A Museum Mobile Game for Children Using QR-Codes

Ugo B. Ceipidor,
Carlo M. Medaglia, Amedeo Perrone
Mass Communication Department
Sapienza University of Rome
P.le Aldo Moro 5, 00198 – Rome
ugo.biader@uniroma1.it
carломaria.medaglia@uniroma1.it,
perrone@cattid.uniroma1.it

Maria De Marsico, Giorgia Di Romano
Computer Science Department
Sapienza University of Rome
Via Salaria 113, 00198, Rome
demarsico@di.uniroma1.it,
giorgiadiro@yahoo.it

ABSTRACT
We present a mobile game to play a museum treasure hunt, addressed to students that are about 11-14. They have to search for the “materializations” of the solutions to a sequence of riddles, and to photograph them by personal camera phones. The letters of a secret word are orderly provided on right answers, spurring the interest for the exhibition through the cellular phone. The novelty is the use of QR-Codes, a kind of 2D codes, to identify the correct answers and to enjoy some other services. A preliminary field test in the Norsk Tekemuseum gave very good results.

Categories and Subject Descriptors
H.5.2 [Information Interfaces and Presentation]: User Interfaces – input devices and strategies, user-centered design.

General Terms
Design, Human Factors.

Keywords
Educational games, mobile interaction, QR-Codes.

1. INTRODUCTION
Technology increasingly influences youngsters. Present cellular phones have joined such scenario. They are still hard to program and many compatibility problems come out; however, they are more accessible, usable and portable for users, and by now part of everyday life of many children too. This takes to more advanced forms of educational entertainment (edutainment). Edu-games exploit graphics and interaction both for gaming and for learning. Students can be further intrigued by using objects and equipments they are familiar with, yet in unanticipated ways. Our application follows the line of “augmenting” a visit to a museum with involving activities. We propose the joint use of 2D QR-Codes and mobile phones with a built-in camera.

2. THE BLÅTANNKODEN PROJECT
In 2D codes, information is stored along both horizontal and vertical dimensions (Figure 1). QR Codes by Denso Wave are an example (Figure 1). We exploit camera phones as “sensors” for 2D codes. Codes are attached to physical objects as a key for related information. Installing the application on a large number of phones requires a light computation, and a simple interface.

Figure 1. A bar code and an example of 2D code (QR Code).

The code can be read by the camera of a normal cellular phone. The QR code can contain an URL as well, so that the phone can connect to a web site. The goal of the project was to develop, in collaboration with IBM Human Centric Solution Center EMEA, a mobile application, namely Blåtannkoden, addressed to students of secondary school. It is important to consider that children in the age group we are working on are exiting from the self-centred attitude approaching to play in groups. They also become more interested in competition, in a way which is tightly bound to the need for acceptance and success. Educational games present challenges with schoolmates can be very engaging, especially if a concrete award is provided. The presented application mainly consists of a treasure hunt during a visit to the Norwegian museum of telecommunications, the Oslo Norsk Tekemuseum (http://www.telemuseum.no), where it is still working. Entering the museum the application is delivered by bluetooth to each student’s phone checking for compatibility. Field observations showed that using a personal object makes users feel more comfortable. On the other hand, this required a careful design process, to avoid a student to be left off the game because of the wrong phone model. Especially at this age, such experiences are very disturbing, due to the competitive attitude in relation with schoolmates. The game requires solving a number of riddles related to museum’s topics. Decoding the first QR Code, first riddle is visualized. The student who solves the riddle has to photograph the a QR Code labelling the solution, i.e. an object to be searched in the museum (Figure 2). An example of riddle might be: “Look for who invented the telephone”. In such case, on a bust or image of A. G. Bell there will be a code to photograph that will take to the answer to be visualized on the phone: “Alexander Graham Bell invented the phone in 1876”.

This will confirm the answer, and give more information or
curiosities about the topic, in this case the year of the invention. By photographing the right code, the student will also receive a secret letter, which will be stored, and the next riddle. Otherwise, the student gets an error message and can try again.

Figure 2. Example solution object.

At the end, stored letters will form the secret word, which represents the game solution. Students showing it at the museum exit receive a gadget. Students are also personally involved, as they can write comments about the game or about the trip. A server immediately displays comments on museum monitors in “tag-clouds” highlighting more frequent words through the graphical effect of font enlargement. This way children can enjoy looking at their comments on the screen, and teachers can grasp at a glance children’s mood about the experience. A second use of QR Codes is intended to merely engage students by amusing them. They can print their own codes with “secret” messages, which can be hanged on ad-hoc boards, where they can be “read” and decoded (Figure 3). This enforces a feeling of group membership, as the other visitors cannot “crack the code”.

Figure 3. Message board.

3. RELATED WORK AND DESIGN FOR WIDE AVAILABILITY

We mostly aimed at allowing to use one’s own camera phone. Many projects provide even more complex functions, but they usually require specific equipment. Some projects, e.g. [2][3], exploit PDAs, due to higher computational power, larger storing space, and higher screen size and resolution. A more comprehensive list of similar systems can be found in [4]. However, PDAs are not so popular among children in our target age group. Design effort can be optimized by considering homogeneous devices from the hosting organization, as in [1]. Such choice allows maximizing effectiveness and efficiency by fully exploiting known hardware and software characteristics. But we soon realized that it is very important for a child to interact with a familiar object. Some informal studies that we performed highlighted that using one’s own cellular phone might increase self-confidence and performance. On the other hand it is very difficult to design mobile applications for so much devices. Some systems [2] support location aware services, but the required equipment (GPS, IR, etc.) is not a standard in children phones.

We tested our application on a number of Nokia and Sony-Ericsson phones. Blåttannkoden was developed in J2ME, Java Micro Edition, which is one of the most used programming technologies for mobile devices, through standard and optional APIs. The project was developed for Connected Limited Device Configuration (CDLC) and Mobile Information Device Profile (MIDP) 2.0. QR decoding was a very challenging point, due to compatibility problems. We finally chose the French Jaxo decoder (http://www.jaxo-systems.com/home). The best way to manage QR Codes would be to store all information (riddle number, answer, secret letter, next riddle) inside them. However, this caused codes size to grow, making decoding to be dramatically slower. Double language would have also required different tags for each language, causing possible errors in taking the photo. We then decided to only keep an ID number for each riddle, working as an index in a subsidiary structure for each language. It is worth noticing that the number is not readable on the code: only decoding allows to check if it corresponds to the right answer. The best choice for subsidiary structures should have been a set of files on the phone, external to the application. Again, we faced a compatibility problem. Not all cellular phones have an actual file system. Some have a simplified storing system, which depends on the device and on how much memory it allows to allocate. On the other hand, phones having a file system do not always support full file access. Moreover, access permission must be obtained from the user for each single operation of unsigned applications. Given the above situation, the final solution was to set up a suitable bean inside the application, containing all the data. Changing the game content just requires changing the bean content.

Thinking aloud and observations with users allowed highlighting and solving some problems. For example, in a first version of the game the choice of language was possible only at the beginning. A player having problems with the foreign language had to restart, which is frustrating. The choice can now be changed without returning back. We will exploit solutions and gathered know-how to set up a new installation in Rome, at Fori Imperiali Museum.

4. ACKNOWLEDGMENTS

The study was supported by a grant by IBM Human Centric Solution Centre, Paris. Special thanks to Nicola Palmarini, Maurice Boudot and their team for the fruitful discussions.

5. REFERENCES


