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An Intelligent Mobile Application to Facilitate the Exploratory and Personalized Learning of Chinese on Smartphones

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Abstract—There are increasing interests to learn Chinese all over the world due to the fast economic growth of China. Intrinsically, learning Chinese is challenging to most foreigners and Chinese students as well due to the complex structures of Chinese Characters, the writing of characters in correct stroke sequences, and their appropriate usage and pronunciation, etc. Even with the guidance of an experienced Chinese teacher, there is often insufficient time to practise the writing or pronunciation during classes. However, mobile devices such as the Android-based smartphones, iPads or iPhones may open up numerous opportunities facilitated by the latest interface and sensing technologies for students to learn anytime and anywhere. Therefore, we propose here an extendible and intelligent mobile application namely the Intelligent Chinese Explorer (iCEExplorer) based on learning objects and fully utilizing the smart sensors including the GPS, touch and image/video sensors of smartphones to facilitate foreigners or Chinese students to learn Chinese more effectively. In particular, we have designed an intelligent algorithm to aid all learners in writing Chinese characters with the correct stroke sequences. To demonstrate the feasibility of our proposal, a prototype of our proposed intelligent application was built on the iOS devices, with some initial positive students’ feedbacks collected and a thorough evaluation plan developed. Undoubtedly, there are many interesting directions for the future extensions including the possible integration of our prototype with some existing e-learning systems or social networking platforms such as the Facebook or Twitter so that learners can share their newly learned Chinese characters or phrases with their families or friends.

II. SYSTEM DESIGN AND FEATURES OF THE iCEExplorer

The iCEExplorer consists of six unique functions or sub-systems including: 1) the character demonstration and stroke practice (for personal revisions of characters); 2) the commonly used phrases (for personal reference); 3) location based learning (for exploratory learning); 4) optical character recognition [OCR] (to capture characters during exploratory/personalized learning); 5) personal character list and word-net (for personal reference); 6) quick pronunciation checker (for exploratory/personalized learning). Fig 1 shows the system architecture of our proposed iCEExplorer e-learning system. After the learners invokes the iCEExplorer application, the local databases of Chinese characters/words on the smartphones will be automatically synchronized with those distributed databases on the cloud storage for character demonstration and stroke practice.
III. An Empirical Evaluation

To demonstrate the feasibility of our proposal, a prototype of the iCExplorer e-learning application was implemented in around 3,000 lines of the Objective-C programming code using the Xcode IDE tool for any iOS device including the iPhone or iPad. The prototype was built and thoroughly tested in 4 man-months, with a total of 6,000 (simplified) Chinese characters stored on the cloud storage. All the Chinese characters are categorized according to their basic radical structures, the number of strokes, the correct stroke sequences and phonetic elements for the standard Chinese, commonly known as the Hanyu Pinyin, and then stored as learning objects on the cloud storage. Through the learning objects, our iCExplorer e-learning system can be easily extended to support new languages or system features. Initially, after the iCExplorer mobile application is launched on the iPhone, the most commonly used 2,400 Chinese characters (i.e. about 2/5 of the total) will be loaded as learning objects via the Internet from the cloud storage onto the local databases of the iPhone. The remaining Chinese characters will later be loaded on demand onto the iPhone whenever necessary for exploratory/personalized learning.

![Fig 2](image1.png)

**Fig. 2. The User Interface of Our iCExplorer Application on an iPhone**

Fig 2 shows the user interface of our prototype implementation of the iCExplorer on the iPhone, containing 6 illustrative icons for the six basic function as aforementioned in Section III and the last one for the system settings. Fig 3 shows the result of correct writing (on the left) of a Chinese character as compared to that of incorrect writing (on the right) of the same Chinese character in the wrong stroke sequence as detected by our iCExplorer e-learning application. Fig 4a) demonstrates the optical character recognition (OCR) function of our iCExplorer application in which a curious learner takes a picture of a Chinese book cover on the left, and then triggering the OCR function of our application to recognize any meaningful Chinese characters to be captured and stored in his/her personalized character/word list on the iPhone for exploratory learning or future reference. Lastly, Fig 4b) gives the user interface of the location based learning function of our iCExplorer application which the learner uses the GPS sensor to locate his/her position for which a detailed Chinese address is shown instantly. From the displayed address, the learner captures one Chinese character with the meaning of ”province” as revealed by his/her personalized character list stored on the iPhone. Our prototype has obtained some initial and very positive feedbacks from a group of 10 Masters of Science students in August of 2013. A more thorough evaluation plan was developed and will be conducted in the upcoming Summer Semester of this year.

![Fig 4](image2.png)

**Fig. 4. The User Interface of a) Optical Character Recognition Function and b) Location Based Learning Function of our iCExplorer Application**

IV. Concluding Remarks

In this paper, we propose to develop an intelligent e-learning platform based on the advanced technologies of smart sensors and learning objects for foreigners or Chinese students to learn Chinese characters in a personalized and societal manner on smartphones. To demonstrate the feasibility of our proposal, we implemented a prototype of our e-learning system named the iCExplorer using the Objective-C and Xcode IDE tool for possible uses on the iPhone or iPad. Our prototype of the iCExplorer application can systematically categorize all the stored Chinese characters in its database according to three basic structures (radical, the total number of strokes, or pin-yin [i.e. the pronunciation]) and then stored as learning objects on the cloud storage for on-demand downloading. All in all, there are many interesting directions for further investigation including its integration with some existing online course materials or social networking platforms like the Facebook/Twitter, and a thorough study on their pedagogic and technological impacts.

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