Implicit Personalization of Public Environments using Bluetooth

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Abstract
Implicit and remote personalization of public environments is technically possible by using Bluetooth technology. We present a concept to allow people to individually influence public content such as songs played in shopping malls, news displayed on big displays, advertisements shown etc. based on the Bluetooth functionality in their mobile. Users define their preferences once and store them in encoded form as the Bluetooth friendly name of their mobile device. We describe the underlining idea, the implementation of the prototype "Bluemusic" as well as the conducted online survey and the initial user trail. The results suggested that the participants are cautious regarding privacy issues but very interested in such implicit interaction possibilities with public environments.

Keywords
Implicit interaction, mobile interaction, personalization, smart environment, Bluetooth interaction

ACM Classification Keywords
H.5.2 User Interfaces, I.3.6 Methodology and Techniques

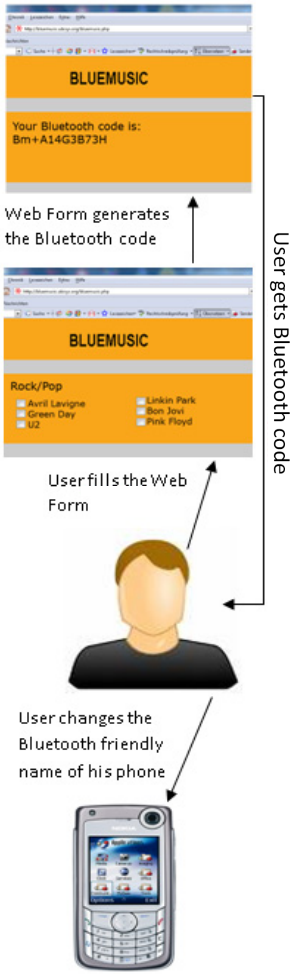

figure 1. User specifies his preferences on the" Bluemusic" web page and sets the generated code as his Bluetooth friendly name.

Introduction

Mobile phones have become ubiquitous and an integral part of our everyday life. Many current phones provide features such as cameras, music player and short range radio. Bluetooth is a common feature on mobile devices providing means to connect and exchange information between devices. A complementary trend is that media content is made available in many different ways (e.g. audio, video) in public environments using, e.g. large displays and music in shops, underground stations etc. This media content is reaching directly to the users but till now very little effort has been made to give users control or let them personalize the media content on the public or semi-public environment. This paper deals with implicit personalization, a form of implicit interaction [6], to provide means for users to influence their environment implicitly by using Bluetooth.

Related Work

Bluetooth-based applications often use the limited range of the Bluetooth signal for their purposes. One typical example is to incite unknown people with similar interests to communicate with each other e.g. [3]. BluetunA [1] is a project especially for sharing music interests with nearby people. One for the advertising industry's upcoming interesting approach is personalized advertising based on discoverable Bluetooth devices, e.g. [5]. This can be done without the need to install any application on the phone. All these systems have in common that information is stored on a central server and the Bluetooth information is used as reference.

Our work was inspired by Villar et al.'s project on an adaptive proactive environment [7]. They developed an environment where large-scale displays are used to present information connected to the communal interests of people nearby. They used a wearable device called Pendle which stores and wirelessly transmits users' preferences for implicit interaction. In 2002, they used custom build badges to interact with the system. Nowadays Bluetooth provides a similar functionality on a phone without the need for an extra device or additional sensors in the environment. Similar to our idea Flytrap [2] and MusicFX [4] use the users' taste of music to adjust music to their preferences. But these projects also need extra tags to identify the audience.

Concept - Broadcast Your Interests

Our goal is to allow people to individually influence public environments based on their preference implicitly, i.e. by just being there. They broadcast their interests by using the Bluetooth friendly name of their mobile phone. The idea is to provide a system which can be used without extra equipment or software to install on the mobile device. The only prerequisite is a Bluetooth enabled mobile device. The environment should be able to use the broadcast information without the need to connect to a server, so that the user can remain anonymous.

In order to make their interests available, users specify their preferences regarding music, movies, social and news interests, weather information, advertisements, etc. through a web form. Their interests are used to generate a string of letters and numbers which reflects their preferences. The users then set the Bluetooth friendly name of their mobile device to this string.

There is no need to register for the system and personal data is not transferred or stored on a central

figure 2. Potential bar owner's music player. At the bottom he sees the current Top-10-list of his costumer's favorite artists.

server. As soon as a user sets the friendly name and sets the phone to be visible to others, the information regarding their preferences is broadcast in the surrounding area. The encoded interests of the users are broadcast implicitly but they are on purpose not directly human readable. Based on this information, different implicit services are possible, such as public displays showing news and advertisements as per user's interests, the temperature in the office adjusting to the user's preferences or playing music at public places like shops, bars etc., according to the user's profile. If there are more than one user in the Bluetooth proximity area the system identifies the preferences shared by most of the users. If the preferences are not shared by the users, the program adds all the preferences to the list and executes them one by one on a random basis. For this purpose we propose two modes. In automatic mode, the system selects the next content (like news or songs) automatically according to the customer's preferences (like in [4]). In manual mode, the content provider chooses from a top-10 list of the costumers' preferences.

A user could, e.g., choose a set of favored artists on a web page and calculate the corresponding Bluetooth name as demonstrated in figure 1. After specifying this name in the phone's settings and entering a store or café, the owner of the store or café can take these preferences into account (see figure 2).

Implementation and Experimental Setup

We implemented "Bluemusic" which supports the personalization of music in public environments. With this system, we conducted initial user tests. It consists of a web application to encode the interest and a music player that takes broadcast interests into account.

Web Application

The web application allows users to set their music preferences. Users can select various artists of their choice from different genres of music provided in a web form (see figure 1). This web form encodes the music preferences into a string which is then to be used as Bluetooth name for the users' mobile phone. The string "Bm+A1R3E5T3" could, e.g., be generated by the form, where "Bm+" at the beginning indicates that the user is associated with the Bluemusic service.

Coding Scheme

Most current mobile phones allow the Bluetooth friendly name to be at least 15 characters (the Bluetooth specification allows a string of up to 248 characters). We allow 64 unique characters for the generation of the name: a-z, A-Z, 0-9 and two special characters '+' (plus) and '.' (dot). Thus, each character can encode 6 bits (2^6 = 64). On the webpage, users can select their favorite artists by clicking on check boxes associated with them. This list of "checked" and "unchecked" states can then directly be mapped to the different characters resulting in a character string usable as the Bluetooth name for the user's mobile phone.

Music Player Implementation

The music player application scans for Bluetooth devices in range and finds devices which support the Bluemusic service, i.e. discoverable devices whose Bluetooth name starts with "Bm+". It retrieves the Bluetooth name for each device and converts them to a bit string according to the inverse code algorithm defined in the coding scheme.

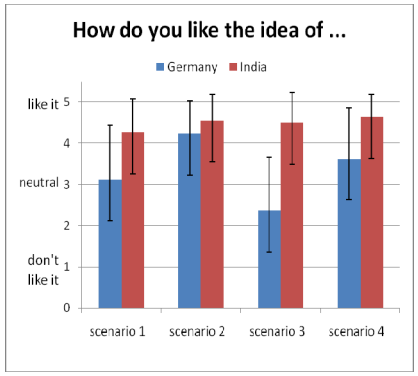

figure 3. Mean and standard deviation of the opinions with respect to scenarios 1-4. Left column denotes people from Germany, right from India.

Bluemusic is implemented in Java in two versions (PC and J2ME for mobile phones). These songs are stored in a list and played by the music player one by one. Since users may leave the Bluetooth proximity area at any time, the program rescans for Bluetooth devices a few seconds before the current song ends. This updates the song list for every user who entered or left the proximity area of the Bluetooth device which runs the program. The song changes only when the current song has finished playing. If there is more than one user in the proximity area, the program merges the preferred artists of all users and sorts it according to the number of occurrences of each artist. It finally plays the songs from different artists according to that list.

User Experience and Expectations

We distributed an online survey to get initial feedback on the users' view towards such a system.

Online Survey

The online survey was conducted to find out about the potential of implicit association of music, advertisement and news as well as the use of Bluetooth as communication tool and privacy issues related to it. This survey was sent to people in India and Germany in order to also find potential cultural differences.

The survey consists of two parts. In the first part, four scenarios are presented, each highlighting possibilities of one specific public environment that could be sensitive to the user's preferences. For each scenario, users can specify their opinion on a scale 1-5 (1=don't like it, 5=like it). In scenario 1, the idea of adjusting the background music in shops is illustrated. Scenario 2 deals with a similar idea but in this case it is in a café instead of a shop. In the third scenario the participants are asked for their opinion about automatically showing advertisements on public displays according to their interests. In scenario 4, the public news displays in subway stations are addressed. These displays show news about topics in which the user is interested.

The second part focuses on the participants' views of Bluetooth as a communication tool. The participants are asked whether they were willing to turn on Bluetooth and change their Bluetooth friendly name to be able to use the systems described in scenario 1-4. Two final questions about privacy complete the questionnaire.

RESULTS:

97 German participants (72 male, 25 female, average age 28) and 38 Indian participants (29 male, 9 female, average age 27) filled in the questionnaire. Figure 3 shows the results of the first part. As seen from the results, the cultural differences are obvious. It seems that the Indian participants in general were more enthusiastic about the presented ideas than the Germans. The results also indicate their different interests. The preferred scenario by Indian people is the scenario about personalized news (with 92% positive opinions). The scenarios 2 and 3 (music in a café and advertisement) got very similar votes. Even the last scenario in this ranking scenario 1 (music and shopping) got 78% positive votes. In contrast, the Germans liked the scenario 3 (advertisement) least (only 25%) and the second scenario (music in a café) most with only 7% who specified they don't like it.

Regarding the second part of the questionnaire, we also observed noteworthy differences between Indian and German participants, see figure 4.

	Germany	India
Would you activate the Bluetooth functionality in your mobile phone to use such services?		
Yes	24%	45%
No	62%	32%
Don't know	14%	23%
Are you willing to change the Bluetooth name of your mobile phone to use these services?		
Yes	31%	61%
No	45%	29%
Don't know	24%	10%
With your Bluetooth is activated for these services, your Bluetooth name indicates your taste of music, news and advertisements. Do you think this would interfere with your privacy?		
Yes	76%	29%
No	17%	55%
Don't know	8%	16%
Do you think that it is worth to use these services on the cost of making your personal preferences visible to everyone?		
Yes	11%	45%
No	70%	37%
Don't know	19%	18%

figure 4. Results from the second part of the survey concerned aspects of Bluetooth and privacy.

Indian people seem to be less afraid of privacy issues. Only 29% see a privacy risk while using such systems while 76% German participants declare that it is an interference with their privacy. We are positively surprised that such a high number of participants in India (nearly 50%) would use such systems, whereas the willingness in Germany to use such systems is lower (less than 25%) but still addresses a considerable portion. This survey reflects a potential difference of views between people in India and Germany. As future work, we seek to investigate this with more surveys and interviews to find out about the reasons behind it.

Initial User Evaluation

We also conducted a user evaluation for personalization of music to get feedback about the usability of the current system, privacy issues related to Bluetooth and to get some suggestions for improving the design. This evaluation was conducted with five users, four male and one female, for about 40 minutes in a closed environment in Germany. In the beginning, the overall concept was explained and users should generate a Bluetooth name for their mobile phone from the web page according to their music preferences. Then the Bluemusic player played songs for about 25 minutes. Users were interviewed one by one according to a set of questions prepared prior to the interview. Users were interviewed to get detailed feedback about the system.

RESULTS

All users taking part in the evaluation possessed a mobile phone with integrated Bluetooth capabilities. They had the Bluetooth in their mobile phones activated and, except one, nobody really used and cared about it. None of the participants felt difficulty in using the web page but came up with some ideas for improvement. A female student suggested that the website should contain some general information about Bluetooth technology and ways to change the Bluetooth name in the mobile phone. Four of them said that they seldom change their Bluetooth name. One of the male participants said that he changes the Bluetooth name but not very frequently. A student, 24, when asked to change the Bluetooth name of his mobile, said that he did not know how to change the name. All the participants felt that changing the Bluetooth name manually was not difficult but merely a boring and cumbersome task. Therefore, according to them, there should be some mechanism that would change the Bluetooth name automatically.

Three among the five participants had no worries in switching their Bluetooth on to use this service but two of the male participants had some worries about security issues (although they currently had it switched on). It was also explained to them that their encoded preferences might become public but none of them had problems in making their preferences public. One of the participants said that it is just a music preference and not directly related to his personal life. According to one participant, in a place like a shopping mall with so many people, it is very difficult for anyone to associate a Bluetooth name to a particular person.

They were also asked about their reaction when their favorite or some other song was played in a shared environment. All of them said that they would feel very good if their favorite song is played but they would not concentrate too much on it. Most of them had no problems if some other song is played. One of the participants said that he would just ignore it and the

other said that she would concentrate more on her current activity like shopping.

All of the participants came up with some suggestions that could be added to the existing system and also some feedback about minor improvements. We got positive feedback from the user evaluation as most of the participants agreed to switch on their Bluetooth and would use this system in future.

Conclusions and Future Work

We presented an approach for implicit personalization of public environments using the Bluetooth friendly name concept. User's preferences are encoded into the Bluetooth name and broadcast implicitly in the proximity. This can, e.g., be used to show news topics on a public display or to select music on public places like shops or bars. The advantages of the concept are:

- Only a Bluetooth-enabled mobile device is needed to take part on such a system.
- No extra software must be installed on the device.
- After an explicit set up, no further activity on user's side is needed, aside from possible profile changes.
- There is no need to register at the system. Thus, no user information is stored on a central server.

The results of the online survey, conducted in Germany and India as well as the user evaluation with the prototype "Bluemusic" showed that people are cautious but interested in such implicit interaction possibilities with the public environment. About half of the Indian and a fourth of the German people would probably use it. Although the user remains anonymous for the system, privacy aspects, which seem to be more important for the German than for the Indian participants, such as others decoding personal preferences, still have to be considered.

As one of the next steps, we will conduct interviews with potential providers of the system. In particular, it would be interesting to know whether and when these prefer a completely automatic system or getting suggestions (e.g., a top-10 list) from which they can manually choose the content which is presented next. With a "Bluetooth-party" we will try to evaluate our prototype under real conditions with a larger user group.

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