Games-Based Learning Framework

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Abstract: This work presents the authors' experience in the field of mobile technologies, from which several initiatives have emerged. As result of this, a games-based framework for learning has been developed in these last years. This framework is composed by a competition called Mobigame, which has as main aim to stimulate the participation of the students. By participating in this competition participants learn to develop for mobile devices. A game to practice Japanese is also presented in this article, which was presented in the above mentioned competition. This game has been developed for mobile phones or PDAs (Personal Digital Assistants) based on the JME (Java Mobile Edition) technology. Finally, another initiative is also presented: A free download platform of digital contents for mobile devices based on info-educational games.

Key words: Game-based learning, mobile, framework.

1. Introduction

Our department, and our research group in particular, has been working more than ten years in the field of e-learning systems. One of its lines of research is the application of mobile devices in the learning process, which is known as m-learning [1]. These devices can be used for many other tasks than those for which they were designed a priori [2-3]. Thus, extending their functionality to other fields such as m-learning is one of the objectives of the TIFYC (Information technologies for the training and knowledge) research group. As a result of this work, a Technical Workshop on Developing for mobile devices has been consolidated since the 2000 year, and it is celebrated each year as a prelude of the Mobigame Competition [4]. This technical workshop offers to the students of Computer Science a basic knowledge of developing for mobiles technologies, such as JME (Java Mobile Edition), Android and Windows Phone. A few months later of this workshop the Mobigame Competition

takes place and all students are welcome to participate developing a game or an application using mobile technologies. The jury is composed by some professors of computer science, experts in mobile devices and company representatives. In the competition of the 2010 year the Kanatest Mobile game was presented, which is an application for mobile phones developed using JME technology. The main aim of this game-based learning is to practice and memorize easily the Kana. The Japanese Kana includes symbols used to write the Japanese alphabet. There are three kinds of symbols sets: Katana, usually used to denote foreign words; Hiragana, used for Japanese words; and Kanji. However, Kanji has not phonetic correspondences, but each symbol represents a different word, thus this game works only with the first two (Katana and Hiragana).

Finally, a Technological Platform has been developed to share info-educational contents [5]. This platform was developed with the objective of being a free and open platform for the exchange of educational contents (games, applications, etc.) for mobile devices. The three main aims of the project were the following:

- Developing contents (games and applications)

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compatible with the highest possible number of devices, analyzing the characteristics of the devices themselves. It was also considered the possibility of creating specific contents that consider the most of the special characteristics of some devices, raising the usability or the level of interactivity (e.g., by using pointing devices);

• Creating a technological architecture to promote the access and use of the developed contents mentioned above;

• Providing the educational contents and games with the required accessibility properties, so they can be used by people with physical limitations.

The following sections present a description of Mobigame competition, Kanatest mobile and the technological platform. And finally, conclusions are drawn.

2. Mobigame

The event Mobigame has been growing since the last years, being now the most important event organized by our Computer Science Department. This event is focused on the creation and development of educational applications, using different mobile technologies such as JME, Android, Windows Phone or iOS (iPhone Operating System). It also promotes team working because participants must work in groups, usually from two to five students. Once the groups are built, they start working on their applications.

From the point of view of the members of the research group, it also allows us to observe common patterns in the participants. The following items are part of these patterns:

• Most of the students asked for help concerning to the same topics. This implies that professors have had to help the students repeating over and over again the same solutions;

• Most of the questions have a technical nature.

It seems a good idea for us to organize some seminars or workshops where we could solve the same problems to all participants at once. In this way, a few months before the event, a set of seminars or technical workshops are organized each year.

The seminars are designed to manage these problems. The following section describes the organization of these seminars.

2.1 Technical Seminars

As mentioned above, some months before the Mobigame event, a series of technical seminars are given to the students. The seminars usually take place in laboratories and consist of technical demonstrations on the functions most commonly used, for example, working with canvas, scrolls, sprites, and so on. These seminars are presented in different mobile technologies, thus the students can choose the technology that they prefer.

The seminars are distributed in several days with duration of around five hours in total. We found enough this time to explain the most important aspects. Moreover, in the last years, as the event has been opened to more development platforms, the seminars have been expanded to cover these new platforms as well. Once the students have participated in the seminars, they are more prepared to complete their work. Some small questions may also appear afterwards, during the development process, but they can be easily solved by the members of our research group. Finally, and after a reasonable period of time, enough for the students to complete their applications, the event Mobigame begins.

2.2 Methodology

Mobigame event spans over three days. The first one, a jury composed of professors of the department evaluates all the proposals. This step is necessary due to the large number of applications submitted by the students. We are forced to choose a selection of applications among all of them, otherwise there would not be enough time for presenting all of them in the remaining days. It also ensures that all the applications that are kept to the second day have a minimum level of

quality. Those that are selected the first day are headed into the second day, they are presented in one of the assembly halls of the school, and authors must talk about their work in front of a real audience, comprising students and members of the department. During the second day, students are asked to prepare a small presentation summarizing the main points of their applications. These points include the reasons that led them to choose a specific platform, how the application is used; or in the case of a game, how it is played; and how they developed the work. Finally, they are also asked to provide a real demonstration of the work with real mobile devices. Based on those points, the best proposals are selected to participate in the final, the following day. It is important to mention that while the first and second day, the jury is composed of members of the department and the research group, the jury of the final day is composed of a group of experts of the IT (Information Technologies) field and companies representatives. During all the years while the event has been taking place, the university has signed agreements with companies related to the mobile communications area, as well as some other important international companies, e.g., Microsoft, Java, Apple, etc. It is also worth mentioning that thanks to this collaboration between the University and the companies, many students have found a job as a result of their work in the event. This is also a great motivation for the students.

3. Kanatest Mobile

3.1 Introduction

Kanatest Mobile is an application for mobile phones, developed in Java using JME technology, which allows practicing and memorizing, through the completion of tests, the Japanese Kanas. One of main development challenges of this application has been the creation of an attractive graphical interface for the user. That is the reason why it has included multimedia content.

There were many possible technologies to develop this game, e.g., Java, Dot Net, etc., but finally Java has been used mainly because this technology is taught at the University of Alcala and in addition this technology can be implemented in a large number of mobile devices because it is widely used. It can be executed in mobile devices with a virtual machine of Java, regardless of operating system.

As it was mentioned above, the application uses Katakana and Hiragana (Fig. 1).

Each of these symbols has a phonetic correspondence, usually a syllable. The application will help the user to learn and recognize these symbols and their phonetic correspondences. Moreover, Kanatest Mobile has the possibility to store the test results, as well as to use different user profiles so each user can check his/her history of performed tests, and the improvement recognizing kanas.

3.2 Game Play

The tools used to develop the game have been:
- NetBeans IDE (Integrated Development Environment). For developing the code and its compilation;
- GIMP 2.6.6 and Inkscape 0.46. For creating and editing graphics;
- Melody Raiser. For creating and editing music;
- Sony Ericsson 760i. For tests and demos.
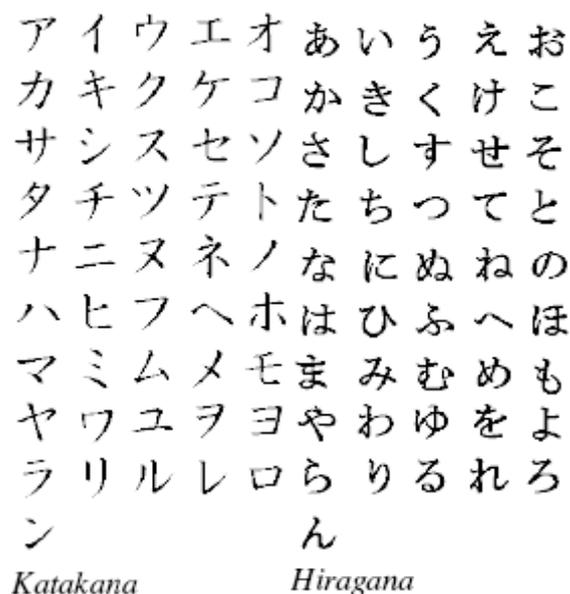
Fig. 1   Katakana and Hiragana alphabet.

The game operation is really simple. Once the user is logged into the game, he or she only has to choose which of the two available kanas wants to practice. Once chosen, the Konichiwa professor welcomes us as we see in Fig. 2.

• Do test: To practice the chosen kana. Reviewing the table. To study the phonetic symbols of the chosen kana.

• Personal statistics: All our results until now.

• Help: This shows a help message.

• Exit: This option allows leaving KanaTest Mobile.

The main menu has the above options (Fig. 3).

If the user chooses the option "Do Test", once he or she has enough knowledge about the chosen kana, the application will ask some questions to determine his/her Japanese language learning level. A test example is shown in Fig. 4.

4. Technological Platform

The technological platform is named Dmovil and it allows the creation of an exchange point to share educational contents; games and applications with an educational objective. The main aim was to create a platform where users could upload their own developments and where other users may also download and score them. To deal with this objective, the platform is built using the latest Java technologies, represented by the Struts framework, which is designed to create web applications with an excellent maintainability and easily extensible. As the system would be accessed from mobile devices and desktop computer web browsers, it supports web protocols and languages as well as WAP (Wireless Application Protocol). The WAP version (Fig. 5) of this platform is optimized for small-screen devices, like those that PDAs (Personal Digital Assistants) and mobile phones have.

The project was based on the following ideas:

• To provide a place where students could share ideas related to their work in the Mobigame event;
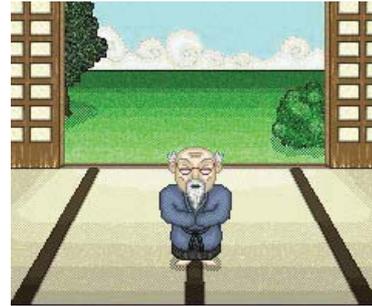
Fig. 2 Konichiwa professor.
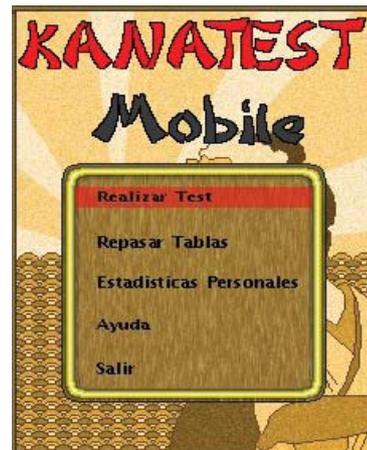
**Fig. 3 Main menu (in Spanish).**
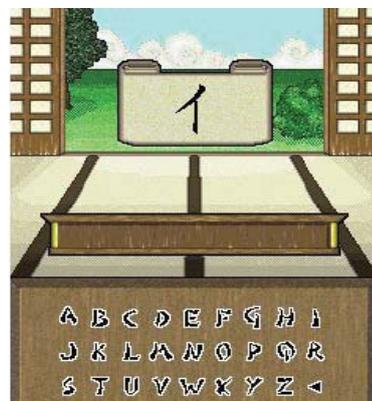
Fig. 4 Test example.

Fig. 5 Main screen WAP version (in Spanish).

- To gather all the information and examples from the technical seminars;

- To offer a place where the developments could be uploaded, and thus be shared with other students.

These ideas were kept in our minds for developing a viable solution with the objective of providing answers to the students' needs. This project aims to create a platform to host and distribute learning content. More specifically the project is focused on the following points:

- Developing specific contents and dealing with the required actions to make the platform more accessible, so they can be used by the widest range of potential users;

- Developing contents (games and applications) compatible with as many devices as possible, analyzing the actual characteristics of the devices (screen size, input method, operating system, etc.). It is also being considered the possibility of creating specific contents that fit the most of the special characteristics of some devices;

- Making use of the connectivity features of the devices, e.g., bluetooth, UMTS (Universal Mobile Telecommunications System), etc., as well as the connective communication technologies, currently used in applications. These technologies would be used to create and promote collaborative games with the required technological architecture;

- Providing the educational contents and games with the required accessibility properties, so they can be used by disabled people.

Currently, games and applications for mobile devices can be found on the Internet. However, there are not specialized systems created to distribute such contents, and those which really exist are cumbersome while using and they are not free. Our system fills an important gap in this area, because it is intended to cover both of these aspects, and can be considered as an integral m-learning platform [6].

Our platform was conceived from the beginning to be free of use, and also to be as easy to work with as

possible. The platform was created and intended to be used by students so, after all, the main idea was to create a place where the students could share their knowledge and get and provide support to and from others. The main screen of Dmovil platform is shown in Fig. 6.

The platform is a portal for distributing educational content implemented on a Web environment. We decided to create a web platform because it was the easiest way to reach all the intended audience (students), much better than distributing an application on a digital format as Compact Disc or a memory stick [7] or forcing the users to download a local application.

Another advantage of a Web application is that updates in the content or the structure of the application are transparent to the users. Changes can be made at any time, and the user will not need to make any changes himself. The application meets the following technological components:

- Java programming language: We decided to choose Java because it was more appropriated for ours needs than other solutions. This platform has a lot of support from the developers' community and, as a result, many libraries and frameworks have been developed. All these pieces of code could be easily put together and adapted to create the platform we had in mind. On the other hand, the application was indented to run on various platforms, so we needed a multiplatform, and Java fits perfectly to this requirement;

Fig. 6   **Main screen web version.**

• Struts framework: The Struts framework is a project of the Apache Foundation and also an open source project. Since it was introduced in 2004, it became a facto standard for web applications, and is now the most used java web framework. The use of this framework can significantly reduce the costs of the development process and the maintaining tasks;

• Web Server—Apache Tomcat: The Apache Tomcat server is another project from the Apache Foundation. It is also an open source application, and could easily deploy written applications using the Struts framework;

• Database Server—any SQL (Structured Query Language) standard compatible: The system has been operating with success using the most popular database servers, i.e., PostgreSQL, MySQL, Oracle and SQL Server. We focused our efforts on creating a system that could be used with the most known database systems.

It is worth mentioning the predominant use of open source software, including multiplatform, which allows its use on Windows and Linux systems. This contributes to our goal of creating a free-to-use system. Another important point of using open-source systems is that defects are found and fixed more quickly [8], which makes our work easier.

5. Results and Conclusions

Mobigame event has been organized over the last years and it has allowed us to discover new ideas around the world of mobile devices and the possibility to exchange perspectives and experiences with some IT professionals. Moreover, the competition motivates students because many of them find their first job when participating with a good project. The Kanatest Mobile game has not been tested yet in a real case but people who have tried it have been pleasantly surprised because it is easy of use, interactive and with the ability to practice easily a complex language like Japanese. The web platform during its first year of life has received multiple visits, downloads of info-educational content (some of these more than 40 downloads) and ratings of the downloads, in addition some users have contributed with more than thirty developments.

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