools and their availability.

Brusilovsky, Knapp, and Gamper (2006) present the problem of unavailability of authoring systems that can support intelligent content authoring for Intelligent Educational Systems. They presented their system ELDIT which tried to solve this problem. It was built for vocabulary acquisition in language learning by using various techniques of computational linguistics.

Demonstr8 is an authoring system which was implemented by Blessing (1997). In this system, courses can be configured only in simple arithmetic related domains. The web-based ITS authoring tool by Virvou and Moundridou (2000) is targeted to domains that make use of algebraic equations. Mason is an authoring tool which was implemented by Csizmadia (2003). It has a tutorial model connected to a constraint based tutoring systems, but it does not support a graphical student interface. REDEEM, which is an authoring tool developed by Ainswirth et al. (2003), focuses on the representation of instructional expertise and does not support multilingual content delivery. In authoring systems such as in FlexiTrainer (Ramachandran et al., 2004) and VersaTutor (Kodaganallur et al., 2004), there are no features which would enable the reuse of learning materials. Furthermore, the authoring tool which was developed by Choksey (2004) is able to build cognitive tutors and focuses on the assistance of author in design, development, implementing, testing, verifying and maintaining cognitive models. Mobile Author is an authoring tool which was implemented by Virvou and Alepis (2005) and allows instructors to create and administer data bases, concerning characteristics of students, of the domain to be taught and of tests and homework, through any computer or mobile phone. Finally, the ITS authoring system, which was developed by Chakraborty et al. (2010), focuses on the allowance of teachers with less computer skill to author most important modules of an ITS with minimum efforts.

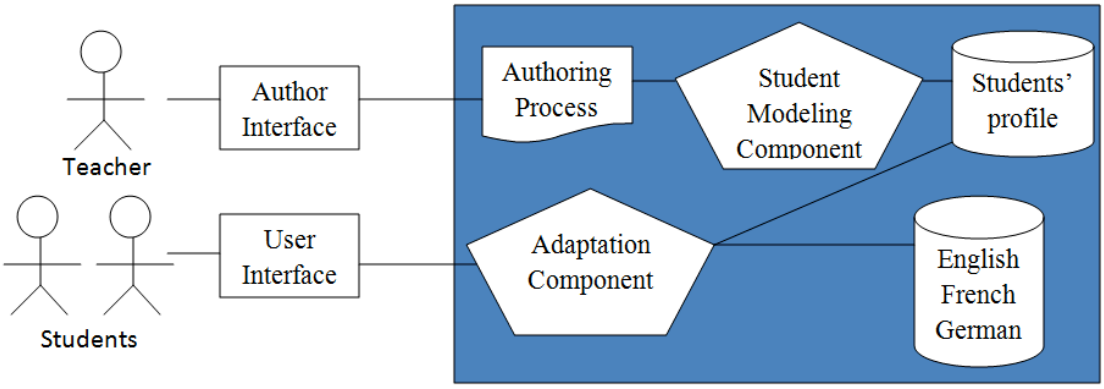
After a thorough investigation in the related scientific literature, however, we came up with the result that there was no implementation of authoring systems that combine student modeling and multilingual support. Hence, we implemented the CAMELL-AUTHOR prototype system, which incorporates intelligence in its diagnostic component, and which performs error diagnosis for students' errors. It also handles the teaching material in a flexible and individualized way.

Architecture of CAMELL-AUTHOR

The system's architecture is illustrated in Figure 1. CAMELL-AUTHOR is able to maintain a history of each student, via the student modeling component. As a result, the system creates an individualized profile for each student. This profile

disposes information for the student, such as the level of knowledge, the performance and the progress in the three languages of the system.

Figure 1: Architecture of CAMELL-AUTHOR



In particular, the teacher is able to check each student's profile. Hence, the teacher is able to update the exercises of each lesson, so as to promote the educational process. The authoring process may be conducted in the three languages, so that each teacher has the possibility of making changes in the educational material, even if s/he has no programming skills. This multilingual component offers the student the possibility of being taught three languages in the same time. Moreover, the material in these three languages can be edited or updated by the teacher with minimum effort and in a reasonable time. Teachers can update the educational material in a flexible environment, which is designed to facilitate the authoring process. The usability of our authoring tool is indicated by the feature of reversal of several changes that may have been done erroneously by the teacher. In CAMELL-AUTHOR, teachers are able to easily see and test the elements of the tutor and its behavior. CAMELL-AUTHOR is designed to work best for teachers with less training, has administrative facilities for grade statistics along with progress reports and promotes the flexibility in the whole process. Finally, our system facilitates the design of the user interface, by providing tools which allow the teachers to author using primitives at the pedagogical level as well as the media level that is "graphic," "button," mouse click, etc. (Murray, 2003).

Overview of the System

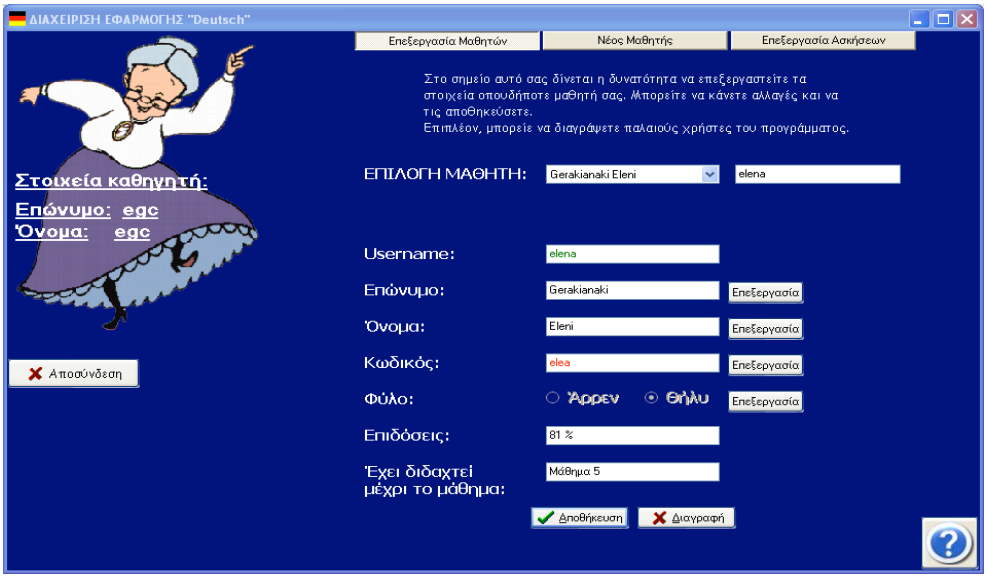
The administration of the system is a crucial component of CAMELL-AUTHOR. Specifically, the teachers have the possibility of registering a new student, updating his/her profile or even canceling his/her profile. The teacher may register a new student by filling in the form, which is illustrated in Figure 2. The teacher has to give a username for the student, to write his/her name and surname and to

define his/her gender. The registration may complete if all the fields are completed.

Figure 2: Registration of a New Student

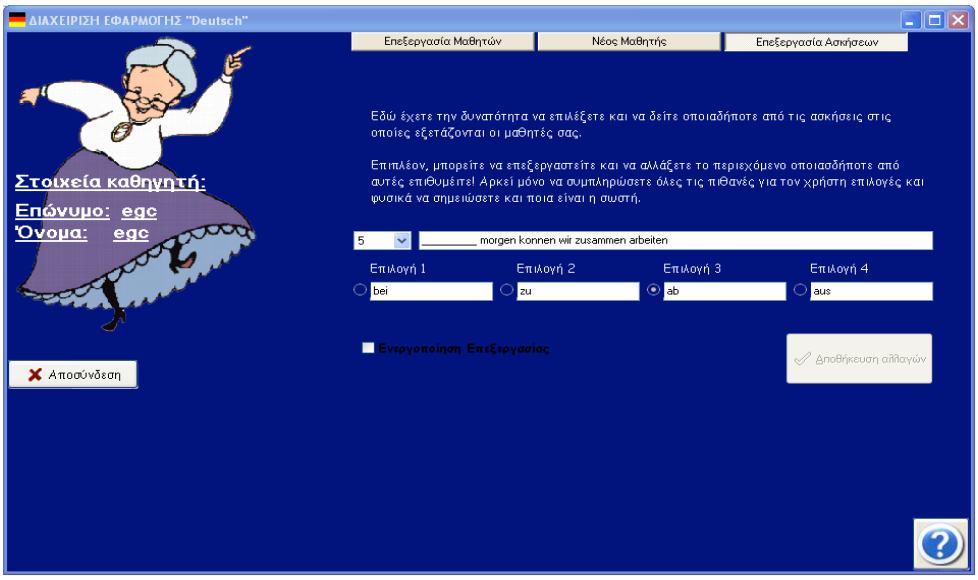
Updating a student profile is illustrated in Figure 3. In this form, the teacher may choose a student from the given list and update his/her profile or may just check the selected student's performance. However, the teacher has no permission to update the student's performance.

Figure 3: Updating a Student's Profile



Furthermore, the teacher has the possibility of editing the multiple choice exercises of the system. In this form, the teacher may choose any question of each lesson. In this way, the teacher may edit any question or its choices.

Figure 4: Edit of the Multiple Choice Exercises



Visualizing CAMELL-AUTHOR's Blueprints

Use Case Diagram. This diagram shows the operability of CAMELL-AUTHOR and the way that the system reacts to reciprocate to any external activator. In particular, the actors "student" and "teacher" can interact with the system in a way that is illustrated in the following diagrams (Figures 5 and 6).

Figure 5: Case Diagram used for the Student

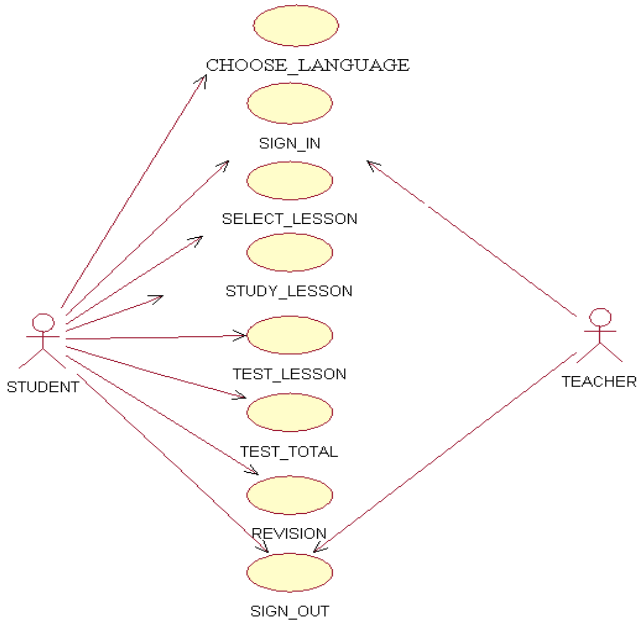
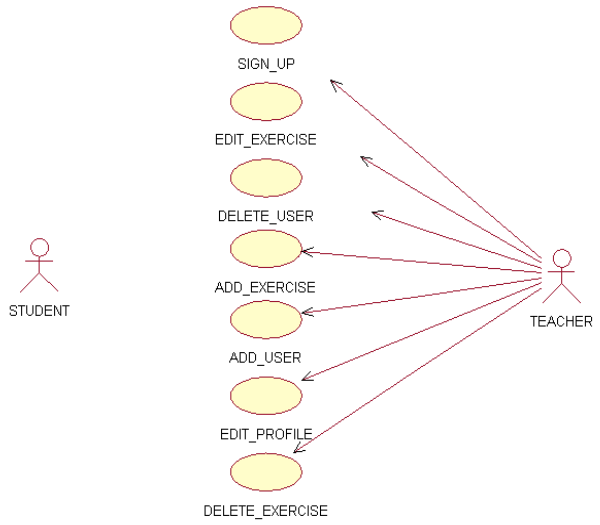


Figure 6: Case Diagram used for the Teacher



Case Study

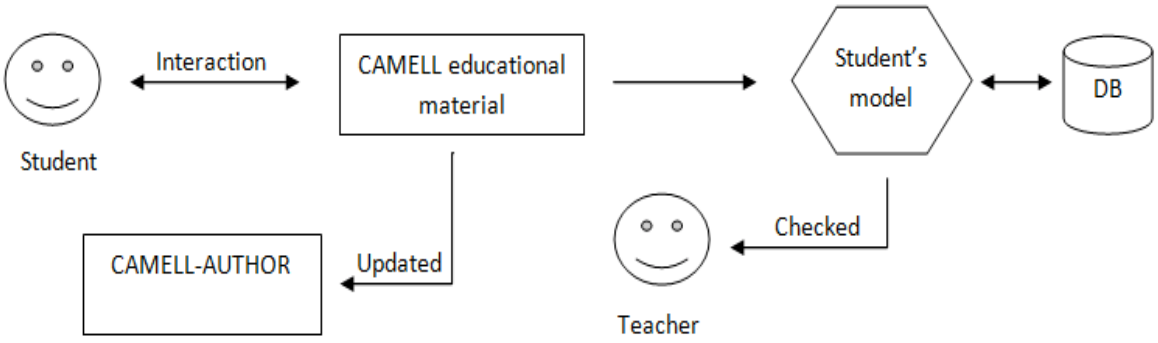
In this section, we will present a case study of our system. The student has to be registered by the teacher. Afterwards, the student can choose one of the three languages and then s/he can log into the system. Hence, the student is able to

interface with several lessons. In order to move to the next lesson, s/he has to answer to the multiple choice exercise, through which the system can evaluate his/her performance. If the grade is satisfactory, according to the system's standards, the student is able to pass to the next lesson. After completing all the lessons, the student is ready to be evaluated by the system through a final test. In this final test, the student is asked to fill in the blanks. After submitting the answers, the system calculates the total grade of the student and informs him/her concerning the errors along with their nature.

The student, who learns more than one language in the same time, can be advised by the system concerning his/her progress and performance in the languages that s/he has already been taught along with the errors that s/he may make. This multilingual component affords the possibility of multiple language learning, opens up new opportunities and gives students perspectives to learn in a personalized and adaptive environment.

Figure 7 illustrates a case study, namely the interaction of the student with the system, the creation of a student model which is stored in the database and is checked by the teacher, and finally the authoring process which obtains information from the student model.

Figure 7: Illustration of the System



Conclusions

Authoring tools for ITSs have the potential of decreasing the effort it takes to build instructional systems or, with the same effort, increasing the adaptivity, depth, and effectiveness of instructional systems (Murray, 2003). CAMELL-AUTHOR is a system which combines the sophistication required to build intelligent tutors along with multilingual support. The multilingual component promotes the educational process, given that the students can learn three foreign languages simultaneously and have the educational material easily updated by their teachers. CAMELL-AUTHOR is a useful tool for teachers who may

annotate learning materials with relevant information and create multilingual learning materials, using a specially designed editor and edit some preliminary information about a student.

Our future plans are to carry out experiments with the system. The results of the experiments will give an indication of the time required to author different parts of a course or student profiles using the present authoring system. This evaluation will prove to be useful for the developers of CAMELL-AUTHOR so as to amend the authoring process.

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