Using Instant Messaging to Provide an Intelligent Learning Environment

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Abstract. Instant Messaging enables learners and educators to interact in an on-line environment. In this paper, we propose an intelligent ChatBot system, based on instant messaging, for student on-line coaching in an English learning environment. The proposed ChatBot facilitates synchronous communication with students by using ready reference materials including, dictionaries, authorized conversation material with speaking, and a question-answering function. The agent records and analyzes conversations so that the teacher can assess students' progress. Our contribution in this paper is that we integrate the NLP Tool and AIML into an instant messaging-based ChatBot for English as a Second Language programs.

1 Introduction

English as a Second Language (ESL) programs are run by most universities, colleges, and some businesses throughout the world. As many researchers acknowledge[4, 5, 16, 17], the best way to learn a second language is in a language environment like that of the mother tongue, but it is still a difficult task. Even though there are many off-line refresher courses, a teacher cannot interact with students anytime, anywhere. Due to the availability of the Internet, however, teachers can now use many applications to provide more assistance. When computing power is increased and Internet bandwidth is broad enough, it is possible to communicate easily with other individuals, and synchronous computer-mediated communication (CMC) becomes easier. We treat chat as a means of synchronous, real-time interaction that can be used in an online language classroom to extend the learning process well beyond the traditional four walls, and thereby make the learning process more fascinating, exciting and enriching.
Many teachers and researchers [3, 12, 16, 18, 22] have found that online chat:

- promotes learner autonomy;
- encourages collaborative learning and team work and helps develop group skills;
- promotes communication skills (carrying on a conversation, interviewing, and negotiating meaning);

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- promotes social and socialization skills and proper etiquette (greeting others, introducing oneself, leave talking, stating and reinforcing one's own ideas, interacting politely and appropriately, showing respect and being responsible, making choices, helping, coaching, etc.);
- facilitates interaction and learning with and from people of different cultures who speak different native languages;
- exposes students to speaking a language as it is used by native speakers and allows them to interact in an authentic context with those speakers;
- promotes different types of interaction: student to student, student to teacher, student to expert, and student to online resource;
- offers an appropriate way of fostering inter-peer communication in a real and meaningful environment;
- balances and increases participation among students with less involvement by teachers;
- reduces anxiety among students; and
- provides useful transcripts (chat logs) for studying the language used or for further analysis of a conversation

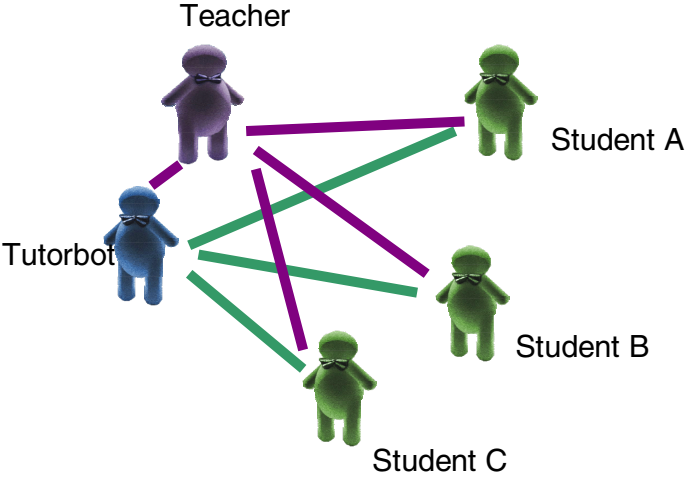

Fig. 1. TutorBot provides synchronous communication between teacher and students

In this paper, we present an enhanced Chatbot system, called TutorBot, which provides students with on-line coaching in a total English learning environment. The question in language learning programs is not whether to teach "phonics", "reading", "comprehension" or "whole language learning," but how to teach them in context —rather than in isolation — so that the learner can make connections between words, pronunciation, and meanings. A Chatbot is defined as a program that emulates human conversation and enables natural-language conversations with computers [20, 21]. The proposed TutorBot has ready reference material (dictionaries, authorized conver-sation material with speaking, and a QA function) that provides synchronous com-munication with

students. TutorBot can also record conversations for analysis so that the teacher can assess students' progress.

TutorBot plays two key roles: it acts as an assistant to the teacher, and as a partner to the student. As we know, people work harder to understand material when they feel they are interacting with a partner, rather than simply receiving information passively. Figure 1 shows how TutorBot provides synchronous communication be-tween teacher and students.

2 Related Work: Psychological Reasons

In addition to the benefits mentioned earlier, chat has other advantages that make it an appropriate tool for learning a second language[5, 7, 8, 17]. Chat not only uses a communication medium that generally appeals to students, i.e., the computer, it also takes place in an innovative and exciting setting, namely, cyberspace or virtual reality. Consequently, it puts a strong emphasis on communication and authentic language like that used in the real world, and thereby generates intensive practice in some basic skills. As students are left on their own to a large extent, they have to fend for themselves. This gives them a greater sense of responsibility and a large degree of autonomy. They have to support each other, and involve themselves more intensely in the collective and collaborative construction of knowledge. Finally, the exchanges are about the 'real' world, with 'real' people, in 'real' time. No doubt, most language teachers know how difficult it is to get students to use a second language in class in a meaningful way, especially at the oral level. So, what better way than to use a tool that mirrors real-life interaction?

Given the wide-spread use of online chat by teachers and students, it is of interest to examine its advantages. The ChatBot agent encourages people to communicate via a computer because of the following factors[10, 11, 13, 14, 18, 19, 20, 21]:

- People work harder to understand material when they feel they are in a conversation with a partner, rather than simply receiving information. An agent with learning capacity can grow with the student.
- Pedagogical agents are onscreen characters that help guide the learning process during an e-learning episode.
- Skill development and expertise are strongly related to the time and efficiency of deliberate practice. An "Instant Messaging" based agent can provide practice anytime, anywhere.
- On-line learning is a collaborative endeavor in which participants learn by collaboration.

Margalit et al. [15] indicate that the majority of students and teachers believe that it is possible to learn through the medium of chat.

3 System Architecture

The system architecture of the proposed TutorBot comprises three main components or robots: (1) RRMBot, (2) ClassifyBot, and (3)AIMLBot. RRMBot provides ready

reference materials (RRM), including the course dialog, idioms, and a dictionary; ClassifyBot facilitates daily conversation practice; and AIMLBot uses Artificial Intelligence Markup Language (AIML) to provide pattern-based, stimulus-response knowledge content. In addition, we use OpenNLP [2] for language analysis and a spell-check engine to improve AIML. The system architecture of TutorBot is shown in Figure 2.

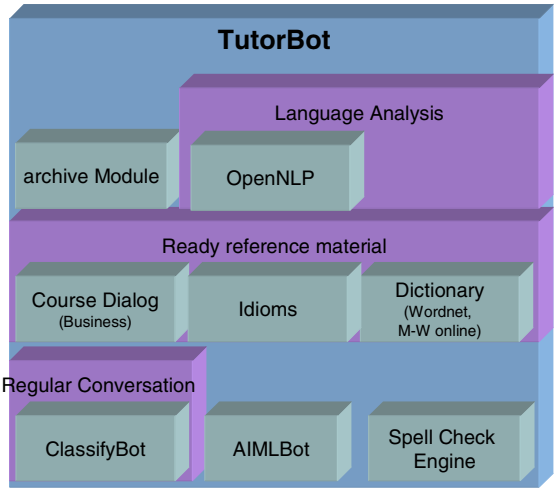

Fig. 2. The system architecture of TutorBot

In the flow chart of the conversation process, shown in Figure 3, the system is divided into a 3-tier architecture, in which every tier has a robot to find the relevant material to answer a student's questions. Initially, the system talks to the student about random topics to decide his/her proficiency level i.e., basic, medium, or advanced. Every level has ready reference (course-based) material and reference sentences.

When TutorBot receives a user's input sentence, the spell check engine processes it and corrects any errors. RRMBot then checks if the sentence exists in the ready reference materials. In addition, ClassifiyBot checks if the sentence exists in the classified conversations, while AIMLBot checks if it exists in AIML conversations. Finally, RRMBot, ClassifyBot and AIMLBot in the English environment are integrated in the conversation UI and passed to TurtorBot for interaction with the user.

3.1 RRMBot (A Robot for Ready Reference Materials)

As noted above, RRMBot provides ready reference materials (RRM). In this paper, RRM denotes a set of well-designed courses and dictionaries. We used the magazines: "Let's Talk in English", "Studio Classroom", and "Advanced," published by "Overseas Radio & Television Inc." as raw materials for course dialogs.

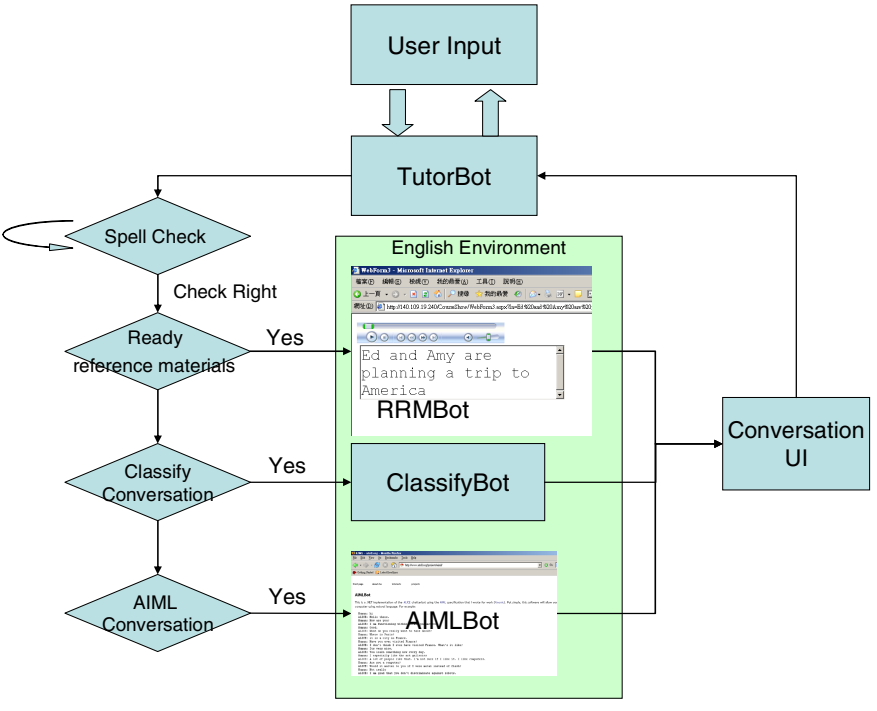

Fig. 3. Conversation flow chart

We adopt WordNet as the lexicon to provide an on-line dictionary service. When a student uses the function "Find: Term" to lookup a dictionary, TutorBot provides an explanation and a URL to retrieve an audio file from Merriam-Webster's Online Dictionary.

For example, TutorBot looks up its dictionary and performs a three-step operation: 1) it enters the new word, e.g., Find: "spectacles"; 2) it finds a description for the item "spectacles"; and 3) it provide a link so that the student can learn the term's pronunciation.

In addition to the dictionary and the course dialogue, a series of idioms are provided for the student to practice.

3.2 ClassifyBot (A Robot for Daily Conversation Practice)

ClassifyBot provides an e-learning environment based on a corpus; therefore, we can use natural language processing technology to provide automatic item generation, which allows a learner to work with different authentic texts each time. Using a corpus integrated with a POS tagger and the OpenNLP parser, we can provide various pages containing concordances, grammar explanations, bilingual terminology, etc. A POS tagger is an algorithm that classifies words into their "Part-of-Speech" or word classes. In this paper, we use Brill's POS tagger [6]. OpenNLP is a publicly available library that provides an organizational structure for coordinating several different projects in

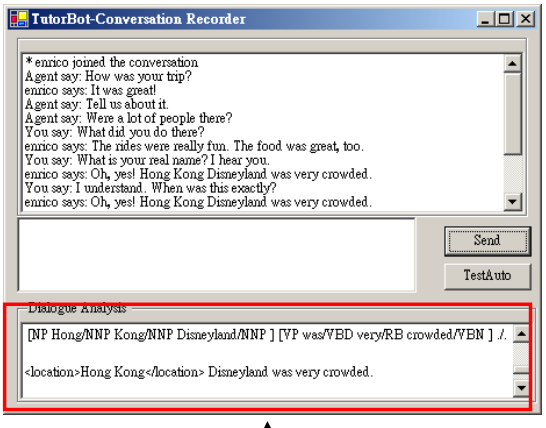

Fig. 4. A ClassifyBot that incorporates POS tagger and OpenNLP parser

NLP [2]. The OpenNLP parser module takes a string as input and produces a structured form representing that string, after which concordance analysis examines a word in the contexts in which it appears [9]. A ClassifyBot that incorporates POS tagger and OpenNLP parser is shown in Figure 4.

The parser provides several types of useful information to the system. For example, chunking/clause information enables a learner to determine whether the structure of a sentence expresses what he or she wants to say. The system can also derive thematic roles from the results of the parser. This is important for dialogues, as it helps the system avoid using material that is irrelevant to the subject.

The conversation shown in Figure 4 demonstrates a chat which user and TutorBot talk about user's trip. When a user inputs the sentence : "Oh, yes! Hong Kong Disneyland was very crowded." to ClassifyBot, the backend of ClassifyBot analyses the dialogue. The process comprises corpus-based concordance analysis and grammar analysis. In addition, the user can specify a command: Grammar "Oh, yes! Hong Kong Disneyland was very crowded." and retrieve the following corpus-based concordance analysis and grammar analysis results from the system: 1) chunk result: "[NP Hong/NNP Kong/NNP Disneyland/NNP] [VP was/VBD very/RB crowded/VBN] ./.", or 2)NER extraction result: "<location>Hong Kong</location> Disneyland was very crowded.". By using the grammar analysis, the TutorBot can find the main topic "Hong Kong" and "Disneyland". Then the processing sentence will be reformulated and expressed in terms of entities and relations in the semantic graph. The semantic graph of context is achieved and used similarity algorithms to find the nearest answer.

3.3 AIMLBot (A Robot which using Artificial Intelligence Markup Language)

Artificial Intelligence Markup Language (AIML) [1] is an XML-compliant language that facilitates the creation of Chatbots with various personalities and kinds of

knowledge. The goal of AIML is to enable pattern-based, stimulus-response knowledge content to be provided, received, and processed on the Web and offline in the same manner that is possible with HTML and XML formats.

However, AIML has some problems that we must resolve. Standard AIML uses depth-first search, which does not optimize the result, as the name implies. It finds the first available solution by searching through a tree of possibilities.

The standard AIML definition of "best" does not attempt to minimize anything, but simply finds the first matching pattern, and does not test if other patterns might fit better. There are some simple ways to make the AIML search work very quickly, but they do not guarantee that any "best" equation is true. Hence, AIML just provides students with an English dialogue environment to help them practice anytime, anywhere.

Also, AIML does not include a spell-check function, although it would be very simple to include this in an efficient manner. The technique proposed here is a method for finding the best result rapidly. When AIML searches for a match to a specific word but cannot find one, the next best match is always a wild-card. Instead of matching an unknown word to an unknown group, the word should also be spell-checked and possible alternatives checked for a match with a higher priority than putting them into an unknown group. We use a spell check engine to overcome this drawback of AIML.

4 User Case Scenario and Discussion

In the following, we describe a user case scenario in TutorBot. Students first add a contact ID: msnbot@hotmail-ppe.com to the MSN Messenger contacts list. When students talk to TutorBot, the system interacts with them according to their level of English comprehension.

The proposed TutorBot has a number of advantages. TutorBot plays the role of "assistant instructor" by providing an active practice and topic tutorial for a total English learning environment. The system interacts with students according to their proficiency, since there are three proficiency levels with corresponding ready reference materials i.e., "Let's Talk in English" for beginner level, "Studio Classroom" for intermediate level, and "Advanced" for advanced level. Students can practice their conversation with TutorBot, and interact with it via authorized conversation material with speaking. The interaction is recorded in the archive module, so that the teacher can evaluate the student's learning status with the concordance and grammar analyzer.

Therefore, the proposed TutorBot gives students more opportunities to develop their English skill by allowing them to interact in an authentic context with RRM in real time without being restricted by location.

With the exception of ready reference materials, TutorBot provides a always online peer counseling service which can make students feeling more unrestrained.

5 Conclusion and Future Work

In this paper, we have proposed an intelligent Chatbot system based on instant messaging to provide students with on-line coaching in an English learning environment. The intelligent Chatbot provides a good synchronous collaboration method for

language learning. TutorBot plays the role of “assistant instructor” to provide service anytime, anywhere. It facilitates synchronous communication with students by using ready reference materials, including dictionaries, authorized conversation material with speaking, and a question answering function. In addition, the agent provides records and analyzes conversations so that the teacher can assess the students’ progress.

Our contribution in this paper is that we use NLP Tool and AIML to integrate several language learning components (words, sentences, sounds, and meanings) in context with an instant messaging-based Chatbot for English as a Second Language programs. Our proposed TutorBot provides the benefits of one-on-one instruction in an English learning environment in an automatic and cost effective way.

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