Sharing Multimedia and Context Information Between Mobile Terminals

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ABSTRACT
Mobile terminal users have needs for sharing experiences and common interests in a context sensitive manner. However, due to the current division of creation, delivery and access functionality of multimedia to applications, much user effort is needed to communicate efficiently. In this paper an approach for a user interface for mobile terminals to share multimedia and context information is presented and discussed. A map-based interface and domain object model -based user interface technique is utilized.

INTRODUCTION
Sharing of experiences using mobile technology is becoming more common since current mobile terminals enable capturing and delivery of multimedia content. However, due to physical limitations of mobile terminals to present and process multimedia they require particular user interface (UI) solutions. Current user interfaces do not provide means to share multimedia content effectively in real time since creating, delivering, and managing multimedia documents needs considerable effort.

Context awareness of mobile terminals enables novel dimensions for mobile communication. Mobile terminals can share and present contexts by showing contexts of their members as symbols in a phonebook [12]. The sharing of context information enables the extension of the basic applications of mobile terminals with context features, for example context based call operation [13] and messaging [7]. Sharing of context information creates potential for more efficient multimedia distribution, augmentation, and content management.

In this paper we present and discuss an approach for a user interface that supports the presentation and sharing of multimedia and context information together on a context aware map. Furthermore, we discuss technologies for enabling user interface solution. A UI solution for an online community is presented in more detail in [15].

TECHNIQUES FOR CREATING AND SHARING MULTIMEDIA

Crossing application boundaries
Applications are an artificial concept of computer science and for users there are often artificial boundaries between applications. In our case distinct applications exist for map-based positioning, taking photos or video shots, playing the media, sharing the media files created and showing the current context of each user.

A great amount of user effort is required in order for crossing those boundaries as discussed in [10]. To deliver information to a community about what is happening and at which location a user needs to copy location information from the positioning application and a media file from the camera application to a message to be sent in an instant messaging application. On the receiving side user effort is needed to figure out the user's position relative to the position of his friend, because the position of his friend is in the received message in the messaging application and his own position is in the positioning application. Further effort is needed to figure out what his friend is doing right now by looking at the context sensitive phonebook if the sender didn't bother to write it directly in the message.

As a solution to the problems caused by applications Raskin stated that there should not be any separate applications, but objects and operations that can manipulate those objects [10]. One of the intriguing technologies towards this direction is the Naked Objects framework [8] that maintains one to one correspondence of the domain or business object model and the UI by enabling the generation of the UI automatically from the domain object model.

Our object model for enabling multimedia communication in an online community consists of people in the community, the multimedia files they create and share, and a shared map acting as a container object for people and multimedia files.

Objects in the UI should look and function in a similar way regardless of the context where they are used and the size rendered [10]. By using icons it is possible to present objects in a very small space [3], which is important to fit more objects to a map being displayed on a small screen. By using the same icon in larger representations of the object the user easily associates the object with the one presented by the small icon.

Maps
Geographical maps have unique advantages being direct representations of the real world already familiar to users and exploiting human spatial memory. Positioning

applications showing your place and route to a destination have been popular especially in car and boat navigation. The impression of connectivity to the real world can be enhanced by using positioning techniques to provide a real time up to date "you are here" position symbol to the map and using an electronic compass to keep the map parallel to the real world despite of device orientation.

The idea of capturing position and context during multimedia creation and using that information for laying multimedia objects to geographical maps has been used successfully for multimedia retrieval [1]. It is easy to find images and video clips about certain situation or place from a map.

The distinction between real world and augmented reality solutions is that maps help users to see farther than physically possible and get an overview of the environment faster than physically possible. This feature has been utilised in many navigational purposes to find a route from place to place.

Geographical maps are also useful for presenting and finding electronic services having an unambiguous geographical location [9] instead of some kind of context aware menu which is constantly changing when you are walking in the city.

Maps have the ability to visualise very heterogeneous objects being either physical like people or immaterial like video clips. The only requirement is that objects must have location information. Putting heterogeneous objects from different sources to a geographical map can help the user to get a good overview of how things are related to each other, which may help in decision making.

We utilise this feature in our user interface. In our case there are terminals, which share their context information and multimedia objects they have created on a map online. Minimal user effort is needed to communicate their position and the context and context of multimedia created. New media objects can be represented by a blinking icon and when the map becomes crowded the oldest media objects can be removed from the map in a similar way that instant messaging applications are removing the oldest messages.

CONTEXT INFORMATION

A mobile terminal may be aware of the context of its user [6,11]. Data provided by several onboard sources, e.g. various types of sensors, and remote sources, e.g. location services, can be processed to a context representation in which context abstractions describe concepts from the real world, for example loud, warm or at home. This facilitates the utilization of context information e.g. in various applications and in communicating context to other terminals [5,6]. Describing the context information using commonly agreed ontology is one way to achieve this. The sharing of context information between several terminals can be realized using the latest communication standard protocols, e.g. GPRS, 3rd generation networks and Bluetooth. Here we discuss the presentation of context information available in mobile terminals to support online communities.

As discussed in the previous section the UI solution for online communities should present many types of information including various multimedia documents, context information and group interests and preferences in an online manner, and at the same time to keep the UI clear and easy to use.

Context information represents the current state of the object or its environment and can be presented as pictures. The classification of UI pictures for small interfaces is provided in [4]. Their explanation based on [2] indicates that picture classes for small UIs are Iconic, Index, and Symbolic pictures. Most UI pictures are Index pictures as they are associated with a function.

In the work of Schmidt et al. [12] availability and location information is presented as pictures in the phonebook. The availability is presented as Symbolic color codes similar to traffic lights while the location is presented as Index pictures of a house indicating ‘at home’, a factory indicating ‘at work’ and a car indicating ‘on the way’.

In our UI context information describing a person's state is coded into the Iconic picture of that person as presented in Table 1. Animation can be used to reflect user activity like walking, running etc. People can express themselves by selecting the icon set representing them, which brings challenges and possibilities for graphic artists.

Table 1. Context information with classes used in user interface.

User activity			
 Standing	 Walking	 Running	 Chatting
Environment			
 Silent		 Loud	
 Dark		 Bright	
 Cold	 Warm	 Hot	
Device Activity			
 Call	 Browse	 Chat	 Idle

Context information related to the environment and device is more challenging, because these are not first class objects

having icons in UI. Therefore we present context information related to environment and device only on request as index and symbolic icons (Table 1) in the same way as done in [12].

PROTOTYPE

We have created a context-aware map-based interface for accessing situated services with mobile terminals [9]. The current prototype, which is built on the Compaq iPAQ 3660 PDA, includes positioning via WLAN and context based control via an external sensor box [14]. XML-based maps are rotated with the aid of a compass sensor, and zooming and scrolling can be performed by a user's gestures derived from proximity and accelerometer sensors, respectively. An ontology for describing sensor-based context information is used in sharing context data [16].

We are exploring the Naked Objects framework [8], as a user interface solution for interacting with objects and extending the Naked Objects platform by implementing an object viewing mechanism (OVM) for PocketPC style devices, because the original framework contains an OVM only for desktop PC.

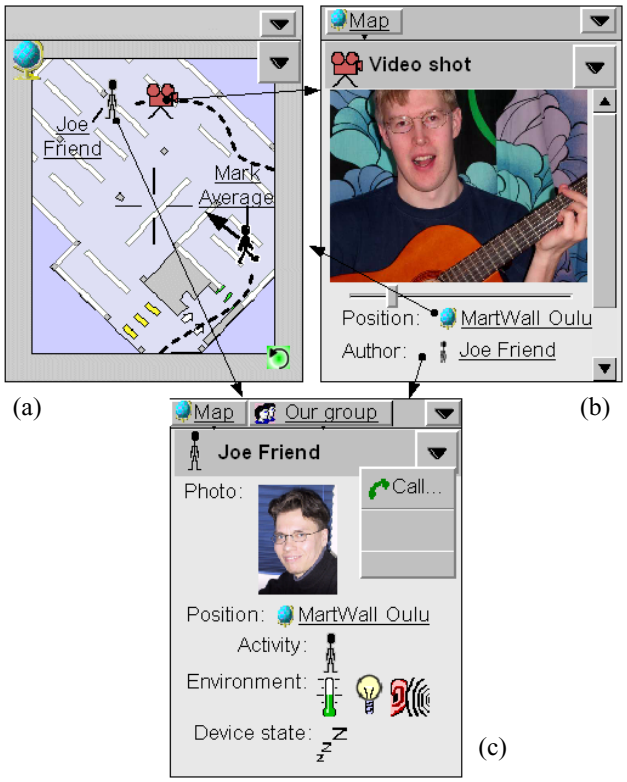

Figure 1. Screenshots of a UI. A user has created a video clip and placed it on a map. Arrows between screenshots describe navigation achieved by clicking at the starting point of the arrow.

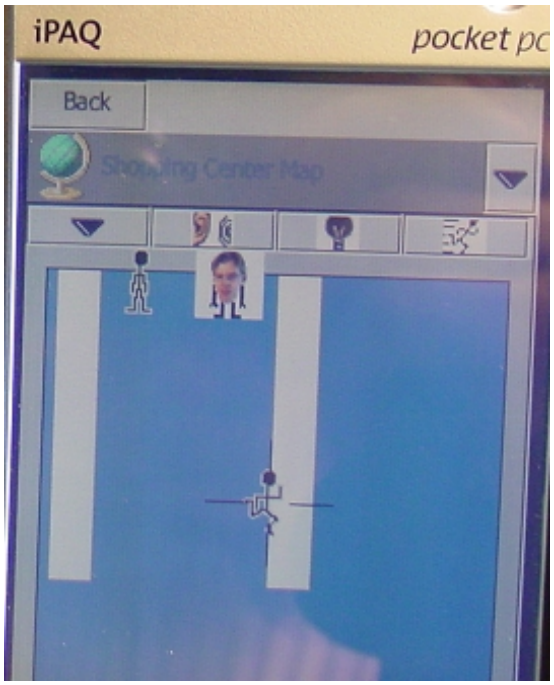

Figure 2. A screenshot of online information sharing (context information-window) Context data is shown with clear visualisations.

With the map-based interface, the author and current location are associated with the multimedia document (Fig.1b), and the document is added on the map (presented as an icon, Fig. 1a). Fig. 1a presents a map-based view seen by User 1. His position is shown in the middle of the screen, in the center of sight. Two other users are also in the visible area, and part of their route is illustrated with broken lines.

The pull-down menu shows available communication operations. The context view (Fig. 1c) shows the detailed context. The context represented by several symbols provides a partial description of the situation, yet the interpretation and understanding of the overall situation is the user's task.

In Fig. 2 a screenshot of online information sharing is presented using a context information –window. Context data is shown with clear visualisations.

The representation and sharing of multimedia and context information with this UI solution does not require any effort for switching between various types of applications. To get rid of the concept of applications that are creating artificial boundaries for users, a lot of research and development is needed to make current computing systems support the division of software into objects and operations.

SUMMARY AND DISCUSSION

A UI solution for mobile terminals presenting and sharing multimedia with context information is introduced. An approach utilizes object oriented UI techniques and a shared geographical map to present multimedia objects and

contexts of group members in the same view. The UI solution satisfied needs:

- Sharing interesting findings from the environment by using multimedia and effortless communication of the current group situation.
- Multimedia documents are presented on the map as icons to compress information representation and to provide easy access to the full content of objects.
- Online sharing of context information (activity, device and environment) with simple but descriptive symbols.

One concern with this approach is that the map becomes crowded due to active multimedia production and by bringing other objects and services to the map. This can be helped to some extend by map labeling algorithms, but some kind of map filtering methods are needed in the long run.

Other issues requiring more concern (for technical implementation) include:

- Deciding how the messages and context information are delivered and stored in the network,
- Where the maps are loaded,
- Who creates maps and in which format.

Moreover, aspects that need further investigation comprise of:

- How the access of users to shared information can be limited.
- How to handle terminals, which do not have a map-based interface.
- How to provide support for representing more multiform context information

In the future, we will continue the integration of the map interface to the Naked Objects platform. Moreover, user tests are required to obtain experiences in real usage situations and understanding of symbols used.

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