QUIZ LOUNGE

Game-based learning on mobile devices

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***Abstract*—The Quiz Lounge project is a collaboration between Hochschule Darmstadt and Lufthansa AG. The goal of the project was the development of a mobile learning application. With the application, the Lufthansa managers should be able to learn about data privacy topics playfully and interactively. The application is based on a quiz concept and asks the user for answers to a series of ten questions which increase in difficulty level. While playing the game the user can use two "lifeline" helpers, the audience- and the 50-50-helper. Furthermore, the user has the ability to browse a glossary of related terms if he or she has the need of more detailed knowledge. New questions and also new games can be added with a web-based authoring tool. The authoring tool was uniquely developed for the Quiz Lounge application and conforms to the specific needs of its architecture.**

Education; e-learning; mobile learning; game-based learning; micro-learning; authoring tool; variable content; multiple mobile platforms

I. INTRODUCTION

The QUIZ LOUNGE app was developed in collaboration between the University of Applied Sciences, Darmstadt and Lufthansa AG, Frankfurt. Students from three departments (Computer Science, Media and Business) followed the goal to design an innovative system which would allow to develop a mobile learning app, present the content in a playful manner and thus meeting principles of game-based learning. As our target group included Lufthansa's management, we carefully interviewed the target group in order to find out where they would draw the line between „playful" and „childish" or "silly" and how they would like the content to be presented. A user-friendly interface was an understood feature. As our prototype was geared towards the content of "data privacy" and "data security", we faced the challenge of presenting a rather dry content in a motivating way. In order to enable Lufthansa to modify or add new content, we designed and uniquely developed a web-based authoring tool which enables users to modify the content of the app using a self-explanatory interface which converts the modifications into XML files read-in by the app dynamically.

II. THE GAME-BASED PRINCIPLE

During the decision process, of which type of game was most suitable for our application, we had to consider various aspects:

- the motivational factor,
- the topic to be taught,
- the fact that this app is to be used in parallel to other Computer Based Training Tools (CBTs) and
- that its primary use meets the German slogan "Leerzeiten zu Lehrzeiten machen" (translation: turn free time into educational units).

Game Based Learning is a variant of E-Learning. E-Learning is an umbrella term for electronically supported learning. Electronically supported learning in this context means software based learning using digital media and web technologies. E-Learning can be based on very different technologies and can be realized in different scenarios such as Computer Based Training, Learning Management Systems or Game Based Learning.

Game Based Learning refers to games that take place in a hard- and software-based virtual environment, so-called Digital Learning Games. Digital Learning Games should be fun, but their primary goal is to acquire knowledge and skills. Fun is to be used as a motivating factor for learning, by connecting the playful action with knowledge on certain topics.

When designing the app, we carefully investigated the game-based e-learning market as well as interviewed Lufthansa's management regarding their ideas of a mobile e-Learning app. We carefully had to find out where our target group would draw the line between "serious & playful" vs. "childish & silly", as the latter would have lead to an immediate failure.

Why did we consider the playful, game-based feature at all?

Marc Prensky, known as a developer of various educational games, is convinced that the huge success of computer games is the main argument for the introduction of Digital Learning Games [1]. The crucial factor for the success of Digital Learning Games is motivation. The reasons for more

motivation are clear. There is a new commitment to learning and the process of learning itself is interactive. According to Prensky, Digital Learning Games are used for:

- Material that is dry, technical and, yes, boring
- Subject matter that is really difficult
- Audiences that are hard to reach
- Difficult assessment and certification issues
- Complex process understanding
- Strategy development and communication.

Prensky also lists criteria that support the development of playful e-learning tools:

Games are a form of **fun**. That gives us ***enjoyment and pleasure***.
Games are a form of **play**. That gives us ***intense and passionate involvement.***
Games have **rules**. That gives us ***structure***
Games have **goals**. That gives us ***motivation***.
Games are **interactive**. That gives us ***doing***.
Games have **outcomes and feedback**. That gives us ***learning***.
Games are **adaptive**. That gives us ***flow***.
Games have **win states**. That gives us ***ego gratification***
Games have **conflict/competition/challenge/opposition**. That gives us ***adrenaline***.
Games have **problem solving**. That sparks our ***creativity***.
Games have **interaction**. That gives us ***social groups***.
Games have **representation and story**. That gives us ***emotion***.

Having confirmed that Digital Learning Games would suit our content and the listed criteria matched what our customer had in kind, we now needed to find out what type of game would be suitable for the content. Prensky suggested different learning activities for various types of content [1]. One of his categories is 'facts', which includes laws, policies and product specifications. Thus we were able to assign our topic of data privacy to this category.

Meier & Seufert [2] also categorize digital learning games (Fig.1). There are games that focus more on qualification and games that focus more on entertainment and fun. The quiz is categorized as a game type with a strong focus on qualification. Thus the game type quiz serves as acquisition of knowledge. However, by introduction of additional gaming elements the fun factor can be increased.

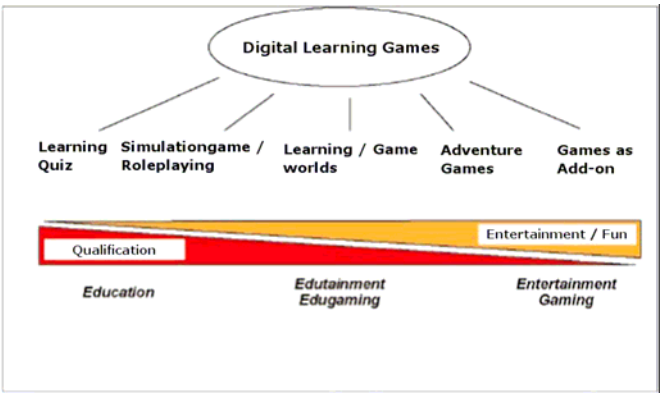

Figure 1: Categorization of Digital Learning Games

The criteria listed by Prensky and Meier & Seufert matched perfectly with the results of our interviews with the customers. Therefore, we decided to use a quiz format for the game. This is based upon the widespread use of quiz games around the world and also on their acceptance across ages. Furthermore, it gives us great flexibility with the content and a familiar learning environment, especially for short sessions, so-called "learning nuggets". Our QUIZ LOUNGE is based on the idea of "Who wants to be a millionaire?" (Fig.2), the internationally known and famous TV show.

Figure 2. Typical screen of the "Who wants to be a millionaire?" show (http://mobile-suite.ru/uploads/posts/2011-02/1297656273_rvqawc1uxusehli.jpeg)

Besides looking at the motivational aspect of a game-based app, we needed to take into consideration the time of development as well as the amount of data that needs to be presented, stored and processed on the mobile device. Educational video games, sometimes referred to as Edutainment, involve large amounts of data and were thus excluded from further plans for the design. Instead of attracting and convincing our users with fancy videos, we focused on an appealing design and textual data.

When designing the gaming idea of our app, we didn't want to reinvent the wheel. Instead, we looked at games that were not only successful with people in our target group but would also meet the needs of a rather fast implementation and a user-friendly end product.

III. THE DESIGN

During the design process for the different Blackberry devices (Lufthansa's management is presently equipped with Bold 9700 and Torch 9800), we faced several challenges imposed by the Blackberry itself. The Bold 9700 is held in portrait mode, the Torch in landscape mode (Fig.3).The fact that the Blackberry is a mobile device restricts the possibilities for the design of the application. The relatively small display shows the content in very high resolution, but the font it uses is often too small and unreadable. To ensure sufficient readability, we had to pay special attention to the font size. Due to the size of the screen, only a limited amount of the content can be shown at one time. Too much text on a page causes the content to be difficult to comprehend, causing the user to quickly lose the joy of using the application.

Figure 3. The Privacy Quiz running on a Blackberry Bold 9700 and Torch 9800

Besides these hardware limitations, an overall user-centred design had to be reflected in all the designs. Thanks to the pre-existing corporate design, we were able to draw upon a styleguide from Lufthansa. The use of the existing appearance of Lufthansa not only creates a simplified usability, but also a good recognition of the brand with all its interpretations: reliability, security, and freedom.

During the entire design process, we followed the iOS design principles [3], which claim "when an app fits well on the device screen and responds to the gestures that people know, it provides much of the experience people are looking for. And although people might not be aware of human interface design principles, […], they can tell when apps follow them and when they don't."

IV. THE QUIZ LOUNGE APP

Our game starts with a Welcome screen (Fig.4) that contains a "Nice-to-know fact" from the field of data security. This fact is shown in order to inform and potentially surprise the user with information they may not know about data security and as a result help the user to create awareness for the topic. It also serves to pique the user's curiosity.

Translation of Fig.4:

Did you know?

…that more than 35.000 Blackberrys are left behind in England's taxis every year?

This corresponds to approximately 40.000.000 e-mails which could contain confidential data about you or your company.

Figure 4. Welcome screen

After reading the "Nice-to-know fact" on the Welcome screen, the user is shown the main menu (Fig.5), where he can either start a new game, continue a game, look-up a word in a glossary or exit.

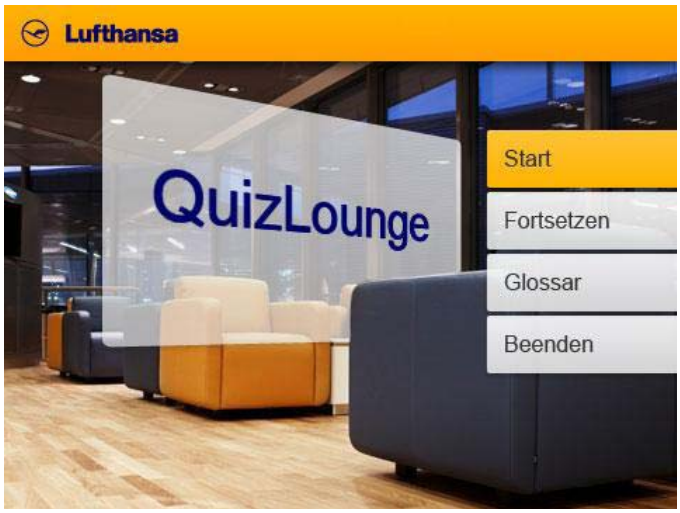

Figure 5. Main menu

When choosing to start a game and selecting a topic and a subcategory inside that topic, a quiz starts (Fig.6). Each quiz consists of 10 questions in three different difficulty levels. Green marking relatively easy questions, yellow marking an intermediate level, and red marking challenging questions.

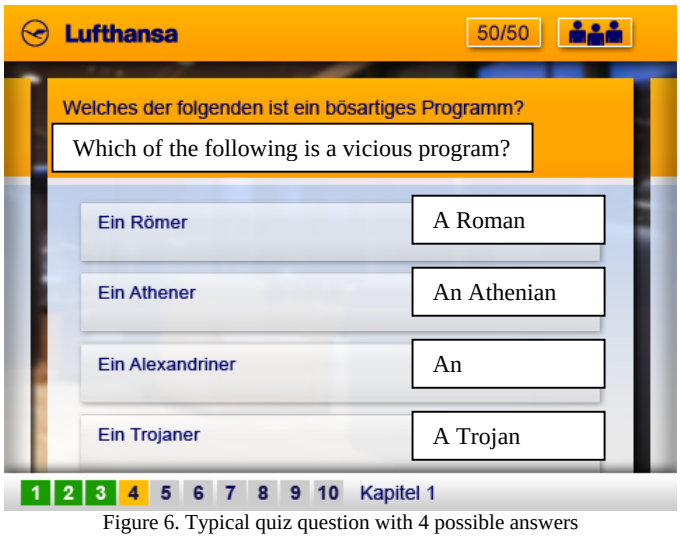

Figure 6. Typical quiz question with 4 possible answers

If a question is answered correctly, the user gets a detailed explanation for his answer (Fig.7).

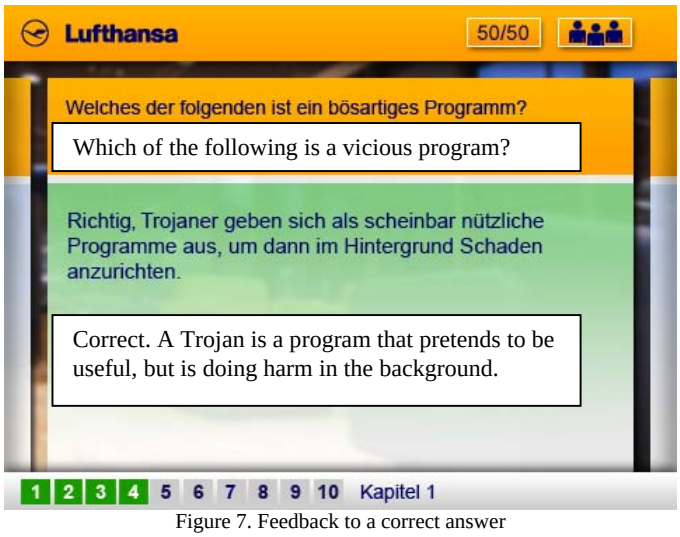

Figure 7. Feedback to a correct answer

In case an incorrect answer was chosen, a detailed explanation is given as well – this time on a red background, marking the incorrect choice (Fig.8).

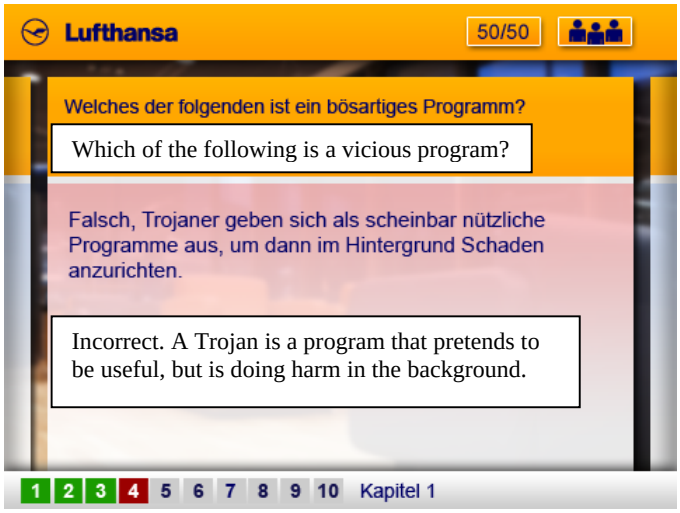

Figure 8. Feedback to an incorrect answer

V. Architecture and Technology of the App

What appears to be convenient for humans to read is usually not readable for computer programs, in this case our Blackberry App, so the content has to be prepared in such a manner that the program is able to read the text and create data objects which can be used as app-internal data representations. In order to meet this requirement, an appropriate format had to be chosen, which can envelope content making it readable and understandable for the app.

Extensible Mark-up Language (XML) is a standard technology that provides the ability to structure a text document to make it readable by humans as well as by computer programs. XML is defined in the XML 1.0 specification produced by the World Wide Web Consortium (W3C). [4]

Because XML is considered standard, a huge number of proprietary and open source programs support it, and hence are able to interpret it easily. Moreover, many programming languages provide APIs for processing XML-documents, including Blackberry JRE. Based on Java - the most supported programming language for developing Blackberry Apps - Blackberry JRE provides API's for handling XML-documents.

Another advantage of using XML is its support of XML Schema Definition (XSD). XSD is recommended by the W3C for defining and structuring XML-documents [5]. XSD enables the formal definition of XML-documents by defining the type and amount of data contained in it. By means of XSD, the structure of an XML-document can be restricted and also validated against the XSD document that describes the document's structure. The ability to validate XML documents was of considerable importance for the project, as the App can check the content for correctness and react appropriately.

The content is transmitted in XML-format from the server to the smartphone and is then parsed into Java objects which are locally stored in the database of the smartphone (Fig.9).

Figure 9. XML connection layer

VI. Authoring Tool

In general, downloadable apps do not come with the option for the user to modify the app. They are rigid in the sense that the user has to wait for a new version if he wants a different functionality or updated content. In our case, we wanted to give this flexibility to Lufthansa.

In order for Lufthansa to be able to modify the content of the data privacy app and also in order for them to be able to create new mobile quiz apps, we designed and uniquely developed a web-based authoring tool which enables users to modify the content of the app using an easy-to-use, self-explanatory interface which enables the author to create new quizzes and new questions for existing quizzes, as well as change existing content (Fig.10).

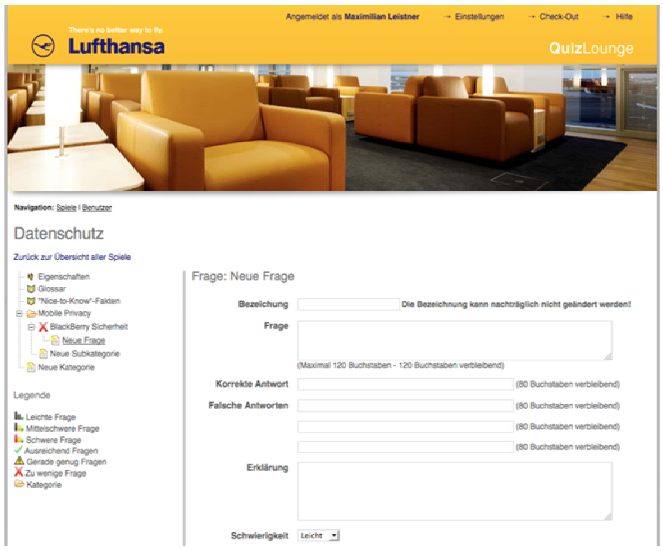

Figure 10. The GUI of the authoring tool

VII. Architecture and Technology of the Authoring Tool

QUIZ LOUNGE's authoring tool is designed and implemented in PHP as a web application, thus demanding minimal computer affinity of the author. Several authors can work in parallel on either the same quiz or different quizzes.

After modifications have been made via the authoring tool, the tool converts these modifications into XML files, which are then transmitted via the server to the smartphone, where the Eclipse-based Blackberry App locally stores them as Java objects in an SQLite database (Fig.11). An update mechanism reacts dynamically to changes in the content by communicating with an Apache-Server. That way, the content on the smartphone is always held current.

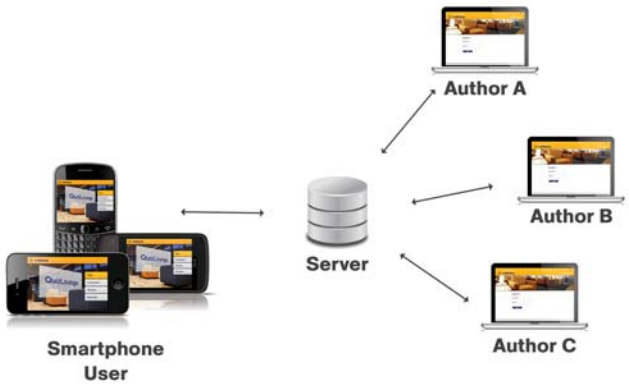

Figure 11. Communication between the author(s) and the app

VIII. Diversity of Mobile Devices & Portability Issues

In order not to be limited to Blackberry devices, and because the smartphone market is very diverse (Fig.12), we explored the question of porting the app to other mobile devices.

Figure 12. Diversity of the mobile device market

After exploring the smartphone market and looking at current sales figures, five main platforms and their different operating systems could currently be identified: Research in Motion (RIM) with their Blackberrys, Apple's iOS and their iPhones, Android devices, Microsoft's Windows Phone and Symbian. For answering the question of portability, we disregarded Symbian phones, as this operating system is undergoing a clear decline in market share [6].

In general there are two alternatives to successfully run the app on other devices:

Either you natively re-code the app for the other operating systems (Fig.12) or you use Cross-Platform Development (CPD) Tools (Fig.13) to convert the apps directly.

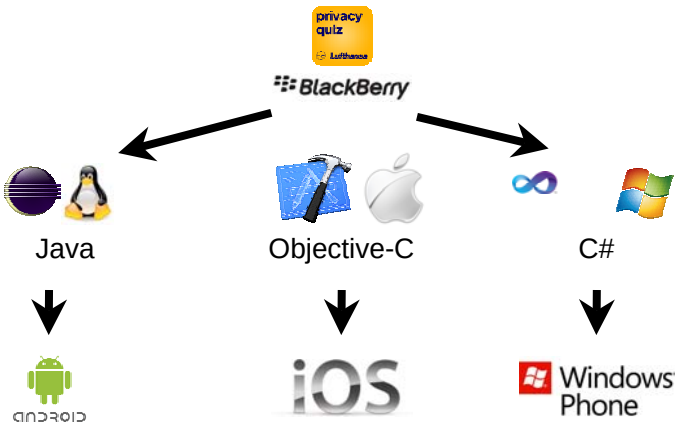

Figure 13. Native Programming of an app for different operating systems and platforms

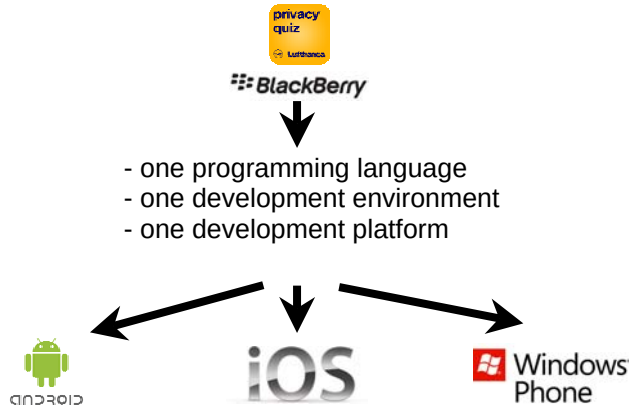

Figure 13. Using CPD tools to convert an app for different operating systems and platforms

After implementing and comparing the alternatives, we didn't come to a clear conclusion as to which of the alternatives is to be preferred. The native approach involves the detailed understanding of different operating systems as well as different programming languages for those operating systems, but leads to a direct transfer of all functionalities of the app, including its navigation on the GUI. The CPD approach, which initially appeared to be faster, resulted in a fast transfer of most of the functionalities, but demanded thorough programming in detail, e.g. when certain details didn't get translated and had to be manually debugged and re-coded. Both approaches led to successful results. End users were not able to distinguish between a natively developed app vs. a CPD-generated app.

The QUIZ LOUNGE is now successfully running on four different platforms.

IX. SUMMARY

The Quiz Lounge project is a collaboration between Hochschule Darmstadt and Lufthansa AG. The goal of the project was the development of a mobile e-Learning application by the use of which Lufthansa's managers should be able to learn about data privacy topics playfully and interactively.
The application is based on a quiz concept and asks the user for answers to a series of ten questions which increase in difficulty level. While playing the game the user can use two "lifeline" helpers, the audience- and the 50-50-helper. Furthermore, the user has the ability to browse a glossary of related terms if he or she has the need of more detailed knowledge. New questions and also new games can be added with a web-based Authoring Tool. The Authoring Tool was uniquely developed for the Quiz Lounge application and conforms to the specific needs of its architecture.

Although the app was initially developed for Blackberry devices, we have ported it to other mobile platforms in order to not be limited to just one environment.

REFERENCES

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