Developing a Mobile Learning Game on the Android Platform

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ABSTRACT
This paper describes the current phase of a long term project to create a reusable, configurable mobile learning game. The game uses a location aware augmented reality scenario in which players, in teams of two, role play business consultants to a technology company that is facing problems. Early versions of the game were developed on the Java Micro Edition platform, but this is becoming increasingly obsolete as a mobile phone programming environment. A decision was therefore taken to continue development of the game on the Android platform. In this paper we describe the issues that we faced in making this transition. Our results so far indicate that there are some problems caused by the wide range of mobile devices that run various versions of the Android operating system. Not all Android devices are able to successfully run the game, and some features (such as location awareness) work more effectively on some devices than others. We hope that sharing our experiences will assist others who wish to either use our mobile game or develop their own.

Author Keywords
Mobile learning game, location awareness, augmented reality, Android, Java

INTRODUCTION

The increasing sophistication of mobile phones means that many students now have access to smart phones with touch screens, location awareness, video, internet access, large amounts of memory and powerful processors. This makes it possible for us to design mobile learning experiences, using students' own devices, which were simply not realistic in the past. Many previous mobile learning projects that involved the creation of location aware augmented reality games relied on the provision of expensive and unusual devices by the learning provider, making such exercises limited in their scalability and reusability. Now, we can deploy complex mobile learning tools to everyday devices. Of course this ubiquity of smart phones does not, unfortunately, remove issues around choosing software deployment environments. There are several possible smartphone platforms and there is no obvious platform of choice for every circumstance. However Android has a number of potential benefits in the context of developing a mobile learning application that is intended to be easily accessible. Deployment to the Android store is easier and cheaper than deployment to the Apple or Windows stores and Android devices come in a range of models at different prices, many of which are more affordable than devices running other operating systems. In addition, Android uses many standard Java interfaces, making it the platform of choice for migrating existing Java applications. We have previously developed a mobile learning game using Java Micro Edition on Nokia S60 devices, but this platform is increasingly obsolete. We have therefore migrated the game to run on Android devices.

RELATED WORK

There is an increasing amount of work in Android mobile learning projects. Sandberg, Maris & de Geus (2011) used devices running an early version of Android to implement a mobile learning game to teach English in the context of visiting a zoo. Although the application was relatively simple, the use of a touch screen was important to the application, as it included activities such as a jigsaw puzzle that relied on this feature. An Android application using GPS, web services, photographs and messaging, is Gymkhanas, a multimedia mobile learning game (Robles, Gonzales-Barahona & Fernandez-Gonzales, 2011). This has some similarities with our own game in that it involves the exploration of a physical environment, though it is not targeted to a specific teaching context. For this application, ease of deployment to the Android store appears to be an important motivation. Brown et al (2011) describe the design of a location-based serious mobile game for people with intellectual disabilities and additional sensory impairments. Reference is made to specific tools available on the Android platform such as the 'eyes free' project. de Urturi, Zorrilla & Zapirain (2011) also use Android devices to assist those who have learning challenges, this time for individuals with Autism Spectrum Disorder (ASD). Their serious game is based on first aid education. The paper states that either Android devices or iPhones could have been used, but some of the test devices used are small screen tablets, a form factor not currently available for iOS devices. Thus specific factors in favor of the Android platform identified by others include ease of deployment, choice of hardware and specific software tools.

CHANGES TO THE GAME FOR ANDROID

Migrating our own game from Java Micro Edition to Android had a major impact on the nature of the learner's interaction with the game. User control had to be migrated from keyboard control to a touch screen. This required a complete redesign of the user interface. Instead of keyboard controlled menus, interaction with the screen is based on tabbed panes selected on the screen. Figure 1 shows the main game screen, displaying the 'Map View', showing the location of the player and their next destination. In addition there are further tabs ('Interviews' and 'Documents') that contain gathered artefacts that the user can switch to at will.

Figure 1. The main game screen with map and locations.

Adapting to the Android programming style was a significant challenge. Using XML to define all the screen layouts rather than doing this programmatically required considerable refactoring of the software. The Android life cycle was also a significant issue, since the event driven interaction of Android devices is more complex than on Java ME devices. Determining what actions should go where in event life cycle methods was problematical. For example, one unexpected side effect of failing to handle these events correctly was that tilting the device would cause videos to restart. Supporting the widely different versions and resolutions of different Android devices e.g. phone and tablet, was also a challenge. Enabling Google Maps required a particular key for the maps API in combination with generating a key for the 'APK' file that is deployed to the device. Failure to configure these properly meant that the map did not appear on the device.

TECHNICAL EVALUATION ISSUES

We used four different devices for testing purposes; LG-P500 (Android 2.2.1, 3.2 inch screen), Samsung Galaxy Tab GT-P1000 (Android 2.2, 7 inch screen), Samsung Galaxy S2 (Android 2.3, 4.3 inch screen) and Samsung Nexus S (Android 4.0.1, 4 inch screen). Given the operating system versions that were supported by the various devices, no features were used that were not supported by Android 2.2. One of the immediate problems of using different devices was that this intensified the device focus of the learner, distracting them from the learning task. In our evaluation the testers tended keep comparing the screen displays of the devices, the difference in performance of the GPS and the relative speed of battery drain. However, these issues with the devices notwithstanding, the results of the test were encouraging. Participants played autonomously, and did not need to be followed around to be given technical support. The application proved technically reliable and robust and was a marked improvement over the previously tested version.

CONCLUSIONS

We have re-implemented a mobile learning augmented reality game from an original version written using Java Micro Edition to one written for the Android platform. Our initial evaluations of this version suggest that the technical platform is proving effective and reliable. However the fragmented nature of the Android market, with many different devices and versions of the operating system can prove a distraction for learners, and some devices perform much better than others.

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