An Exploration of Distributed Mobile Audio and Games

Karen Collins
Canadian Centre of Arts and Technology, University of Waterloo
Waterloo, Canada.
collinsk@uwaterloo.ca

Bill Kapralos, Andrew Hogue
Faculty of Business and IT
University of Ontario Institute of Technology, Oshawa, Canada.
{bill.kapralos, andrew.hogue}@uoit.ca

Kamen Kanev
Research Institute of Electronics
Shizuoka University
Hamamatsu, Japan
kanev@rie.shizuoka.ac.jp

ABSTRACT

In this paper, we present work in progress on distributed mobile audio games. We outline some of our areas of exploration along with how these types of games may be particularly useful in educational environments that require training in, for example, mixing, spatial sound and orchestration.

Categories and Subject Descriptors

K.8.0 [**Computing Milieux**]: Computing Milieux-Personal Computing-General-Games.

Keywords

Games, mobile, audio, distributed games, smart table.

1. INTRODUCTION

Mobile devices are becoming an increasingly important part of the information technology ecosystem as the power of these devices increase and network bandwidth improves. The unique characteristics of these devices have a significant impact on the development of applications for them, and since these devices are relatively new, the design space is largely unexplored. The main properties of mobile devices that differentiate them from other computing devices are the fact that they are always on, carried on the individual most of the time, and they have the ability to be connected to some type of network. This allows for connectivity between various devices using WiFi (when available) or Bluetooth. Furthermore, various devices including the Apple iPhone, employ assisted GPS technologies providing the ability to localize the device physically within a 10-20m accuracy, opening up a huge possibility for interesting applications.

An underexplored area of gaming is the idea of networking mobile devices (particularly smart phones) together for distributed gaming applications. Here we present the possibility of combining mobile devices together, and with collaborative displays in audio-based games. We suggest that in addition to being fun, audio-based games may be useful in training students of sound and music in particular aspects of their craft and that smart phones lend themselves well to distributed gaming applications. Traditionally, audio games include audio-only computer games (that is, where there are no visuals) and audio-based games (where visuals are included but not the focus). The idea of audio-based games dates back to at least *Real Sound–Kazeno Regret,* a commercial audio adventure game designed specifically for visually impaired children and released for the Sega Dreamcast and Saturn by Sega in 1999. Essentially, *Real Sound- Kaze no Regret* was an interactive radio drama, similar to a "choose-your-own-adventure" style audio-book. Several audio-based or audio-only games have now been adapted from popular existing games. For a more complete survey, see [4].

Augmented mobile audio-based games represent a new technological trend that enriches the real acoustic environment with synthesized sound produced by virtual sound objects [8]. These games have primarily tapped into ideas of utilizing spatialized sound on mobile devices, rather than using the potential for networking these devices together in a larger pervasive gaming space, limiting their potential use and application. There are several reasons for this, most notably due to the some current issues or problems with networking mobile devices and with their audio capabilities.

2. ISSUES WITH MOBILE DEVICES

Despite the opportunities presented by mobile devices, there are still many issues that must be addressed for these types of games to become more popular, particularly when with respect to sound generation and sound output for gaming applications. Gaming sound requirements are computationally demanding, thus difficult to sustain in terms of the limited speed and memory bandwidth inherent in mobile devices [1]. This is further complicated when spatial sound is required. In this case, the amount of information that needs to be computed and transferred is difficult to manage on the limited storage and computing ability of a small hand-held device.

Battery life is another significant issue, as audio is used in combination with demanding high-band width processing (3D graphics, video); keeping a high-priority for audio is mandatory to avoid dropouts [1]. Furthermore, mobile devices typically employ just one loudspeaker (which is of poor quality), preventing the effective output of spatial sound unless headphones are employed. Headphones themselves have their share of problems, including the fact that they may not always be practical to wear and they commonly have to be tethered to the device itself (wireless, Bluetooth-based headphones are available but these have issues of their own including limited battery life).

3. EXAMPLE GAMING APPLICATIONS

There are many areas of mobile audio networked games that we wish to explore. Here we present two novel games that we are currently developing.

3.1 Mobile Audio Positioning Game with Marker-Based Interactions

In this game, players are assigned a particular sound to their mobile device and given a corresponding positional marker to wear on a hat on their head. In a room configured with cameras, the position of the players is tracked using the ARToolKit, a computer vision-based augmented reality library that can be used to recognize specific real-world objects [3]. A large screen on one

ACM FuturePlay 2010, May 6-7, 2010, Vancouver, Canada.

wall presents the results of the positioning in a 3D representation. Players must then create a soundscape to match the landscape by positioning themselves in the room according to a series of directions. Players may be required to continuously move about the room to match the positioning of a moving item in the landscape (e.g., a train or loud animal). Players score points for quickly finding the correct position of their sound-making object in the landscape.

This game can be played with visuals on or off, and so can be used as an audio-only game in which players must first listen to the spatialized soundscape played back over surround speakers, and then try to recreate that soundscape in the physical space by correctly positioning their sounds in the 'mix'. The game can be used to teach students about soundscapes and auditory effects as well as spatial audio positioning, Doppler effects, and so on. A similar game can also be designed to teach students about the virtual 'sound box' in music, 'a concept that acknowledges the way sound sources are perceived to exist in four dimensions: laterality, register, prominence, and temporal continuity' [7]. Each student for instance could be assigned an instrument and must then re-create the song in real three-dimensional space according to their perceptions of the instrumentation spatialization.

3.2 Mobile/Augmented Table Music Game

A second series of games address the idea of connecting mobile phones to augmented-reality smart table games. This concept of using small, private individualized devices with larger, collective screens has become a recent area of interest in pervasive gaming [2,9], and using mobile devices in particular is becoming an important area of inquiry [2]. Sahami *et al*. [9], have recently designed games that explore using mobile phones through a combination of smart table and gestural mobile interaction (tilting, throwing, and shaking the phone). One can easily imagine this gestural interaction incorporated into a musical jam session in which one person controls a kind of sequencer at the tabletop and sends sounds or sequences out to individuals who then 'play' those sounds/instruments. Turning this into a game may involve, for instance, a *Rock Band* style musical game in which the timing of the individual performance is tied to a larger group performance. Again, this type of game may be particularly useful for educational purposes, in teaching orchestration, musical composition, and other music-based topics.

4. CONCLUDING REMARKS

Our games are in conceptual stage at the moment. In the next few months we will be building early prototypes. There are several noted problems with the technology at the moment, but it is our hope that raising interest in these possible uses of mobile devices may encourage mobile developers to incorporate better networking capabilities between phones, as well as high fidelity and louder speakers in phones. We welcome all suggestions at this stage. Solving problems of networking audio on mobile phones can provide some interesting applications in non-gaming scenarios. We present below two scenarios that we envisage could be useful applications:

Imagine walking into a business meeting with your new video projector-phone, ready to excite customers with a powerful movie presentation, complete with surround sound. However, you arrive to find that there are no loudspeakers available and your laptop loud speakers are of very poor quality (typical in most laptops currently available), and even in their loudest setting, cannot be heard by those in the audience sitting in the back of the room. Now imagine could the ability to network your presentation to everyone in the room with a phone, projecting your audio to their phones, so that everyone's phone becomes a speaker: Instant surround sound.[1] While it may not be configured as well as a fixed surround application, the general effect will be good enough for the purpose at hand. Taking that same idea, imagine being in a concert venue where the band projects its music to everyone in the venue, or selects sections and projects certain instruments to segments of a larger venue, perhaps changing the configuration of projected audio during a performance. The audience could even become an interactive part of the experience, by actively selecting which instrument they wish to have projected from their phone.

4. ACKNOWLEDGMENTS

Financial support of the Social Sciences and Humanities Research Council of Canada (SSHRC), Natural Sciences and Engineering Research Council of Canada (NSERC), and funding for research collaboration by Shizuoka University is gratefully acknowledged.

5. REFERENCES

[1] P. S. Bossart. A survey of mobile audio architecture issues.*AES 29th Int. Conf.,* Seoul, South Korea, Sep.2-4, 2006.

[2] F. Chehimi, and P. Coulton. Motion controlled mobile 3D Multiplayer gaming, *ACM ACE 08*, pp. 267-270, Yokohama, Japan, Dec. 3-5, 2008.

[3] F. Echtler, and G. Klinker. Tracking mobile phones on interactive tabletops**.** *MEIS'08*, Munich, Germany, Sep. 11, 2008.

[4] F. Hamidi, M. Kaftarian, D. Natapov, B. Kapralos, and K. Collins. "A Survey of Audio-Based Digital Media for the Visually Impaired: What we can learn from audio-based interactions" (under review).

[5] H. Kato and M. Billinghurst. Marker tracking and HMD calibration for a video-based augmented reality conferencing system. *IEEE and ACM IWAR 99*, pp. 85–94, San Francisco, CA,USA, Oct. 20-21 1999.

[6] A. Krohn, T. Zimmer, M. Beigl. Enhancing Tabletop Games with Relative Positioning Technology. Advances in Pervasive Computing. Oesterreichische Computer Gesellschaft, 2004.

[7] A. F. Moore, and R. Dockwray. The establishment of the virtual performance space in rock. *Twentieth-Century Music*, 5(2):219–241, 2010.

[8] M. Nikolaos, F. Andreas, and K. Nikolaos. An interactive augmented reality audio-game prototype. *127th AES Convention*, NY. USA, Oct. 9-12, 2009.

[9] A. S. Shirazi, T. Döring, P. Parvahan, B. Ahrens, and A. Schmidt. Poker surface: Combining a multi-touch table and mobile phones in interactive card games. *MobileHCI '09*, Bonn, Germany, Sep. 15 - 18, 2009.

[1] This idea arose from work done with Karen Collins at Project Bar-B-Q 2009 but doesn't appear in the report: 'Hear, There and Everywhere' http://www.projectbarbq.com/bbq09/bbq09r3.htm