Mobile Game Development: A Survey on the Tecnology and Platforms for Mobile Game Development

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Abstract
Games for mobile phones have many constraints. Most of these constraints are mainly because of its hardware, like the size of screen, processing power and buttons layout. Because of this, game designers and developers must address those constraints when developing for those platforms. On the other hand, mobile phones have some unique characteristics, when compared to PC hardware, which can be used to make unique game: like location based games, voice based games, camera based games, and touch based games. This paper tries to aid the mobile games designers and developers by presenting the current top of the edge characteristics of mobile phones that can be used for designing games. Also, when developing for mobile phones there are many different platforms that the developers must address, this paper presents a resume of the most popular game mobile development platforms and their characteristics.

Keywords: Mobile Phones, Mobile Games, Mobile Development Platforms

1. Introduction

Mobile game phones are a growing market [Koivisto 2006] and in 2010 the sales of smart phones is expected to suppress the laptops sales [Oliver 2008]. And more than 10 million of people worldwide play games on mobile phones and handheld devices [Soh and Tan]. Also the world-wide mobile gaming revenue is expected to reach $9.6 billion by 2011 [Gartner 2007]. These factors come as motivations for game developers and designers to create mobile blockbusters games.

Digital games are defined as real-time multimedia applications that have time constraints to run their tasks. If the game is not able to execute its processing under some time threshold, it will fail [Joselli et al. 2009]. Mobile games are also real-time multimedia application that runs on mobile phones that have time constraints and many others constraints [Chehimi et al. 2008], when compared to PC or console games, like: hardware
constraints, like processing power and screen size; user input, like buttons, voice, touch screen and accelerometers.

On the other hand, mobile games have some unique characteristics, that can be used to make some unique type of games, like: location based games [M1ndLab 2007, De Souza E Silva 2009], voice based games [Zyda et al. 2008], accelerometer based games [Chehimi and Coulton 2008, Gilbertson et al 2008], camera based games [Park and Jung 2009] and touch based games [Rohs 2007]. In order to make good mobile games, they must be design to take advantages of such unique characteristics into game play [Zyda et al 2007]. This paper tries to help mobile game designers and developers by presenting the current characteristics of the top of the edge mobile phones.

The evolution of mobile phones has increase the processing power of such devices and also new forms of input, like touch screen devices, devices equipped with accelerometers, voice recognition and devices equipped with camera. With the development of touch phones, like Motorola a1200, HTC Diamond, Sony Ericson w960i, Samsung Ultra Smart F520, Nokia N810, new forms of user interaction has appeared though the use of finger or pen. This innovation has led to changes on the way users iterate with the operation system and with games.

With the popularization of the use of accelerometer by the Wiimote, the major mobile phone manufactures has equipped their top handsets with accelerometer, like Nokia N95, Sony Ericson F305, Samsung Omnia and Motorola W7 to name a few. But this new form of user interaction has not led to major change on the user interaction. This is mostly because most programs/games only uses the accelerometer data as orientation. Also, Iphone was one of the first devices that is equipped with touch screen and accelerometer that has mostly of the user input made though touch or motion, soon others companies followed like: Rim blackberry Storm, Nokia 5800, LG Arena, and many others. They basically only uses touch for user interaction, the use of the accelerometer data is only for orientation, just like the others phones equipped with accelerometer. This paper tries to fulfill a gap on user interaction by presenting ways to take advantage of such features.

Also mobile games have another constraint; each mobile phone company normally has different operation systems and with that comes different developing platforms. This make difficult for the developer because one game source does not run on all platforms. The main platforms for mobile game developing are Apple Iphone SDK [Apple 2009],
Google Android [Google 2009], J2ME [Sun 2009], Microsoft Windows Mobile [Microsoft 2009] and Flash Lite [Adobe 2009]. In order to help developers this paper shows the differences between developing for such platforms.

The paper is organized as follows: Section 2 presents and shows the currents hardware characteristics available for mobile phones and how to use those characteristics in mobile games. Section 3 presents the current developing platforms for mobile phones and their main differences when developing for them. Sections 4 present and discuss the conclusions and final considerations of this work.

2. Mobile Hardware

Mobile phones have specific hardware, lots of them different from traditional game platform, video games and PCs. This difference comes from the fact that mobile phones are mainly designed for talking and the use of it for games is a plus, not a must. The main hardware characteristics discussed in this section are: processing power; screen resolution; user input; use of mobile phone features to allow multiplayer games; use of GPS or LBS for location games; and the use of mobile cameras in games.

When developing games for mobiles phone, one of the main problem was the processing power. The processing power of such devices was very limited so that games have to be designed to be simple. But nowadays, the smartphones have more processing power allowing the developer to create complex games, for example the Iphone has a 700MHz processor with 256 Mb RAM memory and even a dedicated graphics chip. With the development of mobile phones with graphics chips, mobile games can have 3D features with the use of mobile versions of OpenGL or DirectX [Cehimi et al 2008].

Another constraint when developing mobile games is the screen resolution; which normally can range from 96x96 to 640x480. Normally when developing a game the developer must address these differences on the size resolution when designing the game. One caveat when using different resolutions is that sometimes the developer needs to scaled or rotate images, and when using traditional images, the quality of the image can decrease considerably. The SVG (Scalable Vectorial Graphics) is a technology, which came solving this problem, since the image is a vector, the image can be transformed without lost in quality.
The user input in such devices can be another constraint, because the keys are mainly designed for number input. This makes very hard to design games that uses many buttons, such that a technical report from Nokia [Nokia 2006] recommends the design of games with only one button press at a time. But since the mobile phones have some others unique user input, like voice, accelerometer and touch, games must be designed to take advantage of such devices.

Nowadays smartphones have reliable speech recognition, which can be used for game input. This type of voice recognition is still a processing expensive task in a mobile phone. Another form of speech recognition in mobile phones is thought the use of speech server using voiceXML. The use of voice in mobile games, and in games in general, is not very explored. In [Zyda et al 2008] explores voice in mobile games using a voiceXML server. Zyda et al show the application of voice in different aspects of the game, for game command input, for chatting in a multiplayer game and for accessing exclusive content of a game.

Mobile phones equipped with accelerometer are getting popular since the release of the Wiimote game controller. The use of accelerated motion on such devices is still very restricted. In mobile operation systems the accelerometer is only used for screen orientation, which is a very limited use of the accelerometer. Future mobile operation systems will probably explore the operation system interaction with the use of motion or gesture, like the work [Delgado et al 2009] show the control of a multi screen system using the wiimote motion.

The use of accelerated motion on mobile games can be used to avoid the number pad input constraint. The accelerated motion can be used as orientation, like control an aircraft in a simulator game or a car in a race game, or gestures, to do like swords fights and bowling games. The use of motion as orientation is easy to be implemented in a mobile game by the developers but the use of gestures is more difficult. Most mobile games seem to use brute force when doing gesture recognition in a game. This limits the precision of such recognition and libraries for gesture recognition for accelerated devices are needed. The works [Scholomer et al. 2008, Popping 2009] shows open source gesture recognition for the wiimote. There is still no work, that have been researched by the authors of this work, that has implemented such gesture recognition library in a mobile phone, but the subject seems to be in research [Choi et al 2005, Prekopcsak 2008].
Mobile phone touch screen devices are also getting pretty common. Most of devices that have such features have very few buttons, having practically all user input to be made by touch. Mobile touch screen games must also be designed to have most of the user input made by touch. The touch in games can be used similar to mouse cliques, allowing developers to make different types of mobile games as the developed for button input. Also the screen can draw buttons and used it to simulate button input. Another type of input is though touch gesture, which [Wei et al 2008] shows the use of this kind of user interaction in a First Person Shooter mobile game.

Nowadays most mobile phones can access the internet, though APNs or Wi-Fi, and can connect though each other with Bluetooth. This makes mobile games featured for multiplayer capability. Games can use the Bluetooth capability to connect to nearby phones and allow local multiplayer games. Also mobile games can use the connection to the internet in order to make (massive) multiplayer game.

Mobile phones have the unique characteristic, when compared to PC and game consoles, that it can be used for location though the use of LBS (location based service) or GPS (global positioning system). The games that uses this unique feature allows players to know and use the others player position in the game. These types of game are commonly called LBMG (location-based mobile game).

Another feature that most phones come with is a camera. Camera can be used in mobile games to detect movement of the phone, by comparing the images taken by the camera, and with that information as user input to the game. [Tran and Huang 2007] shows the implementation of an API for the use of camera motion as the input for 2D or 3D games. But it seems that the computation of this movements is very computation intensive, an FPS with the movement calculation runs at 2 frames per second in the study of [Tran and Huang 2007], and the mobile phones equipped with accelerometer can use the motion to do the similar game experience.

3. Mobile Development Platforms

Besides hardware difference, mobile phones also have many different operation systems. A lot of companies have proprietary systems like: Iphone has IphoneOS; Rim Blackberry has the Blackberry OS; and others like Sony Ericson, Samsung and LG. Also there are some operation systems that are used by different manufactures like Android, Windows
Mobile and Symbian. With these different operation systems come different platforms for mobile game development. The main platforms for mobile game developing, which are presented by this work, are Apple Iphone SDK [Apple 2009], Google Android [Google 2009], J2ME [Sun 2009], Microsoft Windows Mobile [Microsoft 2009] and Flash Lite [Adobe 2009].

The Iphone SDK is a development platform for the Iphones and for the Ipod touch. For game development it uses smart C language, it has a 3D API based on OpenGL ES and it has access for all the hardware resource presented in the last section. The IDE used is Xcode that can be used for testing, on device debugging and deployment of applications. One of the main advantages of developing for this platform is that there are some commercial game engines that can be used for development, like Torque [Garage Games 2009] and Unity3D [Unity 2009]. The SDK download is only available for Mac and it requires buying a license in order to publish the application. It has its own market where the developer can sell and distribute their application.

Android is developed by Open Handset Alliance which is leaded by Google. It is an open source operation system based on Linux Kernel 2.6 and license as GPL, which is used by HTC, T-1, Motorola and Samsung. For development it uses Java programming language using a custom API SDK, which uses many of the standard Java classes as well as adding a large number in its own android package. For development platform it provides an Eclipse IDE plug-in, which the user can use to build and debug its application/games, but it also provide the tools to integrate the SDK in any other IDE. The SDK download is available for Windows, Linux and Mac and is without any costs and registration. Also the developed games can be sold/distributed the Android Market. From the SDK the developer can access all the hardware a mobile game may need. For graphics the SDK provides a 2D library and a 3D graphics library based on OpenGL ES 1.0.

Java micro edition is the most popular platform of mobile game development. The main reason of this, is because it is accepted in most mobile operation systems (the exception are Iphone, Android and Windows Mobile), making it acceptable in most of mobile phones. Since J2ME consist of specifications, each manufactory implements J2ME API in their own way. So normally, when developing a J2ME mobile game, the code must be adapted for different phone models and manufactures. There a lot of IDE available for J2ME development like Eclipse and Netbeans. The SDK is available from Sun but in order to take advantage of special APIs and debug each manufacturer releases a version of
their own SDK. From the SDK normally the developer can access all the hardware a mobile game may need. Since the J2ME are implemented by the manufactures, each one implements the security differently, and sometimes there are some resources that need special requirements, like signing the code, which can cost some hundred dollars for each model. There are 2D library and M3G library for developing 3D applications. There are some market places for mobile J2ME applications, but none of them are as popular as the ones from Apple and Google.

Windows mobile is a closed source operation system developed by Microsoft. It uses C#, C++ or Visual Basic as languages of development. It is used by many manufactures like HTC, Samsung, Motorola and Sony Ericson. For IDE it uses a paid development platform which is the Microsoft Visual Studio 2005 or 2008. The SDK is only available for Windows without any costs and registration. It does not have a market place where the developer can distribute their application, but Microsoft claims that it will be released in latter 2009. From the SDK the developer can access all the hardware a mobile game may need. For graphics SDK it uses a mobile version of DirectX for both 2D and 3D graphics.

Symbian is an open source operating system developed by Symbian Foundation. It is used mainly by Nokia, but also Motorola and Sony Ericson has some mobile phones in such platform. It uses C\C++ for coding with its own sets of libraries. For IDE the developer can use Eclipse. The SDK is without costs but for device testing and distribution the application must be signed, which is very cheap. Nokia just released a market place where developers can distribute their games and applications. From the SDK, the developer can access all hardware resources it may need for a game. For graphics it has its own set of libraries and OpenGL for 3D.

Flash Lite is developed by Adobe and is a simpler version of Flash. The Flash Lite application runs on a player which is available for Symbian, Windows Mobile and many others. The coding is all done in ActionScript 2.0 and the IDE is the Adobe Flash CS4. From the Flash Lite the developer can only access the user input and network. With flash the developer can only make 2D games.

There is also Qualcomm BREW, Palm and other development platform, but the market share of this devices is not very big compared to the others platforms, hence this work has not focused on those platforms.
4. Conclusion

The mobile gaming market is a growing market, motivating game developers to have more focus on mobile development. Also mobile phones now have much more processing power allowing mobile games to have more complexity.

Mobile phones have specialized hardware, so that game developers and designer to address those. This work helped those developers by presenting the common and unique characteristics of mobile phones and how they have been used in game development. Also there are many different platforms when developing for mobile phone devices. This work presented the basic information about the most important platforms for mobile game development.

Bibliography


