Tan, S. C. et al. (Eds.) (2013). Workshop Proceedings of the 21st International Conference on Computers in Education. Indonesia: Asia-Pacific Society for Computers in Education

Establishing an Innovative Plant Learning Platform with Expandable Learning Materials Using Wiki Software

Shu-Chen Cheng, Chien-Ming Shao
Department of Computer Science and Information Engineering Southern Taiwan University of Science and Technology, Taiwan
kittyc@mail.stust.edu.tw

Abstract: Currently, plant education in elementary schools is an insignificant part of Nature courses, and students learn only the basic knowledge of plants, rather than profound knowledge. This study aims to establish an innovative plant learning platform to help students gain knowledge of plants, as based on the instructional website of a wiki engine. Through the characteristics of wiki, it invites scholars in plant studies to edit plant data and design related tests on the platform. Students can check their knowledge of plants on this system by various platforms, such as computers or mobile phones. The keywords can be the characteristics of leaves, flowers, and names of plants. In the experiment of study, a pretest is conducted on students using the items proposed by scholars, and a posttest is conducted after the students used the proposed system. The results of the two tests were compared. This study anticipates that the proposed system can allow students to have higher interest in learning about plants, thus gaining more knowledge on plants.

Keywords: Wiki, Plant Search System, U-Learning

1. Introduction

Research Background

At present, elementary school students learn about plants in the Nature courses, and the courses on plants account for a small part of the Nature courses. Some schools erect signage alongside plants for simple introduction. Those methods can only provide students with limited knowledge on plants. Using the plant features search system, a wiki engine, and mobile devices, this study aims to construct an encyclopedia learning system of plants in order to enhance elementary school students' knowledge and interest in plants.
In addition to the search of leaf features, this study includes the flower features as reference for search. By multiple search methods, users can find their searched plants.

Research Purposes

The purpose of this study is to establish an encyclopedia learning system of plants in order to help elementary school students gain knowledge of plants. After the students have used the system, the researcher obtains their feedbacks and determines whether the system is effective. The design of the system is to add a function of wiki in a plant features search system, as the wiki has advantages in data editing and expansion. The experts can contribute their knowledge on the platform, and students can search for plant information on the webpage. The proposed system is expected to enhance students' interest in plants and their knowledge.

2. Literary Reviews

The plant search system quantifies leaf features by fuzzy function

Currently, there are few methods to search for plant information, and the search is particularly difficult for people lacking knowledge of plants. The common search method is one-by-one comparison of Kingdom, Phylum, Class, Order, Family, Genus, and Species of Biological Classification. Only plant experts, who are used to careful observations of plants, are familiar with the comparison, and it is difficult for the public to search for plants by the same method.

Cheng, Jhou, & Liou (2007) proposed the classification of plants by leaf. The leaf of each species of plant is unique, thus can be used as the reference for classification. The leaf features include 8 types, which are apex, base, margin, arrangement, vein, size, and growth. Users can select the feature items, and use fuzzy function for comparison with the plant data in the database. The score of the plant feature is calculated, a higher score indicates the higher probability of the search results.

By this method, users can quickly and precisely find plants. Moreover, considering that mobile devices are popularly used, a mobile version of the proposed system is also developed, allowing users to use this study outdoors.

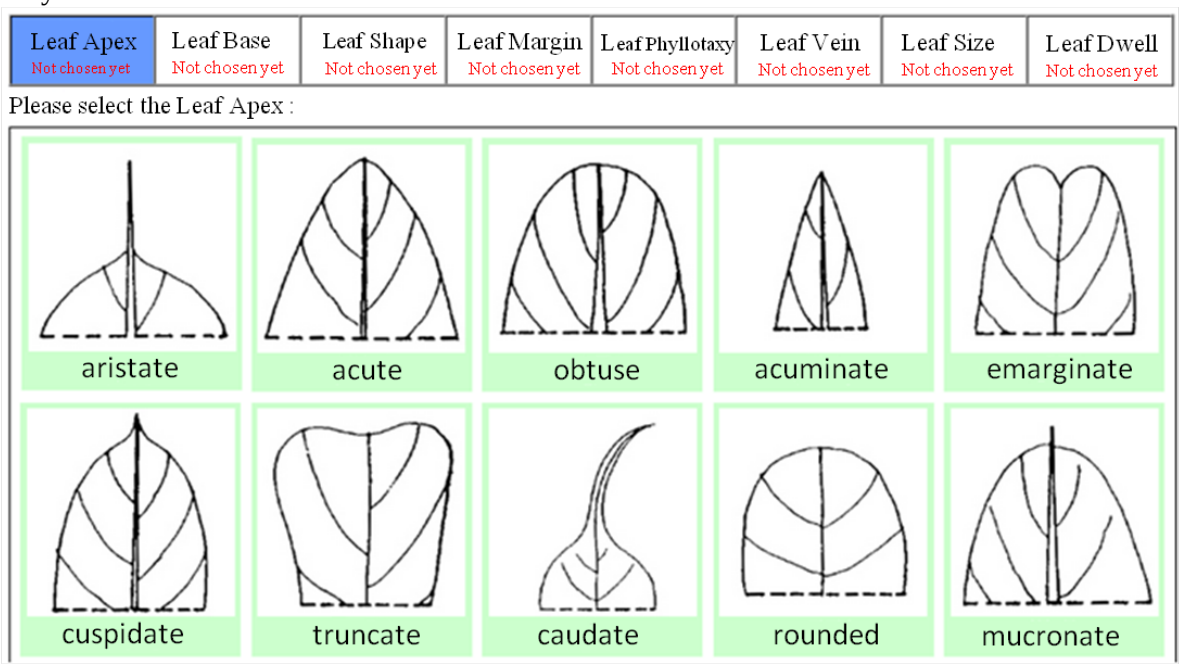

Figure 1. Interface of the feature selection of the leaf apex (Cheng, Jhou, & Liou (2007))

Plant search system on mobile devices

In order to help people learning about the plants they see outdoors, Cheng, Jhou, & Liou (2007) developed a leaf features search system using fuzzy function on the PDA platform, which can be used outdoors. With this system, users can search for and read information anywhere about plants with a PDA.

Although the PDA version is convenient, the number of PDA users is few. Thus, this study modified the system on Android, as it has become popular in recent years. It is expected that the Android platform will attract more users.

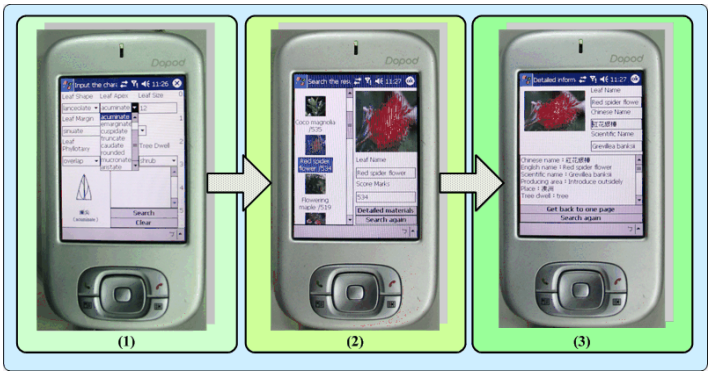

Figure 2. Interface of the mobile plant search system (Cheng, Jhou, & Liou (2007))

Other plant learning application

In order to allow elementary school students to approach plants on campus, Hwang, Chu, Huang, & Huang (2011) suggested combining PDA and RFID technology, and placing sensors on plants around campus, thus allowing students to find plants according to searched items on PDA through RFID. If the result is wrong, the students will be provided with clues to find the correct plants. Test questions on the plants will then be shown, and students can answer the questions after observing the plants. The students are thus encouraged to approach plants and gain plant knowledge.
Huang's experiment was based on RFID and PDA. However, RFID was only installed on plants on campus, thus, the system cannot be used outside of the school. The leaf features search system can solve this problem.

Figure 3. Interface of the ubiquitous learning system(Hwang, Chu, Huang, & Huang (2011))

Wiki engine

Wiki engine is a hypertext system created by the collaboration of many people, where users can freely establish and edit explanation items (Shih, Tseng, & Yang, 2008). The most well-known website that uses wiki engine is Wikipedia. At present, Wikipedia has constructed more than 20 million pieces of data, and public editing can easily expand the data. However, the disadvantage is that most of the information is not proved, or is fabricated by the editors, thus, it is not reliable. In order to establish a website of knowledge by this function, the editors should be professional personnel in order to minimize the error rate and increase the readability of items.

3. Method

Content of the plant knowledge website

This study plans to invite scholars and experts in the field of plant studies to edit the data, thus ensuring the accuracy and readability of the information. The teaching materials compiled using wiki can allow multiple editors to work on the content, making it easier to expand data, as compared to ordinary

textbooks. The advantage is that after one editor finishes writing, other editors can examine the content, and supplement or revise the content at any time.
In addition to contributing the information on plants, the functions of wiki also allow the scholars to construct an item bank on plant knowledge. The numerous contributors also enhance the expandability of the item bank, while specifically targeting at learners of different ages. As a result, the learning effectiveness on plant knowledge will be enhanced.

Plant search system

As an extension of the leaf features search function, the proposed system includes the function of flower features search. The features of flowers include color, form, flowering period, and inflorescence. Using the theory of fuzzy function, this study constructs a search system according to the flower features, allowing the search results to be more precise.

Plant search system on mobile devices

The original version of the plant features search system for mobile devices was designed for PDA. However, the number of PDA users has decreased in recent years. Considering the rise of smart phones, this study uses the Android system to modify the search system, so that it can be used on smart phones and tablet PC. By accessing the Internet through 3G, users can search for information at anytime and anywhere. In comparison to the RFID system on plants at schools, the search range can move beyond the campus, thus achieving ubiquitous learning.

Use of the website by the students

A pretest is conducted using the questions created by the scholars in order to determine students' current plant knowledge. The students can access the website via a computer or a mobile device. After students use the proposed system, a posttest is conducted to evaluate the learning outcomes.

4. System Architecture

Editing system for experts

The plant information is edited by plant experts and scholars using the wiki engine. System flow shown in Figure 4, They first search the plant items in the database for editing, and the data of the plants selected will be shown. They then determine if the content needs to be revised. If plant information cannot be found, they can add the item by creating a new page for such plants. Moreover, they can update the data in the database, and the new data will be displayed for the users.

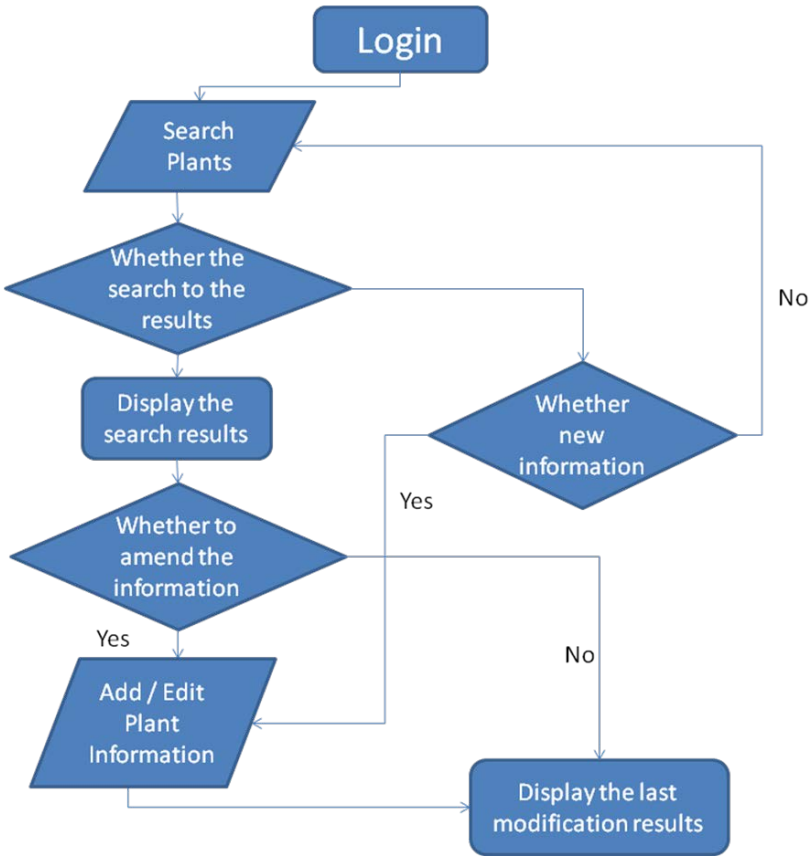

Figure 4. Flow chart of editing system for experts

Search system for students

When students visit the website, search process shown in Figure 5, they can search for plants by keying in the leaf and flower features, which will be transmitted to the system to calculate the plants matched. By fuzzy function, the system calculates the plants matching the inputted features, and displays the plants that match the features by score ranking. It is noted that the plant with the highest score may not be the plant that the users intend to search; this is probably because the users have chosen the wrong features or failed to input features. In this case, the system calculates the search result, according to other correct features. The users can browse the search results to find the plant that they intend to search.

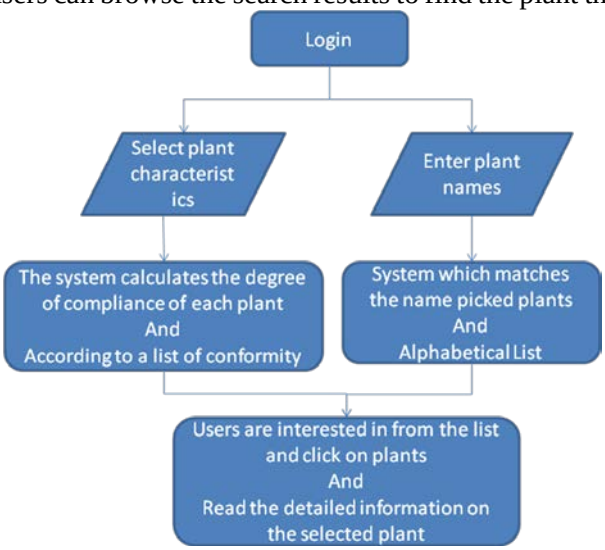

Figure 5. Flow chart of the search system for students

Experimental Procedure

This research will find two classes of elementary school students as experimental subjects, the experimental group and the control one. The control group will be taught using traditional methods of lecturing while the experimental group will experience the plant learning system. The experimental time is expected to last for four weeks. The experimental procedures are as follows:

Step 1: The two groups will do the pretest according to the questions designed by experts.
Step 2: Introduce the plant learning system to the experimental group.
Step 3: The two groups will do the posttest after 4-week experiments.
Step 4: Ask the participants in the experimental group to fill out the system satisfaction questionnaire.

5. Conclusions

Using the wiki engine, this study constructs a learning system that can easily expand plant knowledge, and allow scholars to revise or input plant data. The database of this system has high expandability on plant information, and provides accurate plant knowledge contributed by scholars. Besides the plant data, the wiki engine is also used to construct an item database for the testing system. It is easy to manage, can provide pretest and posttest functions, and allow students to self-test their plant knowledge.

Students can use this system on multiple platforms, such as computer, smart phone, and tablet PC, with access to the Internet. Moreover, they can immediately search for plant information when they see plants outdoors, achieving ubiquitous learning outside of campus.

Based on the above, the proposed system is expected to effectively assist students in learning plant knowledge, and increase their interest in plants to cultivate the next generation of plant experts.

References

Bennett, S., Bishop, A., Dalgarno, B., Waycott, J., & Kennedy, G. (2011). Implementing Web 2.0 technologies in higher education: A collective case study. *Computers & Education*, *59* (2), 524-534.

Biasutti, M., & EL-Deghaidy, H. (2012). Using Wiki in teacher education: Impact on knowledge management processes and student satisfaction. *Computers & Education*, *59* (3), 861–872.

Cheng, S.C., & Huang, T.Y. Constructing A Plant Learning System Based On Web 2.0. *ICCE2009*. Hong Kong Institute of Education. Hong Kong.

Cheng, S. C., Jhou, J.J., & Liou, B.H. (2007). PDA Plant Search System Based on the Characteristics of Leaves Using Fuzzy Function. *Lecture Notes in Artificial Intelligence*, *4570*, 834-844.

CHENG, S.C., PEN, I.C., & LIN, Y.C. Evaluation for the Test Quality of Dynamic Question Generation by Particle Swarm Optimization for Adaptive Testing. *ICCE2012*. Nanyang Technological University. Singapore.

Huang, Y.M., Kuo, Y.H., Lin, Y.T., & Cheng, S.C. (2008). Toward Interactive Mobile Synchronous Learning Environment with Context-awareness Service. *Computers & Education*, *51*(3),1205-126.

Huang, Y.M., Lin, Y.T., & Cheng, S.C. (2010). Effectiveness of a mobile plant learning system in a science curriculum in Taiwanese elementary education. *Computers & Education*, *54*(1),47-58.

Hwang, G.H., Chu, H.C., Huang, Y.T., & Huang, S.H. Motivation and Effectiveness Analysis of Formative Evaluation Strategies in Ubiquitous Learning Environment. *TWELF2011*. Taipei. Taiwan.

Moskaliuk, J., Kimmerle, J., & Cress, U. (2011). Collaborative knowledge building with wikis: The impact of redundancy and polarity. *Computers & Education*, *58*(4), 1049-1057.

Shih, W.C., Tseng, S.S., & Yang, C.T. (2008). Wiki-based rapid prototyping for teaching-material design in e-Learning grids. *Computers & Education*, *51*(3), 1037-1057.