

# ARCHAEOLOGICAL SCAVENGER HUNT ON MOBILE DEVICES: FROM E-EDUCATION TO E-BUSINESS

## *A Triple Adaptive Mobile Application for Supporting Experts, Tourists and Children*

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Keywords: iPhone App, Mobility, Archaeology, Scavenger hunt, Collective intelligence.

Abstract: This paper reports on the design and development of a mobile application to support archaeological education and to raise awareness for our cultural heritage by making use of the powerful notion of play. The application reads information from Quick-Response Codes (QR-Codes) on paper sheets, which can be placed directly at the points of interest. Users can now follow an archaeological scavenger hunt along those points of interest. They start at one point of interest and get hints on how to find the others. This makes use of collective intelligence, i.e. using the mobile devices amongst the group of users as social communicators in order to get specific information on the target; through these additional discussions both the one who states questions and the one who gets the answer can learn incidentally. Although this App has been developed for educational purposes, it can be used just for fun, e.g. for a children's birthday party: Hiding treasures in various spots in the garden and delivering information on QR-codes showing hints on how to find the spots. Moreover, the use of the ArchaeoApp in the Tourism modus, is a challenge for e-Business.

## 1 INTRODUCTION

A fundamental problem in urban archaeology is that objects found at archaeological excavations have been removed to a museum or depot and the site is built over and thus no longer visible: neither to experts nor to the interested public.

Consequently, it is of professional, educational and touristic interest to label such points of interests (POI) and to provide electronic information about the removed artefacts and their history in the context directly at the POI.

Due to the widespread and growing availability of Smart Phones (e.g. iPhone), the goal of this project was to make such information accessible by using ubiquitous/mobile devices (for example on iPhones, see Figure 1) and to address the specific interests, needs and demands of three different user groups: experts (students), tourists and children.



Figure 1: A view on the ArcheoApp (left: geo-location; right: the corresponding archaeological information).

The ArcheoApp can be adapted to three different levels of expertise (Figure 2):

- Expert modus, for students of Archaeology;
- Tourist modus, for people interested in Archaeology and
- Children modus, to be used in a context of a scavenger hunt.

A scavenger hunt is a typical mobile activity that both adults and children can perform. In a scavenger hunt, participants are divided into teams and given a list of items, often unrelated and obscure. The first team to collect all the listed items within a given time limit wins the game. The essential elements of this play (timed task, teamwork, mobility) can be used for a mobile collaborative problem-solving approach.

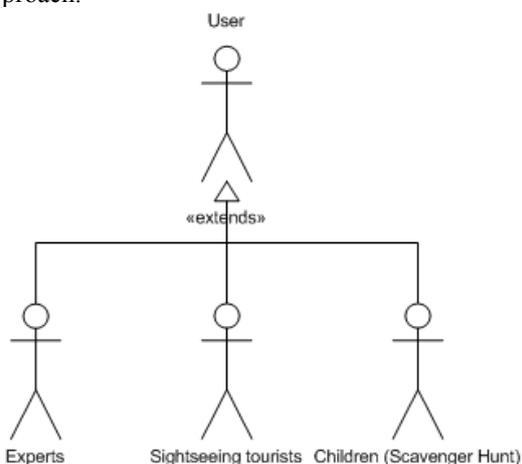


Figure 2: The triple mode of the ArcheoApp (for a better understanding look also on figures 5 and 6).

Such a scavenger hunt tool confronts users with a problem, which is usually more easily solved by the collective intelligence of the whole group (Massimi, Ganoë & Carroll, 2007). Collective Intelligence is currently of high interest among researchers, due to the fact that there are effects regarding the performance of individuals on a wide variety of cognitive tasks (Woolley et al., 2010). Recent research showed that different collaboration models, strategies, as well as atmospheres can greatly influence the performances of its members. In collaboration, each individual can have better learning effectiveness (Shih et al., 2010).

## 2 BACKGROUND

Originally, the idea of this project was to use radio frequency identification technology (RFID) for

tagging archaeological objects and to make use of separate devices including Tablet-PC's (Holzinger et al., 2010c).

This was obviously due to the fact that we have past experience with the application of RFID based technologies and mobile devices (Holzinger et al., 2010a), (Holzinger, Schaupp & Eder-Halbedl, 2008b), (Holzinger et al., 2008a), (Weippl, Holzinger & Tjoa, 2006), (Holzinger, Schwabinger & Weitlaner, 2005), .

Based on the archaeological problem description in section 1 and the lecture of Urban Archaeology which consists of 13 points of interest (Figure 3), a concept for a mobile application has been created. A description of the 13 POIs from an Archaeological viewpoint can be found in (Holzinger et al., 2011).



Figure 3: The basis for ArcheoApp: 13 points of interest (indicated by red numbers) along an urban archaeological tour for students of Archaeology (M. Lehner, Graz).

Our first field tests in summer 2010 with a group of 8 students of archaeology on the archaeological route of 13 points of interests revealed that more than one device is awkward and difficult to handle – for both the students and the teacher; most of all the users reported that the tablet size (even the iPad) is still too large and too heavy for outdoor activities.

Based on these experiences, we decided to use smaller devices (e.g. iPhones, which are increasingly available amongst students) and Quick-Response (QR-Codes) as these have the advantages of being optical readable, i.e. functioning with any handheld with a camera.

## 3 RELATED WORK

Although there is some related work on the use of tagging POIs with QR-Tags, there is to date no such work within archaeological education.



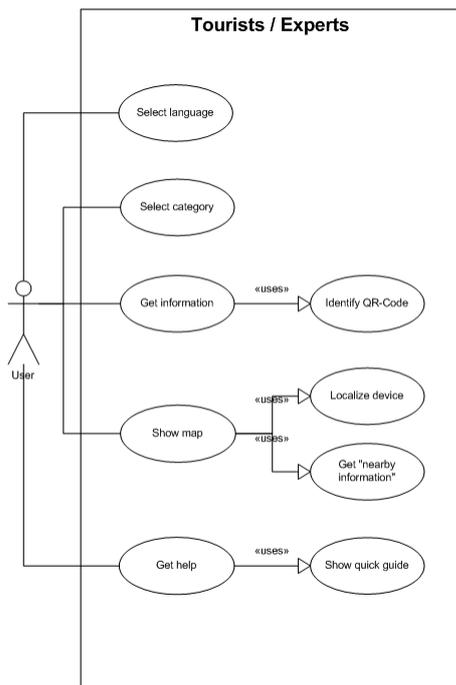


Figure 5: Typical Tourist and Expert Use Case of ArcheoApp.

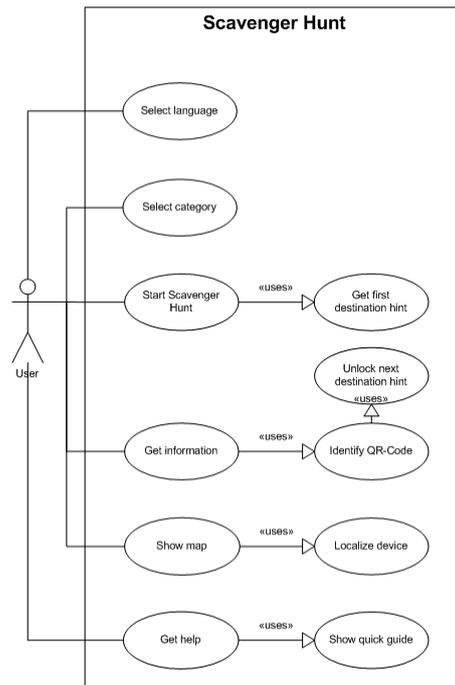


Figure 6: The Scavenger Hunt Use Case of ArcheoApp.

For the implementation of the software we made use of existing frameworks and for the recognition/processing of the QR codes we used the Open Source Encoder ObjQREncoder (Verkoeyen, 2011).

For the geo-location and map view we used the already integrated framework "CoreLocation" (Kuehn & Sieck, 2009), and "MapKit" (Mark & LaMarche, 2009).

These two frameworks are not only for the retrieval of up-to-date maps, we are also able to determine the position of the device on the map, i.e. the ArcheoApp can also be used for navigational purposes – which is also a relevant feature in the work of archaeologists.

The archaeological information described in section 1 is displayed in a so-called "Web View".

In this view, you can easily embed web content in the application. In our case, this is done by using HTML code, which has the big advantage that the content can be edited without much programming knowledge.

## 5 E-EDUCATION & E-BUSINESS

Whereas the primary intention of ArcheoApp was e-Education, it can also bring some other benefits:

On a Business-to-Consumer level (B2C) there is a mass market in tourist areas on a personal level, where interested people can download ArcheoApp for a small fee.

On a Business-to-Business level (B2B) ArcheoApp can be interesting for a mass market in large towns with a historic background (e.g. Rome). This is also interesting for smaller towns, open-air museums or archaeological finding places (e.g. Flavia Solva (formerly in the Roman province of Noricum, now Styria (Austria), or Carnuntum (formerly in the Roman province of Pannonia (now Lower Austria (Austria), etc.). It is proven that customer interactions can create opportunities for positive experiences that can lead to long-term relationship building (Rose, Hair & Clark, 2011). This can be especially relevant for tourism.

Moreover, by using ArcheoApp as an attractive customer benefit, the circle is closed by offering the big advantage of raising awareness for our cultural heritage – thus combining both aspects: e-education and e-business.

## 6 CONCLUSION AND FUTURE WORK

Mobile computing, along with new concepts including Web 2.0 in Archaeology is generally very promising (Holzinger et al., 2009).

ArcheoApp shows some interesting possibilities on various levels, including:

1) Enabling a group of archaeological students to accomplish efficient fieldwork – once performed individually – in teams even over distance. This enables us to make use of some promising concepts, e.g.

a) Mobile collaborative problem-solving generally has a big potential for learning (Massimi et al., 2007) and makes use of collective intelligence.

b) The game-based approach can be very powerful (c.f. with (Ebner & Holzinger, 2007)), in order to raise awareness for our cultural heritage, which is of raising importance of our society, even – or especially – amongst younger children.

2) The archaeological scavenger hunt shown in this paper is similar to a geocaching experience, which is of growing popularity (O'Hara, 2008).

To date, no work on the implementation of an archaeological scavenger hunt has been reported.

However, future work must address issues of privacy, security and data protection (Holzinger et al., 2010b) and a large scale study on the effects of using the concepts presented in this paper must follow.

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