HTML Paper

Design and Implementation of an Intelligent Web-based Interactive Language Learning System

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ABSTRACT

The design and implementation of an Intelligent Web-based Interactive Language Learning (IWiLL) system to support English learning on the Internet is described. We designed two kinds of learning environments: (1) interactive English writing environment and (2) mining movies for real English. These are intended to improve learners' basic language skills such as listening, reading, and writing. In addition, the system also offers authoring tools that facilitate teachers' content preparation. The system not only provides multimedia learning environments for users, but also builds a learner corpus, an archive of annotated English texts written by learners for whom English is a second language. Further analysis of the learner corpus creates the potential to detect the users' persistent errors and then provide adequate help to the users.

1. INTRODUCTION

In this paper, we describe the design and implementation of an intelligent web-based interactive language learning system called IWiLL. In our design, we integrate results from the areas of language pedagogy, linguistics, computer, networks, and multimedia technologies to build a networked learning system. The system includes advanced features to assist learners in learning basic language skills such as listening, speaking, reading, and writing. It is worth mentioning that the system not only provides multimedia learning environments for users, but also builds a learner corpus, a machine-readable archive of essays written by learners for whom English is a second language. Further analysis of the learner corpus is supported and creates the potential to detect the users persistent errors and then provide adequate helps to the users [1][2].

Many Computer Aided Language Learning (CALL) [3][4] systems have been developed to support language learning. Most of them only make use of computing resources from local computers. The computing and knowledge resources are limited by this restriction. Due to the popularity of the Internet, another opportunity has become available for further breaking down the temporal and spatial limitations imposed by traditional CALL. Existing approaches, however, do not fully exploit the strength of the integration of computer, networks, and linguistics in language learning. To illustrate the advantages of such integration, we describe in this paper the design and implementation of two language learning environments: (1) interactive networked English writing environment and (2) mining movies for real English.

The present paper is organized as follows. In section 2, the design paradigm and philosophy of the proposed system are presented. Followed by these two designed learning environment, where the functionality and features of each environment are described. The system integration portion is provided in section 3 and the corresponding video/audio transmission mechanisms are briefly introduced. Section 4 offers a conclusion.

2. DESIGN OF IWiLL LEARNING ENVIRONMENTS

The basic design schema of IWiLL is illustrated in Fig. 1. The center of the schema includes two kinds of learning environments: (1) interactive networked English writing environment and (2) mining movies for real English. These can be accessed by learners, teachers, and researchers online. Special interfaces have been developed such that learners can request the specific content they want or content assigned by the teacher. Note that learners and teachers also have input to the learning environments. Learners input their essays and teachers input teaching materials and mark learners' essays. The collection of this data can be used to generate learning performance indices to inform teachers and learners of the learning process of each individual learner. Further analysis of the learner corpus can be used to detect the learners' persistent problems. The results of these analyses put us in a position to provide online help for the learning environments to benefit to all users. In this manner, the expertise of teachers and the learning experience of learners can be accumulated and can enrich the environment the more it is used.

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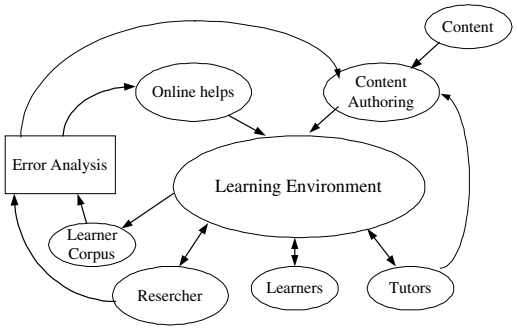

Figure 1. The design schema of IWiLL.

2.1 Interactive Networked English Writing Environment

In this paper, we report two kinds of writing environments in IWiLL, an asynchronous writing environment and a synchronous writing environment. The asynchronous writing environment mainly allows both teachers and learners to work and interact without being online at the same time. IWiLL includes functions for turning in essays via the Internet either to the teacher or to peers for peer commenting, for examining essays that have been turned in and/or returned from the teacher. Students can examine essays that the teacher has returned, with teacher comments appearing in pop-up form. A special feature is that learners can retrieve all the comments the teacher has made on all of his or her essays cumulatively, with each comment linked to the portion of the student essay that was the target of the comment. Hence, at a glance students can know their most persistent difficulties. Each class has its own discussion board as well.

2.2 Synchronous English Writing Environment

To imitate the on-site writing clinic on the Internet and to exploit the potential of integrating computer, communication networks, linguistics, and language pedagogy, a synchronous module called Write Now is provided in the writing environment offering the following special tools and functions.

- ***Co-editing.*** This function provides an environment to attract that learner and tutor or two peers to the same focal point. Both learner and tutor are able to work on the same sentence and immediately identify the writing problem. However, co-editing the same sentence may result in conflicting data if a suitable co-editing mechanism is not available [5]. We therefore have developed a textual co-editing mechanism to meet this challenge [6].
- ***Online conversation.*** To achieve a better environment for communication between the participants, real-time voice conversation channel is offered. Because most of the present Internet systems only deliver best effort service, we have developed a voice transmission scheme to overcome packet delay, jitter and packet loss problems to provide good quality voice transmission for our purpose [7].

2.3 Mining Real English from Movies

To stimulate the students' interest in self-guided learning, IWiLL makes use of VoD technology in the design of environment for viewing English video. The proposed environment consists of two portions: (1) viewing movies and (2) mining movies for real English. In the first portion, the system allows users to view on the Internet a movie designated by teachers or a movie of the student's own choice. In the second portion, the system provides users a tool for strengthening their command of English expressions. The tool allows learners to extract instances of specified English vocabulary from the videos in the database. The results can be played back, offering the students ample examples of a particular expression in context. This allows teachers and learners to locate multiple examples of specific English expressions as they appear in authentic contextualized use in the films. This tool is especially valuable for teachers who are not native speakers of English since it enables them to provide students with a vast array of specific, authentic English input at will. This is very useful to learners who do not live in an English speaking society.

The VoD technology is well known [8][9]. Therefore, we will only describe the mining real English from movie portion. It consists of two user interfaces, one for content authoring and the other for learner access. For content authoring, the user interface is designed to facilitate system content authors, e.g., teachers, to prepare the examples from movies. For example, users in Taiwan often have difficulties in using the word, even. Teachers who want to illustrate the examples can input the word, and system will retrieve all sentences with the word 'even' in the movies. Furthermore, the authoring interface also allows teacher to (1) extend the amount of context given to the student preceding and following the target word, (2) exclude the unsuitable examples, and (3) arrange the presentation sequence of the examples. With the learner interface, a student is able to play back the examples with full control over the examples to be played and the number of times any example is played. This function puts a high degree of control in the hands of the learners while at the same time giving them direct exposure to the precise usage of the word. The user interface for content authoring is given in Fig. 2. The learners' access interface, as shown in Fig. 3, consists of keyword searching sub-interface and movie playback sub-interface. It only allows the free replay of the examples.

Figure 2. Teacher interface for mining English from movies.

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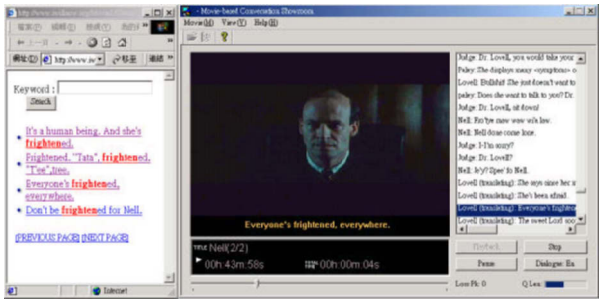

Figure 3. Learner interface for viewing movie examples.

3. SYSTEM INTEGRATION

To facilitate global access, the system is available from the Internet. We make use of MS VC++, MS SQL, and JAVA programming languages as system development tools. The system architecture of IWiLL is illustrated in Fig. 4. It includes two database servers, i.e. learner corpus and video servers to store the corresponding data and information of the system. Based on the temporal characteristics of media transmission, the learning environment can be classified into two types, asynchronous learning environment and synchronous learning environment. In order to build the above learning environments, we also designed video and voice processing/transmission and content filtering mechanisms. As is well known, the present Internet may present network delay, jitter and packet loss, which are hostile to continuous media transmission. We address these issues in our design to achieve good quality of multimedia transmission. In this section, we briefly describe the realization of these mechanisms.

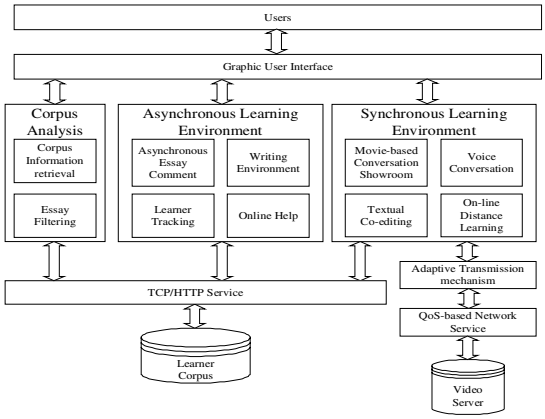

Figure 4. The system architecture of IWiLL.

3.1 Voice Transmission

The Internet currently offers only a point-to-point *best-effort* service, which may present packet delay, delay variation, and packet loss [10][11]. As a result, the voice quality is degraded. We design an adaptive voice transmission tool, which uses Forward Error Correction (FEC) methodology, to overcome the above voice transmission difficulties [7].

The desired mechanisms in the realization of the proposed voice tool includes echo cancellation, silence detection, automatic gain control, voice compression, redundant packet sending control, network QoS monitoring, and adaptive playout [7]. The design of redundant packet sending control, QoS monitoring, and adaptive playout receive special treatment. The redundant packet sending mechanism determines the sending packet from a set of compression packet formats to compensate for packet loss. The QoS monitoring mechanism serves the purpose of collecting information on the present network traffic conditions such as delay, delay jitter, and packet loss. The information will be used in playout time adjustment. The above learning environments are thus equipped with voice channel support over LANs and WANs.

3.2 Video Processing and Transmission

The video used in IWiLL is stored in MPEG-1 format. Thus, video transmission requires a great amount of bandwidth in the case of movie transmission. We have designed a video storage placement and transmission mechanism to increase the number of simultaneous accesses possible. The system architecture for movie playback is illustrated in Fig. 5. Further details can be found in [12]. In our proposed mechanism, the *idle round* scheme is developed to reduce the variability of the data rate of the VBR MPEG-1 video effectively. Because the resulting data rate is near constant, the transmission of video is able to use the RSVP through the MS GQoS architecture to reserve effectively the required bandwidth to achieve good video playback quality [13].

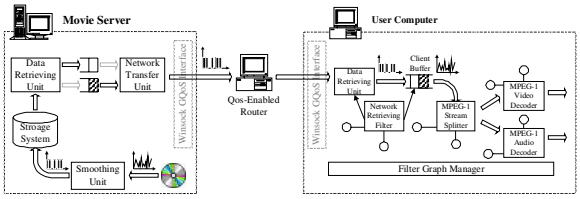

Figure 5. The system architecture for movie playback.

In addition, for mining movie, the movie dialogue is provided to the learner corpus while the movie is stored in the movie storage system. The whole process is shown in fig. 6. After

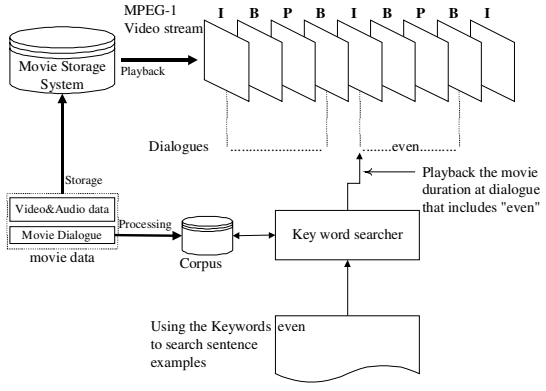

Figure 6. Movie processing for sentence searching.

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processing, these movie dialogues, like common essay sentences, are useful for the keyword searcher. When the searching result includes movie dialogues, learners can be able to playback these corresponding movie durations through the learners' movie access interface.

3.3 Content Filtering

The lecture materials in IWiLL may come from different resources, e.g., teacher provided lecture, journal articles, newspaper, magazine, web pages. These materials are classified and filtered based on content attributes and levels. Learners are able to access these materials based on their levels and interests. In other words, the system may provide different lecture materials to different levels of people. To do the above efficiently, we use the lexical difficulty filter (LDF) which we designed for this purpose. Each article collected is passed into the LDF to obtain the corresponding difficulty level index. As teachers or learners specify their requests, the system responds with a list of essays in ranking order. In other words, IWiLL has the capability to deliver materials matched to needs or requests of individual learners. This provides the flexibility intended to stimulate the learners' interest in reading.

3.4 Individualized Learning Environment

General users can access the system IWiLL. However, the system is not a flat content provider. It also takes each individual into account. We develop personalized learning environments for each learner. After the user registration, the system creates an individualized access page based on user level. At the present time, we use vocabulary frequency lists as a tracking reference to track the student's' learning trajectory. Based upon a set of vocabulary frequency lists, each individual is recommended a set of vocabulary to focus on for their current stage in learning before progressing to another level.

4. CONCLUSION

Computer and networks play a crucial role in language learning. Many academic and commercial computer aided language learning system or software packages are developed. In this paper, we propose a novel design schema to develop two kinds of advance language environments: (1) interactive networked English writing environment and (2) mining real English from movie. These learning environments are able to stimulate learner interests and improve learner basic language skills. Furthermore, the collected learners' outputs constitute a learner corpus. By analyzing the learner corpus, we are able to develop a process in detecting persist errors of learners and design online help accordingly. The above two learning environments are available on the Internet and are being pilot tested by more than 300 students in Tamkang University. Readers can access our web site (http://www.can.tku.edu.tw/IWiLL) to view the system.

5. ACKNOWLEDGEMENTS

Part of the work described in this paper was performed while Chin-Hwa Kuo and David Wible visited Institute of Information Science, Academia Sincia.

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