

New Perspectives on the Development of Virtual Exhibitions for Mobile Devices

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The paper presents the rapid evolution of mobile devices and technologies in the last period, which facilitate the development of new kinds of mobile applications, such as mobile virtual exhibitions. New paradigms about mobile virtual exhibitions are highlighted, such as the business models and payment possibilities for accessing the cultural content. The Julieta mobile application is described, which implements a virtual exhibition with educational character. A survey on the use of Julieta mobile application was realized and its results were presented and analyzed.

Keywords: Mobile Application, Virtual Exhibition, Cultural Heritage, Business Model

1 Mobile Technologies

Mobile technologies have seen a huge increase in the last period and some operating systems, such as iOS, Android and Windows Phone, captured the mobile market.

Mobile devices have a great variety on the market, they differ in hardware and software, but from the developers' point of view, we are interested on the operating system installed on these devices. According to Gartner (<http://www.gartner.com>), the main mobile operating systems found on these devices are: Android OS with a market share of 57%, Apple iOS with 23%, Microsoft Windows Phone 11% and others 9%. The mobile operating systems distribution is displayed in Figure 1.

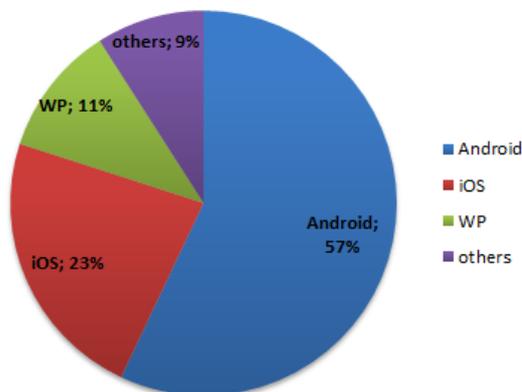


Fig. 1. Mobile operating systems distribution

As we can see in Figure 1, the Android operating system occupies more than half of

the market, which means that his application store (Google Play) contains the widest range of applications.

2 New Paradigms about Mobile Virtual Exhibitions

The mobile technologies ensure not only the better knowledge, protection and preservation of cultural objects, but promise more direct visitors of cultural institutions, such as museums and libraries. The objective of remote access to cultural objects is not to bring out people from the real cultural institutions, but rather to stimulate to visit them [1].

Virtual exhibitions have many advantages compared to traditional exhibitions, because it is very easy to add new components in the gallery of objects or to modify the existing ones. A particular advantage is that of having electronic duplicates of physical cultural heritage items, which in most cases are very expensive and fragile and could be damaged by handling [2].

The implementation problem of virtual exhibitions for mobile devices is the business model that can be applied in order to make possible the business flow of development and commercialization. The following question appears in order to make viable the business model: who will pay for the mobile application development? We can find some good answers to this question, as follows [1]:

- implementation of marketing freemium strategies, so that users of mobile application will pay the access to the virtual exhibition presented in the mobile application, as a special access to resources dedicated to a specific category of people;
- development of mobile applications for virtual exhibitions by external software companies, other than museums and libraries; in this situation, other two questions will arise:
 - who/ how/ whom will do the marketing?
 - who pays for the access to virtual exhibitions?

In the second situation, if the virtual exhibition has an educational character, some schools or universities can pay the fee for their students in order to get access to collections presented in the mobile application.

The impact of the business model is upon several domains, such as education, in terms of increase in quality and attractiveness, tourism, by diversification of the offer of services, the field of direct e-commerce with digital content and consumer goods industry. Virtual exhibitions allow the expanded multimedia access to cultural heritage from libraries, museums and art galleries, increasing the public interest for collections, while libraries and museums exploit their resources in order to enrich and maintain them, becoming true documentation centers that promote culture.

Virtual exhibitions for mobile devices include GLAM (Galleries, Libraries, Archives and Museums) content, which means that multimedia objects promoted are digital representations of the real objects that can be found in galleries, libraries, archives and museums.

In a mobile virtual exhibition, the mobile application provider becomes implicitly an intermediary in a transaction with digital content. It appears the question of commercial and legal relationship with the owner of collections, which can be or not the owner of intellectual property rights on the

distribution line. Also, there must be realized a clear distinction between the permanent collections of museums and unique exhibitions organized with special situations. The access through mobile solutions and technologies to cultural collections can influence the market of art works and the financial sustainability of museums and libraries, because mobile contents may become substitutes for the elements of the original collections.

3 Juliett – the Mobile Educational Virtual Exhibition

We live in a world with limited time. We live in a world where knowledge means power. Usually we don't have the necessary time and patience to wait in line for paying the bills or for visiting an art exhibition. Inevitably, we dive in worries. However, we have museums, good literature and great writers. Why don't we use the power of these simple and profound things? Often, the only capable thing to pull us from the worries ocean, is the music. Music is everywhere: iPods, smartphones, and tablets. No matter the age, the social status, the education, the daily devices became an extension of us. I figured out that bringing art in the hands of people, inside their favorite gadgets, might help them overpass the daily routine and, why not, make the people happier. This is how Juliett – mobile application for android devices - got born. The main purposes of this mobile application cover cultural and social areas.

Exploring one museum using mobile devices can offer advantages like: freedom to move, unconditioned by time and place access, creating a list of favorite objects and the easiness of exploring. Juliett was built on simplicity, accessibility and intuition. The purpose of this project is not replacing physical museums or physical exhibitions, but to make art accessible regardless time and place and to keep people informed about the art events and about the new collections. Also, Juliett can be a useful tool in education. The advantages of this project, are both for art consumers and also for art providers. The

art consumers would have all the necessary information about the art exhibitions and about the museums. On the other hand, the art providers would grow its public [3].

3.1 Flow

The flow of activities is presented in the Figure 2. The number of activities is reduced to 6, because of the main principles which

are the foundation of the application: easiness, intuition, fast and efficient exploring. The main purpose of *Julieta* is the simulation of an art exhibition, though a secondary purpose is to give the possibility to the users to have more information about a specific object by scanning and interpreting QR codes.

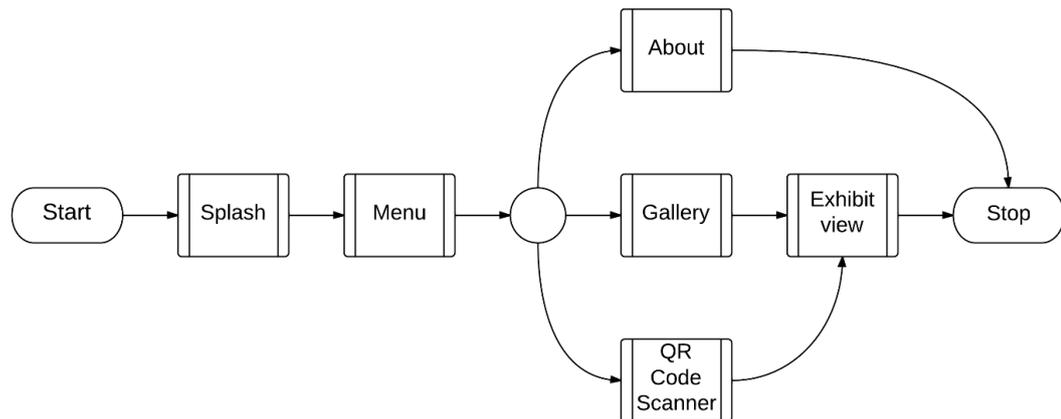


Fig. 2. The flow of activities in the mobile application

Figure 2 presents the detailed flow of the application. The first contact of users with *Julieta* is the splash screen, followed automatically by the menu, which offers the following options: *Gallery*, *QR Code Scanner* and *About*.

3.2 Architecture

Logically, the application works according to the following flow. A PHP web-service makes queries on the MySQL database and transforms the results of the queries into JSON structured data. The next step is to

parse the JSON structured data and use the resulted information inside the application.

An extra functionality is the possibility of creating one own exhibition with favorite objects, facility developed using a SQLite internal database. The IDE used for development was Eclipse Kepler and the database is stored into a server accessed with PHPmyAdmin interface.

The architecture of mobile application is displayed in Figure 3.

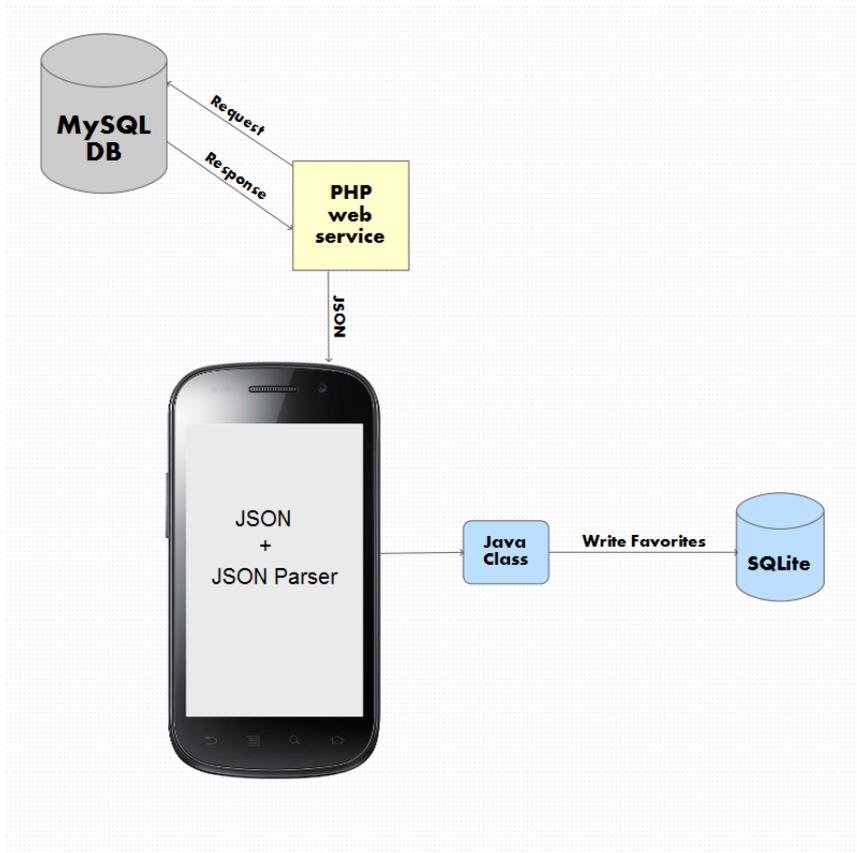


Fig. 3. The architecture of Juliatt mobile application

As seen from Figure 3, the flow of the mobile application means to use a PHP web service that works with a MySQL database. Also, the application store persistent data locally in a SQLite database.

4 Components of Juliatt Mobile Application

Juliatt was built based on seven Java modules and others auxiliary classes.

Object viewer	ObjectViewActivity.java, QRScanResult.java
Favorites	FavoritesProvider.java, FavoritesFragment
Drawer	Library android-support-v7-appcompat, SlideMenuClickListener.java, NavDrawerItem.java, DrawerListAdapter.java, Drawer.java

Table 1. Components of Juliatt mobile application

Module name	Java classes
JSON Parser	ItemsJSONParser.java
Opener	Splash.java, Menu.java
List loader	HomeFragment.java, FavoritesFragment.java, ...
QR reader	Library CaptureActivity, QRScanResult.java

The *List loader* module, has the purpose to load a list of objects from a specific collection. By default, the collection named “Trending” will appear on the screen. Every option present in *Drawer*, is actually a “link” (intent actually) to a fragment. The fragments are: *Trending*, *Favorites*, *Expressionism*, *Dada*, *Bauhaus*, *Abstract Expressionism*. The first fragment contains trending objects which are actually in the physic exhibition. The second one contains only the user favorite objects. The last four, are collections presented in the exhibition. The

customizability is very huge in this part of the application and it can be adapted to almost every exhibition. The *Object viewer* module allows users to visualize extra information about every object from the collection and to add it into Favorites collection. Here the users can see a full screen image of the objects and detailed information about the author, about the year of creation, the artistic period and others. The *Favorite* module works in background and is based on working with an internal SQLite database. Users can add and remove objects from their favorite collection.

All modules shown until now are part of the Gallery. Another flow, is based on using the *QR reader* module.

The main menu activity of the mobile application is presented in Figure 4. The main options (*Gallery*, *About*, *QR Scanner*) can be accessed through three buttons, displayed on the interface.

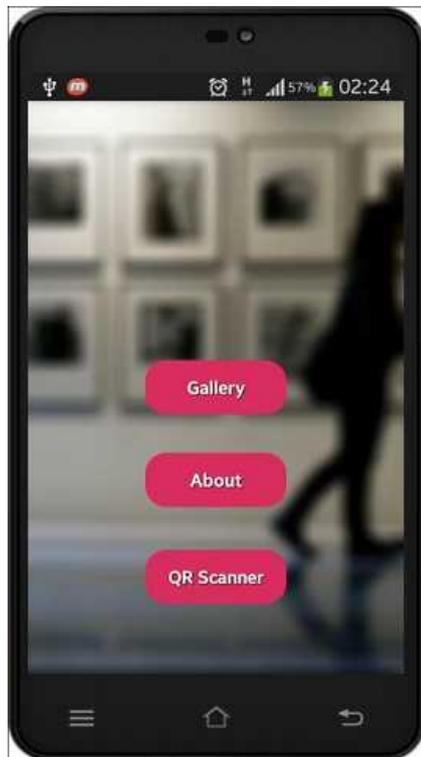


Fig. 4. Main activity of Juliett mobile application

Each item selected from the Gallery contains the image associated and a short description, as presented in Figure 5. The image and text associated were carefully selected in order to

be representative for the object described and to attract the user to visit the library/museum where the object is located. The main objective of the application, being a virtual exhibition, is to determine the users to visit the physical exhibition, if this is still available.

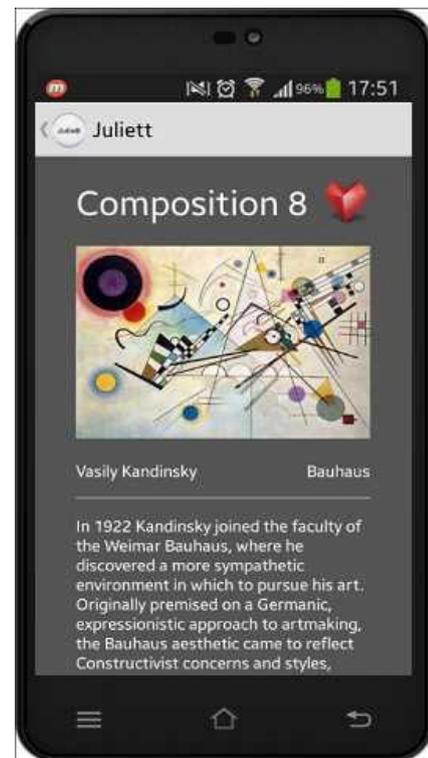


Fig. 5. Selected item from *Gallery* activity of Juliett mobile application

In order to view details of the selected object, the user can make zoom on the selected item and can better analyze it, as displayed in Figure 6.

The exploration of the selected object from gallery is an important aspect when speaking about the user experience with the mobile application. Taking into consideration that the main objective of the application is to implement a virtual exhibition, the manner in which the user can see the elements from the collection is very important, because we must consider the limitations of mobile devices in terms of displays and resolutions [4] [5].



Fig. 6. Detailed view of selected item from *Gallery* activity



Fig. 7. The *About* activity of Juliett mobile application

The *About* page of the activity is displayed in Figure 7.

In this activity are presented relevant information about the developer and the objective of the mobile application. These details are useful for users that want to know more about the application and which want to send feedback to the developer.

5 Survey on the Usage of Juliett Mobile Application

The objective of this survey was to the users and usage patterns of Juliett mobile application, in order to measure the users' behavior [7].

The survey was carried out with the help of an online questionnaire, realized with Google Forms on a number of 100 students, which have used the application on their Android devices (smartphones and tablets). The data gathered helped to improve the user interaction aspects of the mobile application, created as a virtual exhibition.

The main quality characteristic of the mobile application, which was measured through the survey was the usability.

Table 2. Survey results on the mobile application usability [9]

Characteristic measured	Satisfactory	Unsatisfactory
Contents of main activity	72%	28%
Graphic design of main activity	79%	21%
Download speed of images	65%	35%
Application navigation	71%	29%
Graphic layout of activities	84%	16%
Navigation between activities	77%	23%

Multimedia content	68%	32%
Personal information requested	55%	45%
Network usage	51%	49%
Storage space needed	89%	11%

The data presented in Table 2 is displayed in a graphic shown in Figure 8. As seen from the graphical representation, the satisfactory

answers are predominant in the total of answers, for each category analyzed.

Satisfaction degree on the mobile application quality characteristics

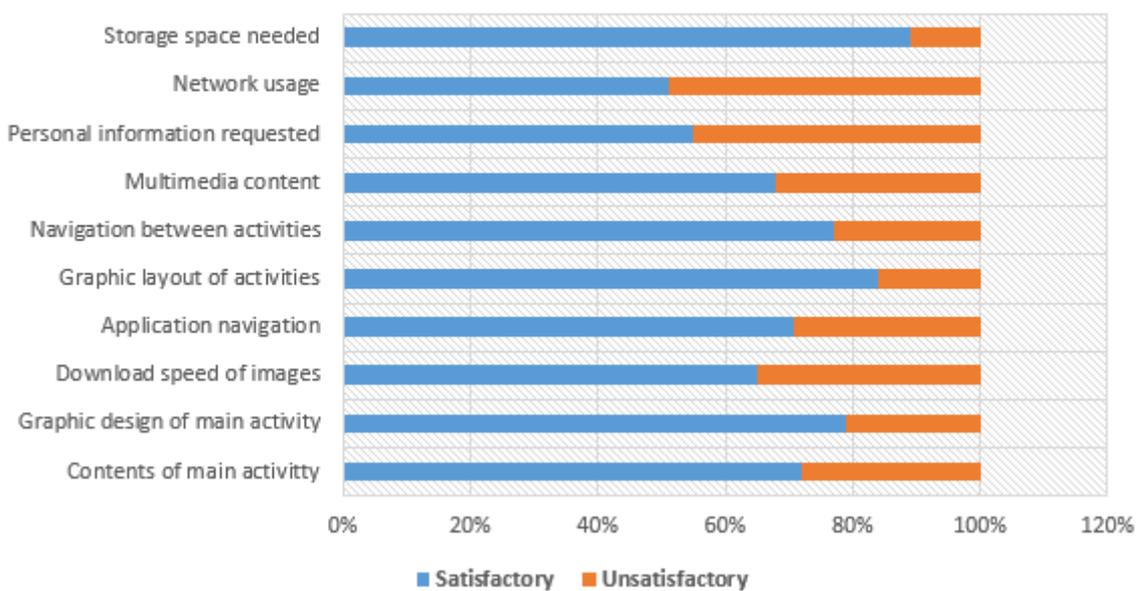


Fig. 8. Satisfaction degree of survey respondents on mobile application usability

The report between the positive and negative answers regarding the quality characteristics of Juliett mobile applications shows that the satisfaction degree is higher than expected.

6 Conclusions

The idea of implementing virtual exhibitions for mobile devices has an interdisciplinary character, because it integrates elements from IT&C and cultural fields, such as the development of mobile applications that presents historical documents in a virtual exhibition.

One of the specific objectives of the mobile applications development in the field of virtual exhibitions can be considered achieved, namely the promotion of culture

and art collections to young people and beyond.

The implementation of mobile applications for virtual exhibitions involves a collaboration between the computer science and humanities, by creating mobile applications that promotes virtual exhibitions and cultural heritage elements.

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