AN INTELLIGENT SYSTEM IN SUPPORT OF ENGLISH LANGUAGE LEARNING AND TEACHING

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Abstract: *To support English language education we propose to develop an intelligent system SYTE (System for Teaching English). Its architecture includes an intelligent agent which uses a database with questions created by the teacher and a graphical interface for access to the application. Students receive randomly chosen test questions on their mobile devices or personal computers at irregular intervals of time and have a time limit to answer them.*

Key words: *VES, e-learning, intelligent agent, e-testing*

1. Introduction

The Distributed eLearning Centre (DeLC) implemented at the Faculty of Mathematics and Informatics aims at providing context-aware delivery of electronic educational services and teaching content, personalized and customized for each individual user [1,2,3]. Considering the trends of progressive transformation of Internet into Internet of Things and the emergence of Semantic Web [4,5] we started developing Virtual Education Space (VES) as an evolution of the DeLC project. VES is an intelligent, context-aware, scenario-oriented and controlled infrastructure maintained by various assistants which are implemented as intelligent agents [6,7].

Three types of assistants are supported in the space [8]:

- personal assistants – these provide an entry point for users to the space and serve as an interface between its owners and the space. If necessary, personal assistants offer various services connected to the personification and adaption. Moreover, they communicate with other specialized assistants in the space to meet the aims and objectives of its owner;
- specialized assistants – these provide different specialized services to the personal assistants thus facilitating the implementation of their plans and objectives;
- guards – special assistants which are responsible for the safety and efficient execution of the plans in the space.

All specialized assistants called Operatives are located in the digital library of VES. This article will present an idea for a specialized assistant which supports English language education by providing students with the opportunity to learn the study material at any time.

2. Digital library

The main part of the VES architecture is the digital library (DigLib). It has all the resources (e-resources) required by the participants in the learning process. Figure 1 shows the architecture of the digital library in VES.

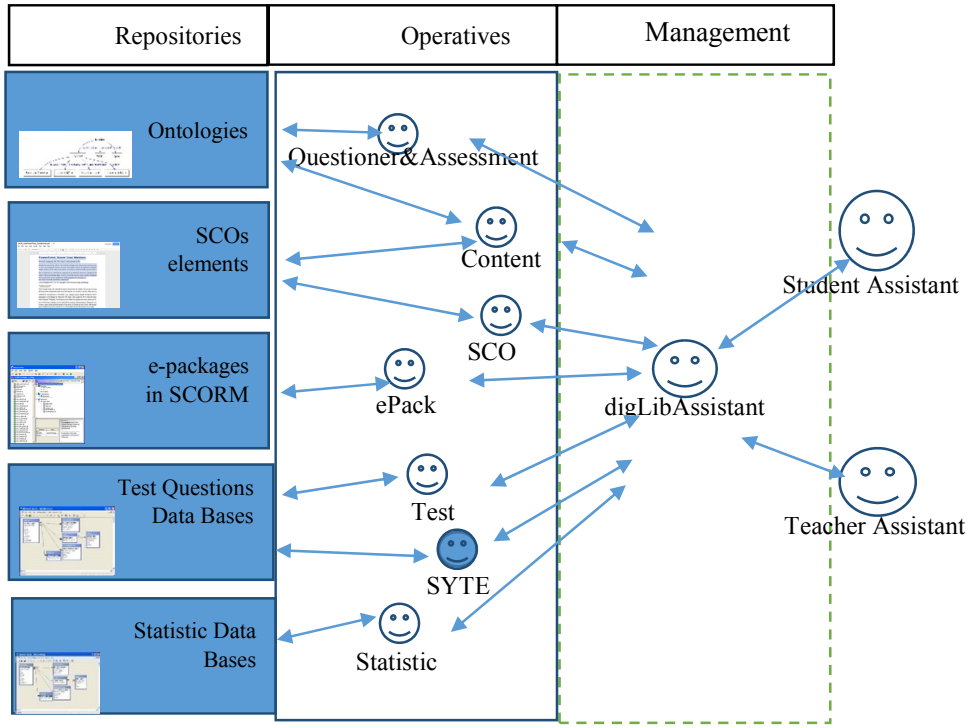

Figure 1: DigLib Architecture

The proposed digital library has three-level architecture:

- Repositories with different types of e-resources – ontologies, Sharable Content Objects (SCO elements), e-packages in SCORM 2004 [9], data bases with test questions, and statistics for the students;
- Operatives that serve the digital library, as they work with a concrete type of e-resources and for certain purposes, can communicate with each other. There are the following operatives in the current DigLib – Questioner &Assessment [10], Content, SCO, ePack, Test, Statistic and SYTE ;
- The high level of the digital library architecture is the management – digLibAssistant. It is an intelligent assistant, which communicates with the environment in VES and accepts requests to the digital library. After that the digLibAssistant distributes requests to the appropriate operatives in the digital library. They fulfil the requests and return a response back to the client. The additional responsibility of the digLibAssistant is to generate operatives with concrete functionality in case there are no such ones or they are busy. The operatives in the library that don't have tasks in a defined time destroy themselves. In this way, the digital library will have just as many operatives as needed.

Below will be discussed the functionality and architecture of the SYTE Operative (SYstem for Teaching English), which is intended to promote e-learning in English Language training.

3. Functionality of SYTE

The main objective of the proposed system is to support English language teaching by providing a means by which students can consolidate their knowledge and skills on a given topic. The teacher can create a set of closed test questions and make them available to students online. The questions will correspond to the material covered during the previous academic classes. The closed type of test questions is selected in order to facilitate answering them from any device. Teachers can base part of the students' grades on their test results. In addition, they can draw conclusions if any aspect of the study material has been inadequately mastered. Each student can subscribe to this service in VES through their personal assistant. The core functionality of SYTE is to use a data base of questions created by the teacher and send them to the student one by one at irregular intervals of time to his/her mobile device or DeLC account. If the student wishes, he or she may or may not answer the received question. If the student answers the test question, their response is recorded in the data base. In case the student does not answer it, the question remains on their device until they select a response, decline to do the test or the test/question time limit is over.

4. Architecture of SYTE Архитектура на SYTE

SYTE represents an intelligent software agent which is located in the digital library of the Virtual Education Space. Its main objectives are to provide an opportunity for teachers of English to generate tests from created closed questions, make these available to students and record their responses. представлява интелигентен софтуерен агент, който се намира в дигиталната библиотека на Виртуалното Образователно пространство. Той има две основни цели – първата е да предоставя възможност на преподавателите по английски език да генерират тест от създадени затворени въпроси, да го предоставя на студентите и да записва дадените от тях отговори.

The agent has sensors and effectors by which it studies the environment and reacts to it, respectively. The agent's environment is a digital library in VES where it awaits messages from the personal assistants of the teacher or the student, or the manager of the library (StudentAsisstant, TeacherAsisstant, DigLibAsisstant). Depending on the message received, SYTE reacts accordingly, and its local management is responsible for the exact way it behaves. Figure 2 presents the communication between the different agents and SYTE. All the messages that the agents exchange are asynchronous.

A student in VES is represented by his/her personal assistant. Through it they can subscribe to the services offered by the specialized agents (Operatives) in the digital library. To subscribe to the service provided by SYTE, a request is sent to the manager of the library which forwards it to SYTE. It, in turn, records this registration and starts providing the service of English language teaching to the student.

The teacher who is presented in VES by his/her own personal assistant can create test questions which are recorded in a data base in the repository of the digital library and used by SYTE. When the data base has enough test questions, the teacher can compile a test or select the questions which will be sent to the student for a specific period of time at irregular time intervals. SYTE forwards a test question to the student's personal assistant

which has to visualize for him/her the question and its possible answers. After the student has selected a response, their personal assistant sends the answer to SYTE which in turn records it in the data base with the questions.

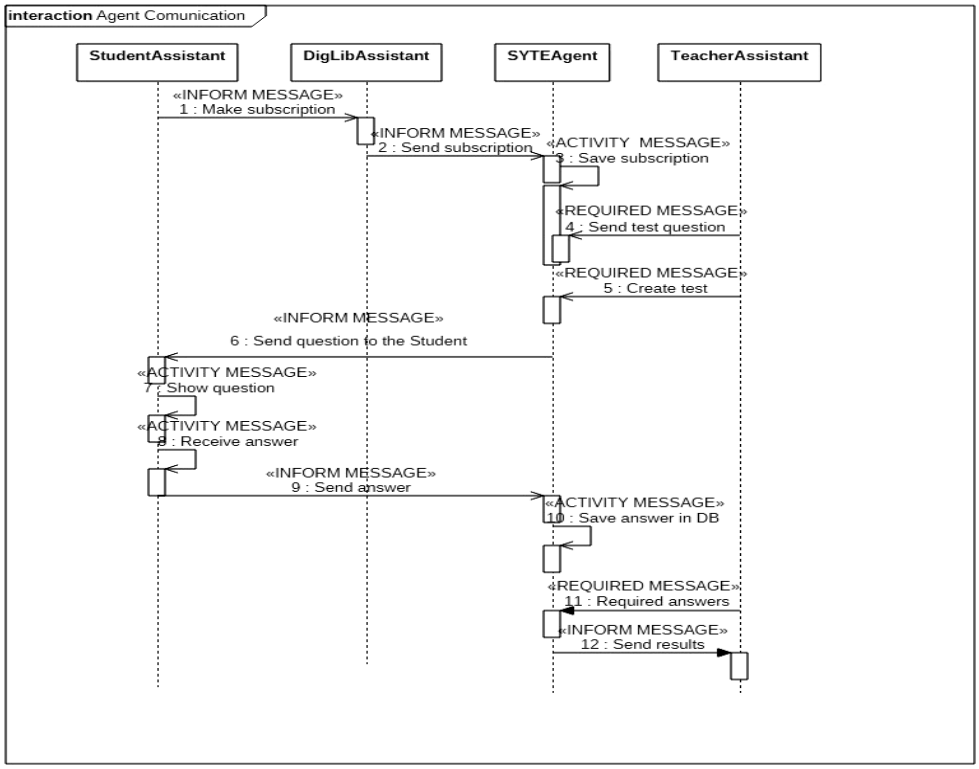

Figure 2: Communication between the agents

The teacher may choose to review a student's answers at any time. Based on these responses, they can come to different conclusions about which material the students has mastered and which has remained insufficiently clear.

5. Model of the data base

One of the fundamental questions to be discussed is the creation of test questions and the way they are stored in the repository of the digital library of VES. We have chosen to use only closed questions in order to assist students in doing tests at any time and at any mobile device. The test questions will be uploaded by the English teachers in a data base located in the repository of the digital library via a graphical interface which will be realized as functionality of the teacher's assistant. Figure 3 shows the logical model of the data base (ER-Diagram) with the questions.

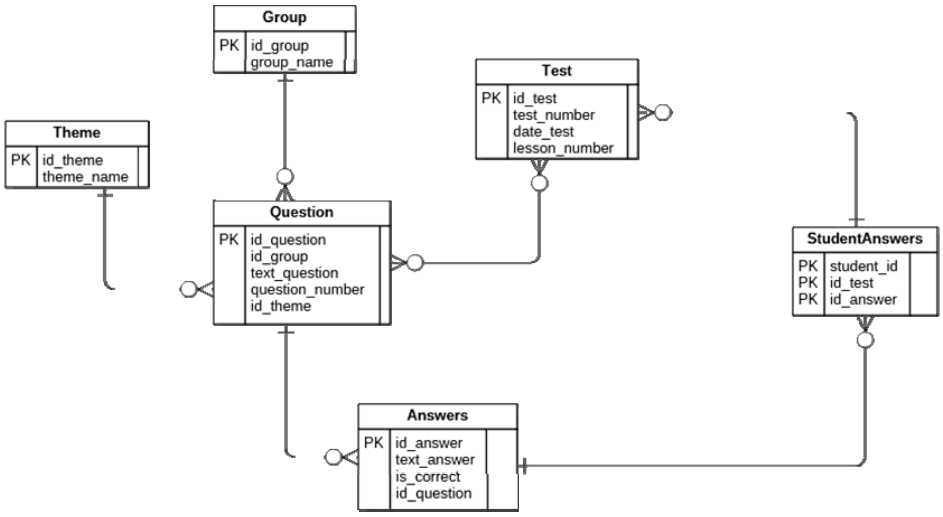

Figure 3: ER-model of the test questions data base

The objective of the tests offered by SYTE is not merely to check whether students can remember the meaning of words from their study materials or recognize certain grammatical structures. They are meant to cover various aspects of the students' knowledge, skills and competences to use the language including their ability to

- reproduce information – test questions for filling in a missing word are used in order to test the students' acquisition of studied lexical or grammatical items, for example:

Our countries share a commitment ……. high quality education.
a. to
b. for
c. in
d. at

- understand the meaning of a word, expression or a phraseological unit – multiple-choice test questions are constructed such as to match a word with its definition or find a synonym (a word with a similar meaning) or an antonym (a word with the opposite meaning) of a word, for example:

*1. Match the word with its **definition**: **skimming***
a. quick reading to get the general idea of a text
b. quick reading to find particular pieces of information
c. slow reading for details including note making and highlighting important points
d. reading for pleasure

*2. Find a **synonym** of the word **daunting***
a. worrying
b. extremely important
c. revealing
d. amusing

- detect errors in various contexts – True/False or multiple-choice test questions are formulated to find spelling or grammar errors, for example:

Choose the part of the sentence which contains a spelling or grammar mistake: ***She rewarded herself for keeping to her promises which made her to feel good about herself.***

a. rewarded herself
b. for keeping to
c. made her to feel
d. good about herself

- make an analysis of the use of lexis and select an appropriate grammatical tense use in a context. Lexis incorporates vocabulary with grammar; vocabulary is typically seen as individual words and often presented in lists while lexis is a wider concept and consists of collocations, chunks and formulaic expressions such as I'd like to .., If I were you, etc. Two test questions that be used for this purpose are to complete a sentence with the correct word(s) and to choose a sentence which explains best the meaning of another one. Here is an example of each:

1. Let sleeping dogs …….
a. lie
b. to lie
c. lying
d. lies

2. Approaching each task separately makes the work more manageable.
a. Finishing a job before starting another one eases your work.
b. If you work on several tasks simultaneously you will find your work easier.
c. To become a manager you have to do your tasks one by one.
d. To succeed you must separate your work into smaller tasks.

6. Conclusion

The generation of various specialized assistants which facilitate e-learning in VES is of utmost importance for the personalization and adaptation of the space to each and every user. SYTE is such an operative offering assistance to students and teachers in the English language education. The full implementation of the prototype and its adaptation to other academic subjects is planned for the imminent future

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