Experience in Mobile Technologies: A Game-based Learning Framework

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Abstract - *This paper presents our experience in the field of mobile technologies, from which several initiatives have emerged. Among them, the Mobigame Competition stands out. Here is included a game to learn Japanese from the above mentioned competition. This game has been made for mobile phones or PDA (Personal Digital Assistant) based on the JME (Java Mobile Edition) technology. Finally, here is presented another initiative from the research project funded by the Spanish Ministry of Industry to create a free download platform of digital contents for mobile devices based on info-educational games.*

Keywords: Mobigame, game-based learning, mobile

1   Introduction

Our department and, in particular, our research group has been working more than ten years in the field of e-learning systems. One of its lines of work 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, to extend its functionality to other fields, such as m-learning, is one of the objectives of the TIFYC research group. As a result of this work, a Technical Workshop on Programming for mobile devices has been consolidated since 2000, prelude of the Mobigame Competition [4]. This conference offers to the students of Computer Engineering basic knowledge of programming for mobiles on the JME (Java Mobile Edition) and Dot NET technologies. After this conference the Mobigame Competition takes place, and any student may submit an application, preferably a game, for mobile devices, and companies determine their degree of difficulty in programming. From the competition of last year the KanaTest Mobile game was presented, an application for mobile phones that supports Java. The aim of this game-based learning is to practice and memorize easier 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 aims to be a free and open exchange of educational contents (games, applications, etc.). The three main aims of the Project are:

- To develop contents and games applications compatible with the highest possible number of devices, analyzing the characteristics of the devices themselves. It is also considered the possibility of creating specific contents that make the most of the special characteristics of some devices, for instance raising the usability or the level of interactivity (e.g. by using pointing devices)

- To create a technological architecture to promote the access and use of the developed contents mentioned above.

- To provide 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 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 department. This event is focused on the creation and development of educational applications, using the JME platform, for its use on mobile devices and Microsoft Dot NET Technology. It also encourages team working, as the contestants are gathered in groups, usually made up of 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 let 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. Thus, we have had to help the

students repeating again and again the same solutions.

- Most of the questions have a technical nature.

- It seems a good idea for us to organize some seminars where we could solve the same problems at once. In this way, a few months before the event, a series of seminars, or technical conferences are organized.

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

2.1   Technical Seminars

As mentioned above, some months before the 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.

The seminars are distributed in several days, and last around five hours in total. We found enough this amount of 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 amount of time, enough for the students to complete their applications, the event itself begins.

2.2   Methodology

The event spans over three days. The first one, a jury composed of members 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 of the total, otherwise there would not be enough time for all of them in the remaining days. It also ensures that all the applications that come in the second day have a minimum level of quality. Those who make the cut are headed into the second day, held in one of the assembly halls of the school, and where they must elaborate 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 actually developed the work. Finally, they are also asked to provide a real demonstration of the work. 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

juries were composed of members of the department and the research group, the final is evaluated by a jury composed of a group of professionals from the IT field. During all the years 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 companies. Among these companies we can find Telefónica, HP, and Microsoft. 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 the 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, programmed in Java using JME technology, that allows to practice and memorize, 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, for this it has included multimedia content. There are many technologies to develop this game: Java, Dot Net, etc. Java has been used mainly because the technology is taught at the University of Alcalá and in addition this technology can be implemented in a large number of mobile devices because it is very extended. As it was mentioned above, the application will use Katakana and Hiragana shown below:

ア イ ウ エ オ   あ い う え お
カ キ ク ケ コ   か き く け こ
サ シ ス セ ソ   さ し す せ そ
タ チ ツ テ ト   た ち つ て と
ナ ニ ヌ ネ ノ   な に ぬ ね の
ハ ヒ フ ヘ ホ   は ひ ふ へ ほ
マ ミ ム メ モ   ま み む め も
ヤ ワ ユ ヲ ヨ   や わ ゆ を よ
ラ リ ル レ ロ   ら り る れ ろ
ン   ん
Katakana   *Hiragana*

Figure 1. Katakana and Hiragana alphabet

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 6.5. For the code edition 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.

The gameplay is really simple. Once the user is logged into the game, s/he only has to choose which of the two available kanas wants to practice. Once chosen, the Konichiwa professor welcomes us as we see in the figure below.
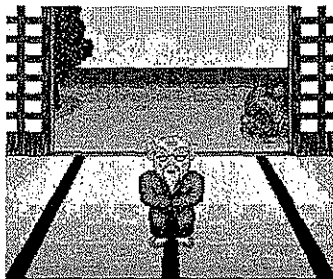

Figure 2. Konichiwa professor

Below it is the menu to access to the following options (figure 3)

- Do test.

- To practice the chosen kana.

- Review the table. To study the phonetic symbols of the chosen kana.

- Personal statistics. All our results so far.

- Help. It shows a help message.

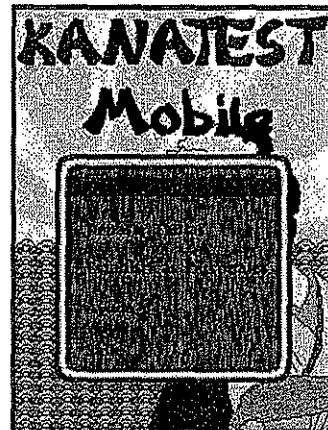- Exit. This option allows to leave *KanaTest Mobile.*

Figure 3. Main Menu

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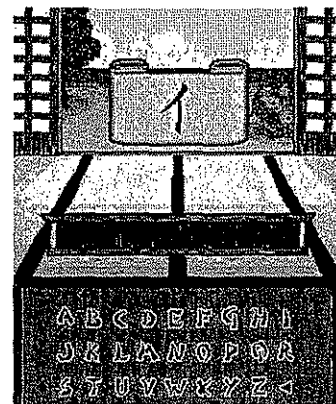

Figure 4. Test example

4 Technological Platform

The platform allows the creation of an exchange point to share educational contents; not only games can be done. The main objective was to create a platform where users can upload their own developments and that other users may also download and to 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 excellent maintainability an extensible. As the system is intended to be accessed from mobile devices and desktop computer web browser, it supports web protocols and languages as well as WAP (Wireless Application Protocol) ones. The WAP version (figure 5) of the share point is optimized for small-screen devices, like the ones PDAs and cell phones have.

The project was based on the following ideas:

- Provide a place where students could share ideas related to their work in the Mobigame event.

- Gather all the common information and examples from the technical seminars.

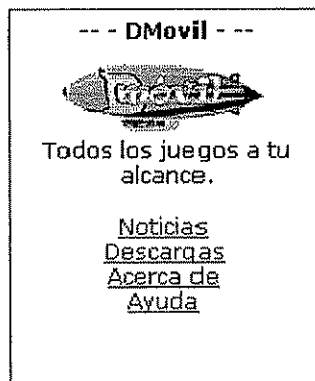- Offer a place where the developments could be uploaded, and thus be shared with other students.

Figure 5. Main Sreen WAP version

These ideas were kept in our minds, checked often to look for viable solutions, until they could be materialized, so we could provide an answer to the students' needs. This project aims to create a platform to host and distribute learning content. More specifically the project is focused on these points:

- Develop specific contents and deal with the required actions to make it more accessible, so they can be used by the widest range of potential users.

- Develop contents and gaming applications compatible with as many devices as possible, analyzing the actual characteristics of the devices themselves. It is also being considered the possibility of creating specific contents that make the most of the special characteristics of some devices.

- Make use of the connectivity features of the devices, as well as the connected communication technologies, currently under-used in current applications. These technologies would be used to create and promote network games, together with the required technological architecture.

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

Currently, games and applications for mobile devices can be found everywhere. However, there are not specialized systems created to distribute such content, and those which really exist are not only not free, but also cumbersome, forcing the user to go through a number of unexpected steps. 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 very 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 platform is called Dmovil, and its main screen is shown in the following figure.

Figure 6. Main Sreen Web version

4.1   Technical Information

The platform is a portal to distribute 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 CD [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 itself 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 this 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.

- Struts framework.
  The Struts framework is a project of the Apache Foundation and an open source project as well. Since it was introduced in 2004, it became the de facto standard for web applications, and is now the most used java web framework by far. The use of this framework can significantly reduce the efforts 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 standard compatible.
  The system has been operating with success using the most popular database servers (PostgreSQL, MySQL, Oracle, SQL Server). Another point that was clear before the development was the need of a database-agnostic platform. So we focused our efforts on creating a system that could be used with the most well-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 organizing the event over the years has allowed us to discover new ideas around the world of mobile devices and the possibility to exchange views and experiences with some IT professionals. Moreover, the competition motivates students because many of them find their first job sending a good project. The game Kanatest Mobile has not been tested yet in a real case but people who have tried have been pleasantly surprised because it's easy of use, interactivity and the ability to practice a complex language like Japanese. The web platform during its first year of life has received multiple visits, downloads info-educational content (some of this more than 40 downloads) and ratings, in addition some users have contributed with more than thirty developments.

6   References

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