

Content Personalization for Mobile Interfaces

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INTRODUCTION

The contribution of context information to content management is of great importance. The increase of storage capacity in mobile devices gives users the possibility to maintain large amounts of content to their phones. As a result, this amount of content is increasing at a high rate. Users are able to store a huge variety of content such as contacts, text messages, ring tones, logos, calendar events, and textual notes. Furthermore, the development of novel applications has created new types of content, which include images, videos, MMS (multi-media messaging), e-mail, music, play lists, audio clips, bookmarks, news and weather, chat, niche information services, travel and entertainment information, driving instructions, banking, and shopping (Schilit & Theimer, 1994; Schilit, Adams, & Want, 1994; Brown, 1996; Brown, Bovey, & Chen, 1997).

The fact that users should be able to store the content on their mobile phone and find the content they need without much effort results in the requirement of managing the content by organizing and annotating it. The purpose of information management is to aid users by offering a safe and easy way of retrieving the relevant content automatically, to minimize their effort and maximize their benefit (Sorvari et al., 2004).

The increasing amount of stored content in mobile devices and the limitations of physical mobile phone user interfaces introduce a usability challenge in content management. The physical mobile phone user interface will not change considerably. The physical display sizes will not increase since in the mobile devices the display already covers a large part of the surface area. Text input speed will not change much, as keyboard-based text input methods have been the most efficient way to reduce slowness. While information is necessary for many applications, the human brain is limited in terms of how much information it can process at one time. The problem of information management is more complex in mobile environments (Campbell & Tarasewich, 2004).

One way to reduce information overload and enhance content management is through the use of *context metadata*.

Context metadata is information that describes the context in which a content item was created or received and can be used to aid users in searching, retrieving, and organizing the relevant content automatically. Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and the applications themselves (Dey, 2001). Some types of context are the *physical context*, such as time, location, and date; the *social context*, such as social group, friends, work, and home; and the *mental context*, which includes users' activities and feelings (Ryan, Pascoe, & Morse, 1997; Dey, Abowd, & Wood, 1998; Lucas, 2001).

By organizing and annotating the content, we develop a new way of managing it, while content management features are created to face efficiently the usability challenge. Context metadata helps the user find the content he needs by enabling single and multi-criteria searches (e.g., find photos taken in Paris last year), example-based searches (e.g., find all the video clips recorded in the same location as the selected video clip), and automatic content organization for efficient browsing (e.g., location-based content view, where the content is arranged hierarchically based on the content capture location and information about the hierarchical relationships of different locations).

DATE, TIME, LOCATION, AND PROXIMITY

While context can be characterized by a large number of different types of attributes, the contribution of context attributes to content management is of great importance. We focus on a small number of attributes, which are considered the most important in supporting content management and also have the most practical implementations in real products, such as date, time, location, and proximity (nearby Bluetooth devices). Bluetooth is a short-range wireless technology used

to create personal area networks among user mobile devices and with other nearby devices.

The first two attributes, date and time, are the most common in use in a wide range of applications. They are used to organize both digital and analog content, and offer an easy way of searching and retrieving the relevant content automatically. For example, many cameras automatically add the date and time to photographs. Furthermore, the location where content is created is another useful attribute for searching the content (e.g., home, workplace, summer cottage). Mobile devices give users the possibility to create content in many different locations. Users can associate the location with the equivalent content in order to add an attribute to it that will enable them to find it easier. Finally, proximity also plays an important role in content management, as nearby Bluetooth devices can provide information both in social and physical context. While each Bluetooth device can be uniquely identified, information can be provided on nearby people by identifying their mobile phones. An example for physical context is the case of a Bluetooth-based hands-free car kit that can be used to identify that the user is in a car.

USABILITY ISSUES AND PROBLEMS

The expansion of the dimension of context information in order to include location, as well as proximity context, can be of benefit to users while they are able to store, access, and share with others their own location-based information such as videos and photos, and feel the sense of community growing among them (Kasinen, 2003; Cheverist, Smith, Mitchell, Friday, & Davies, 2001). But when it comes to proximity to be included in context information, the problem of *privacy* emerges. It appears that users are willing to accept a loss of privacy when they take into account the benefits of receiving useful information, but they would like to control the release of private information (Ljungstrand, 2001; Ackerman, Darrel, & Weitzner, 2001).

While context metadata is attached to content, when users share content, they have to decide if they share all the metadata with the content or they filter out all or some part of them. The cost for memory and transmission of metadata, as it is textual information, is not an important factor to influence this decision. When the user receives location and proximity information attached to content, he or she may also find out where and with whom the creator of the content was when the content was created. As a result, both the location of the content creator and the location of nearby people are shared along with the content information. If this information is private, the sharing of it could be considered as a privacy violation. This violation may be 'multiplied' if the first recipient forwards the content and the metadata to other users.

However, users seem to be willing to share context metadata attached to content, as it would be convenient if context metadata were automatically available with the content (so that users do not have to add this information manually). Furthermore, it would be very helpful for the recipient if the received content was annotated with context metadata so that the recipient does not have to annotate it manually and be able to manage the content more easily. For example, in the case of image and video content, the filtering of context metadata such as location and people could be useless, since these same items appearing in the image or video can be identified visually from the image content itself.

But what is meaningful information to the end user? It seems that users want meaningful information, but they are not willing to put too much effort in creating it, unless this information is expected to be very useful. In the case of location, it would be difficult for users to type the name of the place and other attributes manually, since it would require their time and effort. Thus it would be important if meaningful context metadata, which include the required information, are automatically generated.

Proximity information also needs to be meaningful. In this way, meaningfulness is important when attaching information on nearby devices in the form of metadata. If the globally unique Bluetooth device address and the real name of the owner of the device could be connected, this functionality would give meaningful information to the user.

It is hard to determine which information is useful, while what is useful information in one situation might be totally useless in another. For example, when looking at photo albums, what is thought to be useful information varies a lot. When one is looking at family pictures taken recently, it is needless to write down the names of the people, since they were well known and discernable. But it is different looking at family pictures taken many years ago: the same people may not be that easily recognizable.

It appears that useful information depends on a user's location, what the information is used for, and in which time span. In order to create meaningful information, users need to put much effort into getting the data, organizing it, and annotating it with context metadata. Ways to minimize their effort and maximize their benefit should be developed.

CONCLUSION

The increasing amount of stored content in mobile devices and the limitations of physical mobile phone user interfaces introduce a usability challenge in content management. The efficient management of large amounts of data requires developing new ways of managing content. Stored data are used by applications which should express information in a sensible way, and offer users a simple and intuitive way of

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