Social Mobile Music Navigation Using The Compass

Atau Tanaka
Sony Computer Science Laboratory Paris
6 rue Amyot
F-75005 Paris, France
+33-1-4408-0512
tanaka@csl.sony.fr

Guillaume Valadon
LIP6
Univ of Paris 6
104 avenue du Président Kennedy
75016 Paris, France
guillaume.valadon@lip6.fr

Christophe Berger
LIP6
Univ of Paris 6
104 avenue du Président Kennedy
75016 Paris, France
christophe.berger@lip6.fr

ABSTRACT

During a regular day while on the move, most people interact with multiple portable devices: a personal music player, mobile phone, and digital camera. People driving cars in addition may also use navigation systems. Whereas each of these devices are getting more and more sophisticated, and packed with numerous functionalities, they are each optimized for specific usages. Modern mobile phones for example, claim to function as digital cameras and music players, but these are features that are more often than not added on almost as an afterthought, and are not integrated with the connectivity that the mobile phone represents.

From an engineering point of view, the goal of this project is to push mass-market mobile phones to their limits in networked musical exchange by implementing The Compass. Specifically, we are targeting phones embedded with WiFi, music player and location[1] capabilities. The idea was to build a true convergence application that integrated localization, mobile networking, and music listening.

1. INTRODUCTION

Various network-based services available in mobile environments have enhanced the realm of possible spontaneous human interactions. The mobile phone is used not just for voice communications, but text messaging, taking pictures, and listening to music. The Global Positioning System (GPS) allows geographic localization not just of the user, but geo-tagging of content that may be generated while on the move. While music can be considered one of the first mobile media, with the arrival of the personal music player in the 1970's, today it lags in exploiting these mobile network services to enhance listener and multi-listener experiences. While miniaturization of storage technologies have allowed the user to carry more hours of music in his shirt pocket, there is little live interaction with musical content that is available to the mobile music lover. In stationary environments, online communities and social software encourage discussion and discovery of new music. Peer-to-peer systems allow decentralized music sharing. These new modes of accessing music have not, to date, been transposed to mobile environments. This paper introduces The Compass as a metaphor, graphic user interface element, and most importantly unifying technical basis for implementing navigable location-aware multi-user music sharing.

4th International Mobile Music Workshop, May 6–8, 2007, Amsterdam, The Netherlands.

[1] Such as phone-GPS, and Bluetooth-GPS.

2. RELATED WORK

The current project follows along the lines of prior work using portable devices and wireless networks for music exchange, including TunA [1], and Push!Music [2]. Since these research projects, some commercial devices, notably the Microsoft Zune [3] have been introduced on the market allowing basic forms of wireless music sharing. All these systems assume that the users entering into interaction are in proximity to be in WiFi or Bluetooth signal range.

Network based services are beginning to be launched, for example SonyNetservices' StreamMan [4] allowing over-the-air downloading of music content. These systems tend to be single user, and any notion of music discovery is based on matching of personal profiles against meta-data tags of the server-side content database. Moreover these systems rely solely on GSM, GPRS, and 3G networks, which for the user are billed by the data volume downloaded. This plus the cost of subscription or cost of content creates a financial barrier which is one reason such systems have not attained commercial success.

Geographic localization services have found use in artists' projects in the field of locative media. They have been used in Human Computer Interaction (HCI) research to explore human interaction. The Familiar Stranger project **Error! Reference source not found.** has resulted in the Jabberwocky **Error! Reference source not found.** software that is downloadable to mobile phones. GPS connected to server-side audio content generation and streaming have been explored in Net_Dérive [7].

Social networks have been at once a field of research and with social software, an area of commercial applications. In the mobile sphere, platforms such as Dodgeball [8] and Socialight [9] have allowed spontaneous social congregation and shared tagging of physical space. Little has been done to extend these possibilities to embrace music.

The present project seeks to fuse these disparate elements of proximal interaction, geographic localization, and social navigation to allow groups of users to intuitively find friends, network connectivity, or new music. The notion of the compass is introduced as a metaphor for navigation across these three domains of community, infrastructure, and content.

3. SCENARIOS

3.1 Current Usage Patterns

Despite the lack of clear present day solutions to facilitate gathering and subsequent music exchange, normal users have found ways to share their musical experiences with friends while on the move.

The classic case is that of "earbud sharing" where the main listener removes one side of their personal music player headphones to have a friend listen along. Ironically, early Walkman models featured two headphone jacks with a volume-ducking feature to allow listeners to attenuate the music and talk to each other. In any case, any actual sharing of music is postponed to a non-mobile moment when the users are back in front of their landline based computers."

New music sharing tendencies have emerged recently with the arrival of mobile phones with high storage capacities. Today, these MP3 enabled devices are quite cheap and are well distributed on the mass market. For example, it is quite common to see high schools students exchanging music using small range technologies such as Bluetooth, or Infrared. While somehow marginal, this usage is really interesting to analyze as users are pushing devices' limitations to fit their needs. Moreover, with the high uptake of peer-to-peer systems, such as edonkey or bittorent, it is quite important to distinguish how people are exchanging music through spheres of friends and acquaintances or through anonymous end-to-end systems.

Most scenarios of socialization through mobile technologies are multi-step processes. Mobile phones have changed social patterns for making fixed appointments. These have entered a taxonomy of techno-social interactions that include terms such as "mobile text meet" and "augmented flesh meet" [10]. While these scenarios represent new forms of social interaction, they are far from seamless. They typically are mediated by Short Message Service (SMS) text messages, often in multiple iterations. Finding out where a friend is, what music they are listening to, and to meet them, or find where they got their music, would be a task that would take more time typing text messages than actually traveling or listening.

3.2 New Scenario

The project described here begins with navigation as an integral first step in its scenario. The different steps in the scenario include:

1. Navigation using initial infrastructure
2. Rapprochement to desired resource
3. Bootstrapping proximal infrastructure
4. Refining content search criteria
5. Content exchange

The elements encountered along the scenario are deliberately described as abstract entities to allow different modes of navigation and search. They are explained in detail below.

Applied to real-world usage, such a scenario would unfold as follows. A user seeks out new music to listen to. The compass indicates that some friends are nearby. He selects one to approach, and the compass indicates the direction and distance. The user walks following the compass indications. When within range, the system proposes to the two users to bootstrap a proximal network. Once this spontaneous private network is established, the two users compare playlists based on various musical criteria. A song of interest to the first user is then copied.

4. CONCEPTUAL MODEL

The compass is the main element in the conceptual model of the system. It serves as a metaphor for the user's understanding of the system. It is also the representation by which different entities in the system are organized. Finally, it is the direct visualization of GPS data that guide entities to converge.

4.1 Compass

The use of the compass at different levels of the conceptual model allows for a consistency of usage. High level graphic interface elements are coherent with and directly related to low level information, but nonetheless protect the user from technical details.

The compass has the advantage of being an intuitive navigation interface for the user as it just points the direction to go. At the same time, it leaves the user a freedom of choice of whether to follow the compass' indications or not. GPS-based car navigations systems are famous for their futility in insisting on the right route with increasing firmness as the user strays. The compass on the other hand, is as accurate, but allows the user to wander, and can even invite the user to a playful misappropriation of the technology, in the spirit of Baudelaire's *flâneur* or the Situationists' *derive*.

4.2 Entities

The compass is able to guide the user to one of three types of entities. These are, 1) networks 2) people 3) music. Networks may be public WiFi hotspots. People may be those in the personal social network of the user – friends, and friend-of-friends. Music may be audio content that is stored on people devices, or locations of concerts. The fact that entities are abstracted and that the compass is able to indicate the proximity of any of these three types of entities points out the flexibility of the system to different modes of usage.

4.3 Decoupling Localization

The use of the compass and the entities permits a decoupling of the system from classic uses of localization technologies such as navigation systems. They are typically used to guide a mobile user to a fixed point, such as a concert theater. In the system presented here, a user can be directed to virtual or fixed entities such as Internet connectivity, musical content, or people. Moreover, unlike in navigation systems, these entities can freely move, as the system is able to update their locations according to user movements.

4.4 Technical Design

The Compass architecture is a hybrid – where a client-server interaction facilitates creating a peer network. The server gathers and distributes data about the mobile users, such as their geographical coordinates and the types of music stored on their phones. This information is automatically uploaded to the server

Figure 1: The Compass interface

using the phone data links[2]. This key element of our proposal makes it possible to always retrieve friends' locations, even if no other users are available *in close range*.

Interacting with the server, The Compass is thus able to provide accurate location details to the users. It acts as location database on top of which the bootstrap is performed. For example, the application will be able to display friends at a walkable distance, thus enhancing the quality and the frequencies of users interactions.

5. IMPLEMENTATION

5.1 System Architecture

This server was developed using Django **Error! Reference source not found.**, a web framework in Python, with an Apache 2 HTTP server and a MySQL database. The amount of data exchanged with the phones was carefully tweaked to decrease the volume, and thus cost of GSM/3G communications. The server stores locations of users and hotspots, as well as types of music stored on phones. Moreover, it maintains information about acquaintances of users in order to build the social network, and to push information about the community to the end user.

5.2 On the Phone

The Compass was implemented out on the Symbian operating system, Series 60 running on Nokia phones. Working in Python **Error! Reference source not found.** allowed rapid prototyping, essential in the beginning in order to verify that The Compass was a good conceptual model for users. Moreover, unlike in Java J2ME as implemented on mobile devices, it is possible to easily extend this language to access low-level functionalities of the phone using C++ API. The alpha release was developed on the Nokia N70 with an external Bluetooth GPS receiver.

After this first development stage, the code was ported to the Nokia N95, advanced model that includes onboard GPS and WiFi chipsets as well as a music player. Using custom made Python modules, The Compass is able to scan for WiFi hotspots, and retrieve GPS data directly from the phone. The interface of The Compass was designed to be consistent with the common Nokia User Interface in order to ease its usage. The **Error! Reference source not found.** shows what the interface The Compass on the Nokia N95 looks like. This screenshot represents what is displayed to the user when he is heading towards a WiFi hotspot.

5.3 A Typical Usage

The scenario described in Section 3.2 is elaborated to a sequence of actions that The Compass software performs on the phone and with the server.

1. **Pushing friends, location and music data:** they are periodically uploaded from the phone to the server with HTTP over 3G, GPRS, or HSDPA. On the server side, the database is updated accordingly to store users' location and the kind of music that they have.
2. **Detecting friends in range:** on the phone as a background task, using data from the server, The Compass detects friends close enough to the users and switch on its WiFi interface. All the phones use the same ESSID, and are pre-configured with a unique IP address generated from their phone numbers. Using location data periodically updated to the server has the advantage of economizing battery life as the WiFi interface is powered on only with a correspondent in range.
3. **Building the social network:** using contacts stored into the phone memory and data retrieved from the server, The Compass builds a list of friends and friends of friends that will be displayed to the user. Moreover, the distance to these users is computed using their geographical coordinates.
4. **Displaying entities:** using the social network's information, The Compass only displays a list of entities at a walkable distance. The user chooses one element from this list and is then guided to the destination with a compass-like interface.
5. **Getting closer to entities:** The Compass offers the same user interface while offering to move towards the different entities. While the user is getting closer to the selected goal, the interface automatically updates with the correct angle, and distance the destination.
6. **Music sharing:** when the user is close enough, to his friends, The Compass will automatically retrieve and display a playlist from his friends' phone. The user will then be able to download and listen MP3 files over the WiFi interface.

6. PERSPECTIVES

The environment, application and metaphor presented above allow mobile users to be loosely guided towards other people in order to share music. The compass may also be used to reach a

[2] WiFi, 3G, GPRS, or HSDPA.

place which gathers the kind of music sought by the mobile user. The compass may also help users find WiFI hotspots in order to provide them with the lowest cost/highest bandwidth for spontaneous file sharing.

The compass metaphor enhances existing scenarios for music sharing and will create new scenarios. The principal limitation of the current version is the lack of precise orientation tracking. For the compass interface to function optimally, it must respond to the sum of position and orientation, and must update a delta of orientation from a fixed position. In the current implementation, orientation is deduced from direction of successive position. An external magnetic field sensor would be necessary to add precise orientation.

The next step consists of testing this environment on a large scale in order to study its impact on the way mobile users share music. We keep in mind that mobile phones have limited resources in terms of battery and that file sharing thus has a *cost* (financial or technical). Mobile Social Music Software (MoSoMuSo) networks have characteristics from both peer-to-peer and mobile networks and several questions have to be answered concerning the network's operation and optimization: with how many people should we share music with? How should we choose the optimal "music sharing partner"? How may users be motivated to share their music despite the battery cost? These issues will be studied in experiments with test users. Their movements and interactions will be logged in real time in order to extract specific mobility patterns, and meeting frequencies. The analysis of these collected data will be used to verify our assumptions that The Compass could enhance music exchange as well as users interactions.

7. CONCLUSION

With its hybrid architecture, The Compass is a tool to study and experiment mobile music navigation. In contrast to other systems where users interactions are limited by the network's range, The Compass is able to increase the interactions using the appropriate network connectivity. Using the location information retrieved from the server with the phone's data link, The Compass can lead the users closer to their friends to start music exchanges with the phone's WiFi connectivity.

Future work based around The Compass will enhance the content that is provided to the users. So far, it is limited to the location of their social acquaintances, and WiFi hotspots. The users are not free to improve The Compass while they walk around a city. The focus will be put on sharing user-generated musical content uploaded to the server from the phone. The users will then be able to do music geotagging enhancing the server's content with information such as concert halls, ephemeral live music event in the streets, or even recorded sound from a café, subway stations or streets sounds.

8. ACKNOWLEDGMENTS

The Compass graphic interface was designed by Clicmobile. The project was carried out with funding from the French Minister of Industry RIAM grant, Mosomuso, with partners Clicmobile, Sony CSL Paris, and University of Paris 6.

9. REFERENCES

[1] Bassoli, A., Cullinan, C., Moore, J., Agamanolis, S. TunA: A Mobile Music Experience to Foster Local Interactions. In *Proceedings UbiComp'03*, Seattle, USA, 2003.

[2] Jacobsson, M.,Rost, M., Håkansson, M. and Holmquist, L. E. Push!Music: Intelligent Music Sharing on Mobile Devices. In *Adjunct Proceedings of UbiComp'05*, Tokyo, Japan, 2005.

[3] http://www.zune.net

[4] http://www.streamman.net/

[5] Paulos, E., Jenkins, T. Urban probes: encountering our emerging urban atmospheres. In *Proceedings of CHI 2005*, Portland, Oregon, 341-350. April 2005.

[6] http://www.urban-atmospheres.net/Jabberwocky/

[7] Tanaka, A., Gemeinboeck, P., Momeni, A. Net_Dérive, A Participative Artwork For Mobile Media. In *Proceedings of Mobile Media 2007 Conference*. Sydney, Australia. In Press.

[8] http://www.dodgeball.com/

[9] http://socialight.com/

[10] Mizuko, I., Okabe, D. ,and Matsuda, M. (Eds) *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life*. MIT Press, Cambridge, MA, 2005.

[11] http://www.djangoproject.com

[12] http://pys60.sf.net