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Author(s)	**Tam, V; Cheung, RLF**
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An Extendible and Ubiquitious e-Learning Software for Foreigners to Learn Chinese on iOS-Based Devices

Vincent Tam

Dept. of Electrical & Electronic Engineering
The University of Hong Kong
Hong Kong
e-mail: vtam@eee.hku.hk

Ralph L.F. Cheung

Dept. of Electrical & Electronic Engineering
The University of Hong Kong
Hong Kong
e-mail: ralphcheunglongfung@gmail.com

Abstract— **The larger screen size, mobility, sensing and multi-touch input features of Android or iOS based devices like the iPad or Android tablet PC offer many exciting opportunities for real-life edutainment applications. An example is the learning of Chinese, especially to write Chinese characters in correct stroke sequences, that is typically considered as a difficult task to most foreigners. In this work, we propose an extendible, easy-to-use and ubiquitous e-learning software that was integrated with mini-games to facilitate the learning of Chinese characters on iOS-based devices such as the iPad. To demonstrate the feasibility of our proposal, a prototype of our proposed e-learning software was built on the iOS-based devices so that foreign students can learn to speak and write Chinese anytime and anywhere. Among the various commercially available iOS-based app for learning Chinese, our proposal represents the first attempt to reduce the complexity of learning to write Chinese characters through mini-games while increasing the extendibility of the e-learning software through component-based design. More importantly, it opens up numerous opportunities for further investigations.**

Keywords-Chinese characters; e-learning systems; iOS devices; stroke sequences.

I. INTRODUCTION

The learning of Chinese has become very important for both Chinese and foreigners due to the alarmingly fast economic development and increasing political influence of China in the global stage in the past decade. Typically, among the four basic skills including listening, reading, speaking and writing to master a language, learning to write Chinese characters with the correct stroke sequences is often the most challenging task for foreigners, or sometimes even Chinese students, taking into account of the complex structures and diversity of Chinese characters with their unique stroke sequences. Even with the latest advance in the development of intelligent character recognition techniques, the complexity of structures of Chinese characters together with their stroke sequences impose a serious challenge to many sophisticated e-learning systems to learn Chinese. As a result, there were very few available e-learning systems integrated with intelligent character recognition techniques that can effectively handle both complex structures and correct stroke sequences of Chinese characters in a timely manner.

To reduce the complexity of the underlying knowledge domain in many practical e-learning systems [3], the IEEE Learning Object Metadata (LOM) standard [8] is widely adopted to construct a systematic organization of learning objects for the specific knowledge domain. Basically, the complicated and diverse structures of Chinese characters can also be decomposed into basic constructs or sets of strokes containing specific semantic meanings, thus ideal for being represented as 'learning objects'. Clearly, this will help students appreciate the meaning of a specific Chinese character through the semantic meanings of the involved basic constructs. More importantly, it can reduce the computational complexity of the character recognition technique used in the more 'extendible' e-learning system to define or recognize Chinese characters based on basic sets of strokes represented as learning objects in its local repository.

Conventionally, there were several Web-based e-learning software [6] that allows students to practise the writing of Chinese characters mainly on desktop computers with the Internet access. With the decreasing prices and increasing processing speeds of mobile devices nowadays, iOS-based devices [9] may provide a more potential e-learning platform with great convenience for students to practise the writing of Chinese characters at their own pace anytime and anywhere. Therefore, we propose to develop an extendible e-learning platform, namely the iWrite system, for foreigners or Chinese students to practise the writing of Chinese characters in correct stroke sequences on iPad.

To demonstrate the feasibility of our proposal, we implemented a prototype of the iWrite system as an extension from a previous work [11] using the Objective C and the Xcode development tool for the iPod Touch™ device or iPad. Our prototype of the iWrite system can systematically categorize all the stored Chinese characters in its database according to the predefined basic constructs as learning objects, and include Chinese characters of all the basic structures into each training exercise. In each step of the training exercise, a template of the selected Chinese character will be displayed for the students to follow in the correct stroke sequence using their fingers to tap at the beginning part of each stroke. After the student finishes inputting the stroke sequence, the iWrite system will employ an efficient and intelligent heuristics to check whether the stroke sequence of the inputted Chinese character is correct

or not. If the tapping position of any stroke is inappropriate, or the sequence of strokes is incorrect, an error message will be displayed. At the end, the student will receive an evaluation report showing at which specific structure(s) of the Chinese characters that the concerned student is relatively weak. A preliminary evaluation was conducted with some encouraging feedbacks collected. A more careful evaluation was planned around the upcoming Fall Semester in which the iWrite system would be available for foreign students in some selected Chinese courses in the University of Hong Kong. After all, there are many interesting directions for further investigation including the integration of relevant multimedia or pointers to online databases about a specific Chinese character into our system, and a thorough study of the pedagogical changes brought by our integrated system for mobile learning.

This paper is organized as follows. Section II details the system design of our proposed learning object based Chinese writing system, iWrite, on iPad to enhance learners' experience on mobile devices for learning to write Chinese. We give an empirical evaluation of our proposal on various criteria in Section III. Lastly, we summarize our work and shed lights on future directions in Section IV.

II. OUR PROPOSAL

As considered in Section II, most of the Chinese characters are constructed by basic structures or sets of ordered strokes that can actually be implemented as learning objects as according to the IEEE-1484 LOM schema [8]. In fact, all such basic structures/radicals have specific meanings that can be expressed as learning objects with related keywords and linked multimedia files for pronunciation and/or animation of relevant concepts in the local repository.

Our proposed e-learning system, based on iOS-based devices for higher portability, has implemented the concepts of learning objects since the basic strokes of Chinese characters will be implemented as learning objects with animations to better the learners' understanding of the specific semantic meanings of the concerned basic strokes. The proposed system has three main components to serve for the functions of illustration, practice, and feedbacks as clearly shown in Figure 1.
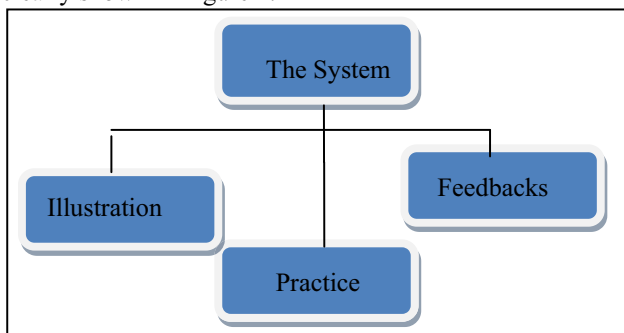

Figure 1. The basic system architecture of our proposed e-learning system for iOS devices

For the illustration part, the e-learning system will provide motion pictures of writing Chinese characters with their correct stroke sequences. For the practice part, the system will provide Chinese character templates for students to follow in writing. The system will check the stroke sequences after (s)he finishes writing on the template. In the returned result, the system will give a detailed analysis of the student's performance including the average rate of errors over all the Chinese characters the student has practiced, and also providing suggestions via the feedbacks subsystem to each individual student on the specific structure(s) that (s)he may work hard to improve.

III. AN EMPIRICAL EVALUATION OF OUR PROTOTYPE

To demonstrate the feasibility of our proposal, we implemented a prototype of the smart e-learning platform [11] using the Objective-C programming language and the Xcode Integrated Development Environment (IDE) [10] tool for execution on iPads for its high popularity and portability. The current prototype implementation consists of approximately 2,000+ lines of source codes. It took around 3 man-months for the design and implementation of our e-learning system.

The MS Paint program is used to build the templates of Chinese characters for our extendible e-learning system. Figure 2 shows the graphical user interface of our e-learning system with a login page prompting for the user's password on an iPad. Figure 3 gives the user interface of our e-learning system run on an iPad when invalid inputs to display all the relevant functions such as the "history", "practice", "similar characters" and "practice" to learn about more detail of a Chinese character. All these relevant functions will provide a comprehensive view for foreigners or even native Chinese students to learn about the character at hand.

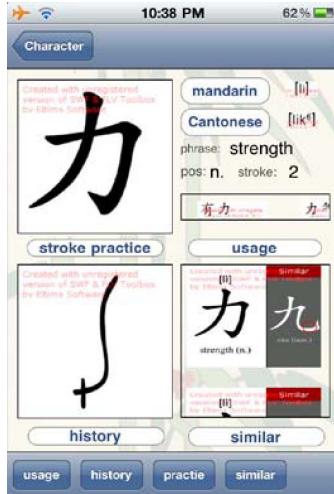Figure 2. The User Interface of Our e-Learning System for the login page on an iPad

Figure 3. The User Interface of Our e-Learning System for the detail of a Chinese character displayed on an iPad
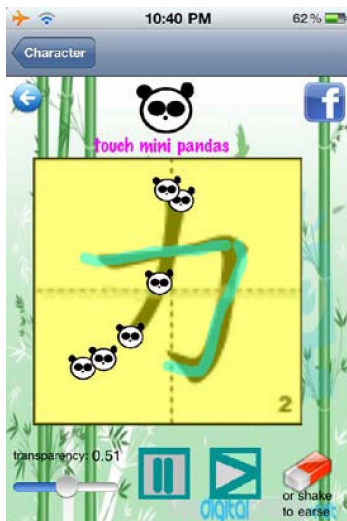
Figure 4. Our e-Learning System containing a mini-game to learn the writing of Chinese character in correct stroke sequences on an iPad

An evaluation was planned and would be conducted in a Chinese course offered to foreign students in the upcoming Fall Semester in the University of Hong Kong. By then, a more detailed analysis will be performed with its result to be published by the end of that semester.

IV. CONCLUDING REMARKS

In this paper, we propose to develop an adaptive and extendible e-learning platform for foreigners or Chinese students to practise the writing of Chinese characters in correct stroke sequences on iOS-based devices [9]. To demonstrate the feasibility of our proposal, we implement a prototype of our e-learning system using the Objective-C and the Xcode IDE tool [10] for execution on iPads/iPod touch. Our prototype of the targeted e-learning system can systematically categorize all the stored Chinese characters

according to four basic structures, and also include Chinese characters of all the basic structures into some mini-games. In the mini-game of small pandas for learning to write Chinese characters, a template of the selected Chinese character will be displayed for the students to input the correct stroke sequence by following the little pandas using the touch-screen of iPads. After the student finishes inputting the stroke sequences, our e-learning system will use an efficient algorithm to check whether the stroke sequences of the inputted Chinese character are correct or not. In case the direction of any stroke or the sequence of strokes is incorrect, an error message will be displayed.

There were some initial and positive feedbacks about our work collected from researchers in the Faculty of Education, and also the School of Chinese in the University of Hong Kong. A thorough evaluation is planned to be conducted in a Chinese course offered to foreign students in the upcoming Fall Semester for a careful analysis. All in all, our work is very promising, and shed sheds light on many interesting directions including the integration with existing online course materials for further investigation on both the pedagogic and technological impacts.

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