

# MobiTip: Using Bluetooth as a Mediator of Social Context

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## ABSTRACT

MobiTip is a social mobile service where comments or *tips* given by one person are made available to another when user devices connect on the fly, when users approach connection hotspots, or on demand. Bluetooth connectivity is used to form a social space of nearby devices that is used as key input for the collaborative filtering of tips. The social space is visualized to show other users nearby, thereby illustrating where tips come from and why they are presented at some particular point in time.

## Keywords

Positioning, social trails, Bluetooth presence, collaborative filtering.

## INTRODUCTION

Mobile and ubiquitous systems often use context parameters as input. Position, noise, temperature, light, pace, body pulse are some parameters from which a ubiquitous system can infer something about its context of use. For mobile systems, geographical position is oftentimes a key property. Many social mobile services take advantage of position, to place digital information in physical space, guide people through museums, or keep track of friends. But geographical position is not the only way by which aspects of the social context at a particular place can be understood.

For social mobile services, a reasonable assumption would be that it is the people inhabiting a space that gives it meaning, and not only the physical coordinates. Global (or local) positioning, such as finding the coordinates of a given device is, however, cumbersome to use if we want to determine if two devices are in the vicinity of each other, at the same time.

To capture movements and activity between people, a positioning technology is needed that positions users in relation to other users and to artifacts in space, and allows for simple communication between them. One possible technology is Bluetooth. It allows for close-range ad-hoc connectivity between devices (< 10 meters), and is commonly available in mobile phones, PDA's, PC and many other gadgets. Thus, Bluetooth has the potential to be used as a mediator and presenter of the digital, social context surrounding us. The MobiTip service described here is a mobile collaborative filtering system that makes use of relative positioning using Bluetooth.

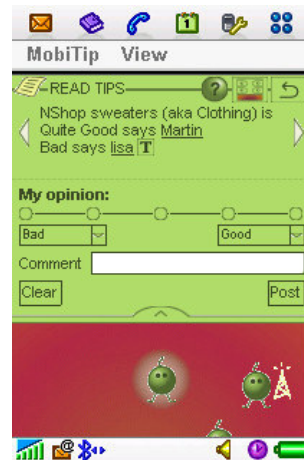


Figure 1. Reading a tip. Tip interaction (green) can be folded in/out.

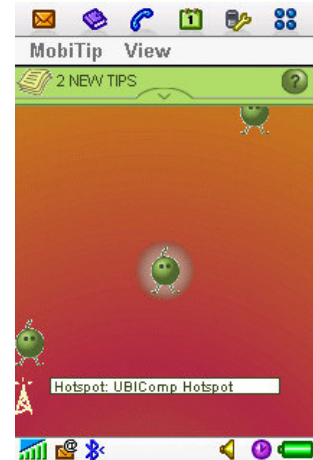


Figure 2. Full size presence display.

## THE MOBITIP SERVICE

MobiTip allows its users to express their opinions and comment on anything of interest in the environment. Comments given by one person are made available to another when users pass each other, when they approach connection hotspots, or on demand. Opinions are presented in aggregated form, as *tips* (or recommendations), using collaborative filtering algorithms suited for mobile devices that are not always connected to a central server.

Users may enter their own opinions, as well as inspect and react to tips from others (Fig. 1). What tip the system presents in a given situation is based on similarities between users, on context as defined by Bluetooth-closeness, and on tip popularity.

User movement and presence of other users, combined with tips and ratings, form a web of social trails. The storage of this web is distributed over the users' phones and over strategically placed Bluetooth hotspots. A core part of MobiTip's functionality is to visualize this web. Fellow MobiTip users, occasional hotspots and other discoverable Bluetooth devices are therefore made visible on the screen, as is the transfer of information between devices. Icons will appear and disappear in the interface as the user moves around (Fig. 2).

As part of the service, a small number of Bluetooth servers (hotspots) are placed at carefully selected locations. Hotspot connections are not necessary, but useful to the service, since they provide access to updated information and historical user presence. However, most of the time users will be in “floating” mode: out of range of hotspots, but possibly connected to surrounding users in ad-hoc networks.

The service is implemented for the Sony Ericsson P800/P900 combined PDA and mobile phone.

### Previous work

The idea of using proximity sensors of a person’s peers is not new. Hummingbird [2] uses a very simple mechanism to alert people when their peers were in close range. Studies showed that Hummingbird spawned new forms of communication. Social Net [5] infers common interests by looking for patterns of proximity over time. Jabberwocky [3] uses Bluetooth technology on mobile phones to exploit the concept of “the familiar stranger”. GeoNotes [4] lets users leave virtual “post-it” notes at locations for others to read and comment.

### SOCIAL POSITIONING

The virtual world is often viewed as a model of the physical world, where every piece of virtual information can and should be tied to a specific physical location. But there are other aspects of physical space that can be considered for positioning. Instead of positioning a user in relation to her physical coordinates we opt for a position that relates her to other inhabitants of the space. We use the term *social space* to denote the people populating a space (currently or over some time period), turning that space into a place as defined by Harrison and Dourish [1]. The fact that “I met you” may affect reasoning and also provide input to positioning in physical space. Social space is a central issue in MobiTip.

### Relative positioning among peers

The fact that two or more people are at the same place at the same time tells something about that place - “Your past is my future”<sup>1</sup>.

For a collaborative filter that groups users with similar taste, social space offers an additional source of input for determining the similarity between users. When MobiTip produces tips it will consequently use two sources of information: the user’s ratings on previous tips and the proximity to other users. This allows MobiTip to adapt to the current setting. If the user is in a shopping mall, tips will be influenced by others in the mall. In a different setting – such as a conference – MobiTip will produce a different set of tips, based on another group of people.

In addition to providing input for determining what should be recommended, social space is used as a trigger for tips. When two users pass each other at close range, their de-

VICES will connect, causing MobiTip to push tips as a result of the encounter.

### Hotspots

Social space is volatile and only exists during brief encounters between people. However, the digital medium offers the opportunity to save selected parts of the social space at key locations, making it accessible for future visitors. A hotspot in this context is a Bluetooth-enabled server placed at a selected location in the environment. A hotspot’s prime task is to act as a collector of user trails within a particular environment. Whenever a user passes a hotspot, the social trails gathered on that user’s device are collected and saved at the hotspot. Thus, in the vicinity of a hotspot, the collaborative filter can use historical user trails in the same way as for actual encounters, triggering tips and exchanging collaborative filtering information.

### Presence map

Contextual parameters are of course only indicators of what a person is doing. When used as input to an automated system, content and timing of system output may be very confusing to the end-user. In MobiTip, a remedy to this problem is to stress the importance of the social space by visualizing it. The presence map shown in Fig. 2 thus illustrates where tips come from and what may have triggered them. When information is transferred back and forth in the social space the user is made aware of it. Changes in proximity between devices are reflected in the map by devices appearing and disappearing from view.

### ACKNOWLEDGMENTS

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<sup>1</sup> Martin Rantzer, personal communication.