CAICT COMMUNICATIONS 2009/7

Songs+Spaces: A Space Indexed Song Selector, Mapper, and Visualizer

Ravi Vatrapu & Sam Joseph[1]

24 November 2009

ISBN 978-87-92524-06-5

[1] Laboratory for Interactive Learning Technologies

Department of Information and Computer Sciences

University of Hawaii at Manoa

1680 East-West RD

Honolulu, HI, 96822 USA

Copenhagen Business School
HANDELSHØJSKOLEN

Center for Applied ICT (CAICT)
Copenhagen Business School - Howitzvej 60 - 2000 Frederiksberg
URL http://www.cbs.dk/caict

Abstract

The Songs+Spaces system supports dynamic song selection and visualization based on the digital artifacts associated with a particular location. Songs+Spaces allows the user to select between different channels that filter out sets of digital artifacts associated with their current location. The Songs+Spaces system chooses songs based on user (self or other) preferences, geo-coded photos, videos, text annotations, and graphics associated with a particular place and uses them to provide visual accompaniment on the screen of a personal media player or heads up display. This application makes use of GPS or other location based services, and will run on any device that has access to such services

ACM Classification Keywords

H.5.1 Multimedia Information Systems: *Artificial, augmented, and virtual realities.*

Introduction

As Turner (2006) articulates "*'Neogeography' … consists of a set of techniques and tools that fall outside the realm of traditional GIS, Geographic Information Systems. Where historically a professional cartographer might use ArcGIS, talk of Mercator versus Mollweide projections, and resolve land area disputes, a neogeographer uses a mapping API like Google Maps, talks about GPX versus KML, and geotags his photos to make a map of his summer vacation. Essentially, Neogeography is about people using and creating their own maps, on their own terms and by combining elements of an existing toolset. Neogeography is about sharing location information with friends and visitors, helping shape context, and conveying understanding through knowledge of place (p.2)*." The proliferation of GIS into the social realm through web oriented mapping applications such as MapQuest, Yahoo Maps, and Google Maps has created a new class of geospatial applications. Our objective is to design and develop mobile applications utilizing ubiquitous high speed Internet for the neogeographic purpose of creating new sorts of social experiences in real-world environments.

This project focuses on digital music selection, mapping, and visualization. The Songs+Spaces system automatically selects a song from a user's personal music collection based on its associations with the current location of the user and provides visualization during playback based on other digital content associated with the current location. For example, in a particular place, the Songs+Spaces system will automatically display geo-tagged and geo-coded songs along with other geo-coded/geo-tagged content. The user can operate in a shuffle mode where songs are played automatically, or can enter a manual mode where the available songs are presented in a list. Independently of how the song is selected the Songs+Spaces system will not only play the track but also visualize the geo-coded/geo-tagged annotations, images, videos, etc. if an output screen is available. Listening to songs in a particular location also creates annotations that can subsequently influence what other users are likely to experience in the same location. Users will also have the ability to actively create "Song Trails". In the next section, we discuss related work.

Related Work

Previous work has investigated the organization and visualization of music playlists (Torrens, Hertzog, & Arcos, 2004) and music archives (Pampalk, 2003; Pampalk, Rauber, & Merkl, 2002). For example, the "*Islands of Music" system (Pampalk et al., 2002)* provides music library exploration without explicit manual genre classification. Other work has investigated designing user interfaces for personal media collections (van Gulik, Vignoli, & van de Wetering). Prior work has also looked into geo-referenced 3D video as a cultural heritage visualization tool (Sechidis, Tsioukas, & Patias, 2001).

Location 33 (Carter & Liu, 2005) distributes a music album over time and space in downtown Los Angeles, USA. Users of the Location 33 system listen to the temporally and spatially distributed music album by walking around down town Los Angeles. Users pick up fragments of the Album at different locations. The integration of the fragments results in the music album. Figure 1 below presents "Path as a Song".

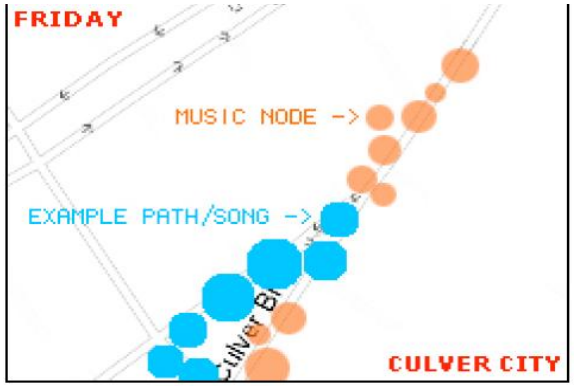

Figure 1: Location 33's "Path as a Song", taken from (Carter & Liu, 2005, p.2).

Figure 2, below, presents the song authoring map.

Figure 2: Location 33's Song Authoring Map, taken from (Carter & Liu, 2005, p.5).

Figure 3 below presents the system architecture for Location 33.

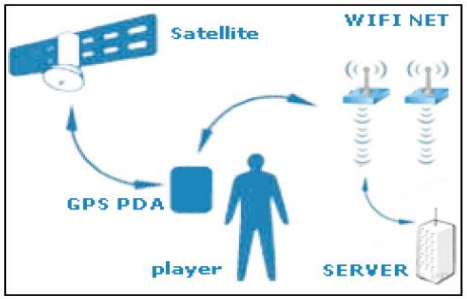

Figure 3:Location 33's "GPS/PDA Data Flow", taken from (Carter & Liu, 2005, p.6).

PathMusic[1] is a locative audio solution that allows users to leave behind trails of their music and heartbeat to be experienced by others. Figure 5 presents a screenshot from the PDA implementation of PathMusic.

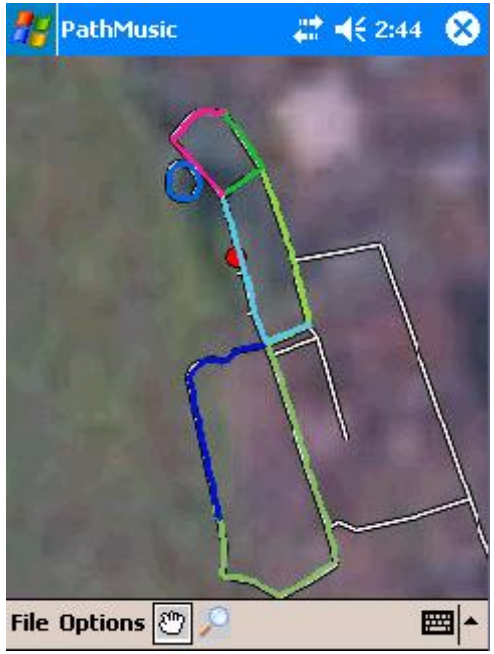

Figure 5: PathMusic represents the user's location with a red dot and various trails with color lines, taken from http://www.viktoria.se/~lalya/track/

[1] http://www.viktoria.se/~lalya/track/

The Here&There project[2] (Rozier, Karahalios, & Donath, 2000) allows users to associate sounds with locations to create "SoundSpots". Figure 4 presents a screenshot of the augmented environment.

Figure 4: GUI of Here&There (Rozier et al., 2000, p.3)

The 34N118W[3] project designed and implemented a system that provided a in-situ historical audio narrative about an area in Los Angeles, USA.

Music visualization i[4]tself is a feature found in many media players that generates animated imagery based on a piece of recorded music. The imagery is often generated and rendered in real time and can be synchronized with the music as it is being played.

[2] http://smg.media.mit.edu/projects/HearAndThere/
[3] http://www.34n118w.net/
[4] http://en.wikipedia.org/wiki/Music_visualization

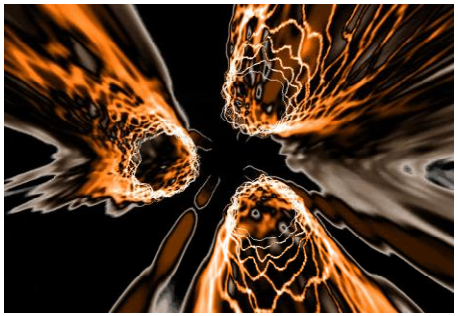

Figure 5: G-Force Platinum Visual from SoundSpectrum

Visualization techniques range from simple ones such as a simulation of an oscilloscope display to more elaborate ones, which may for example include a plurality of composited effects. Changes in the music's loudness and frequency spectrum are among the properties used as input to the visualization.

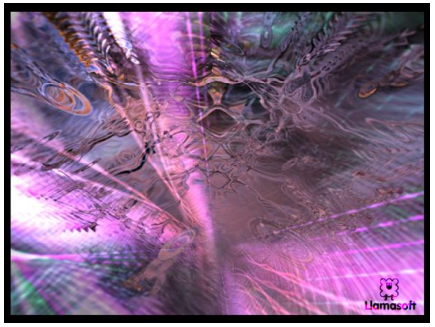

Figure 6: Xbox 360 bundled Neon from Llamasoft

Description of the Songs+Spaces System

The key idea is that any geographical location can be thought of as a point in a volume of space containing user generated digital content such as geo-coded and/or geo-tagged photos, audio clips, video recordings, text annotations, virtual objects etc. The Songs+Spaces system implements an algorithm that selects both the song and the associated visualizations by probabilistically determining both based on user preferences, social network recommendations and geographical location information.

The Songs+Spaces system assumes the existence of the following three key infrastructure functionalities:

1. Location based lookup – the ability to request a set of artifacts associated with a particular location, and/or those artifacts within a certain distance of that location.

2. Location encoding – the ability to assign (potentially multple) location co-ordinates and field strength to an artifact.

3. Associative network – any artifact can be associated (in terms of a particular predicate such as "related" or "friend of") with any other artifact, allowing lookup of sets of associations for each artifact.

Given these three basic operations, and the presence of a set of location-coded inter-associated artifacts and a set of artifacts that include users who are organized in a friendship network, the Songs+Spaces system provides the following features:

Dynamic song selection as a function of:

- Digital artifacts associated with user location
- User preferences (channel selection)

- Recommendations through friendship network

The possible types of digital artifacts are described below, but they influence song selection to the extent that they are associated with particular music tracks. For example a photo that has been tagged with a particular location might have been associated with a piece of music, increasing the chance that it will be automatically played or offered for selection when the user is in that location. User preferences include the ability to switch between manual and automated song selection, and to specify whether selection should be a function of friend network, and how deeply the network influence should be considered. For example the user might specify selection of songs to be only a function of non-user artifacts, or to be a function of friends preferences, or allow friends of friends, and friends to influence song selection. These different settings can be thought of as channels, but since any artifact can be associated with any artifact, it is possible to create channels by associating a "Channel Artifact" with some subset of other artifacts and then to derive song selection from only those things that are "in" that channel.

Digital artifacts include, but are not limited to:

- Photos
- Videos
- Text annotations
- Graphics
- Music
- User traces

The locations or geo-codes assigned to digital artifacts can be provided by content creators/distributors or by users themselves. For example, photos taken in a certain location can be coded with those location co-ordinates, as can those taken in other locations that are perceived to be related in some fashion. The same goes for other types of recorded media. User traces are a particular type of coded artifact in that they indicate that a user was experiencing an artifact at that location at some point in the past. Users have the option to automatically leave behind a music trail based on their experience that can then be factored into song selection for themselves and others as they cover the same ground in future.

The Visualization function makes use of:

- Song currently being played
- Digital artifacts associated with location
- User preferences

The visualizations are essentially random based on music beat and tempo, but also composed to some extent from the visual forms of the artifacts associated with the current location. User preferences include the ability to switch visualization "channel", i.e. restrict the set of artifacts that are input to the visualizer.

Discussion

Currently, we are unaware of any system that exists with the twin capabilities of geographic location based song selection and the associated community-

generated content visualization. Currently, users have to explicitly organize a play list or let the software choose a random play list. There are a few existing systems that associate music with geographic data and playback as a function of user location, but they do not influence the existing music playlists of users and do not provide music visualizations. A

References

Carter, W., & Liu, L. S. (2005). Location33: Envisioning Post iPodalyptic Mobile Music. *Mobile Music Technology: Second International Workshop, Vancouver, Canada*.

Pampalk, E. (2003). Islands of Music: Analysis, Organization, and Visualization of Music Archives. *Journal of the Austrian Soc. for Artificial Intelligence, 22*(4), 20-23.

Pampalk, E., Rauber, A., & Merkl, D. (2002). *Content-based organization and visualization of music archives*: ACM Press New York, NY, USA.

Rozier, J., Karahalios, K., & Donath, J. (2000). Hear&There: An Augmented Reality System of Linked Audio'Online Proceedings of the International Conference on Auditory Display. *Available at http://www.icad. org/websiteV2.0/Conferences*.

Sechidis, L., Tsioukas, V., & Patias, P. (2001). Geo-referenced 3D Video as visualization and measurement tool for Cultural Heritage. *International Archives of CIPA, 18*, 0256-1840.

Torrens, M., Hertzog, P., & Arcos, J. L. (2004). Visualizing and exploring personal music libraries. *Proc. ISMIR*, 421–424.

Turner, A. (2006). *Introduction to Neogeography*: O'Reilly.

van Gulik, R., Vignoli, F., & van de Wetering, H. Mapping music in the palm of your hand, explore and discover your collection. *ISMIR 2004 5th International Conference on Music Information Retrieval. Available online, 302*.

Appendix A: System Architecture