Event-Based Mobile Social Network Services

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ABSTRACT
There are an increasing number of mobile applications that use contextual data to provide their service, but few use the wide range of data available to the device to full effect. Looking beyond individual user context to sources such as the user's social network, mobile applications can be developed that provide a service to both the individual and the wider social group. We first present a platform that uses the detection of events to try to interpret individual and group context. We introduce three mobile applications that use this platform to provide a service back to the individual and the social group attending an event.

Categories and Subject Descriptors
H.5.3 [Group and Organization Interfaces]: Collaborative Computing, H.4.3 [Communications Applications]: Information Browsers.

Keywords
Event, Event Detection, Context, Social Network, Mobile.

1. INTRODUCTION
There are vast and diverse ranges of services, technologies and platforms in the current global mobile environment that can often overwhelm users, particularly when it comes to discovering and effectively using these services. The mobile device is regularly used in a time-critical (e.g. work) or unfamiliar (e.g. tourist) environment, therefore correctly interpreting the device (and, hence, user) context can allow for an enhanced user experience.

Increasingly, mobile applications attempt to use contextual data to provide their service to the user. Many of these services utilise location data to interpret basic context, but few applications effectively use the wide range of contextual data available to the device; particularly data that can be sourced from outside the individual user context. Dey argues that context can be any information that can characterise the situation of an *entity* [4] where an entity is not just the user or device. Objects, people and places are entities and they can all be relevant to the user and her interactions and activities.

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Take a typical social event such as a night out in a city. During this event, the people involved will be exposed to large amounts of contextual data that could be gathered by their mobile devices at any given time, e.g. GPS data or cell base station IDs; devices within Bluetooth or Wi-Fi range; and communication data from sources such as voice calls, SMS and email.

The concept of an event is quite broad. Although variable in their nature, there are basic properties that have been used to model the characteristics of an event [11, 12]. If we could use the mobile device to recognise such properties from available data sources, we could try to detect the occurrence of a social event and potentially develop applications that offer services specifically to those attending the event.

We are developing a platform that gathers and processes contextual data from the user's mobile device. The high level objective of the platform is to determine both individual and group context in order to allow social networking applications to deliver tailored services back to the users in the mobile environment. At present, we have: (i) interpreted both individual and group context through the detection of real time group events; (ii) designed and built prototype mobile social networking applications that use this context and knowledge of the event to provide some exemplar services to the group and individual users.

We first introduce the platform and the method of real time event detection to interpret the user and group context. We then show three example mobile social network services that use the detected event to provide their services. Related work in event detection methods and context-aware social networking applications is reviewed, prior to discussion of issues raised during our work and potential paths for future work.

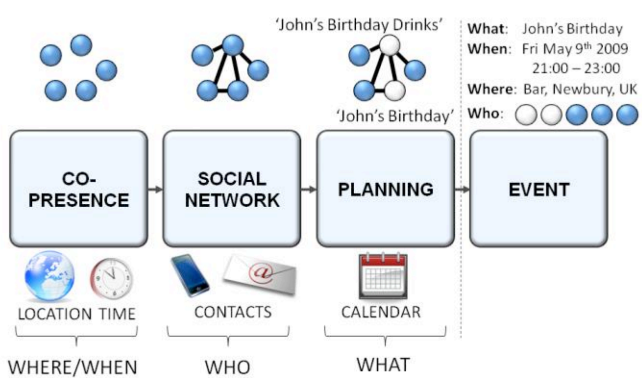

Figure 1. The process of event detection within the platform.

2. SYSTEM OVERVIEW

In order to perform the event detection process, we use some key data types that describe the characteristics of an event from the 'who', 'what', 'where' and 'when' facets used by [12], sampled from the model in [11]. We identify the event location, the start and end times, the event name and the event attenders. The data is gathered through individual mobile devices and processed by the platform for context interpretation. If an event is identified as occurring, the platform passes this information to the mobile applications for their operation.

2.1 Event Detection within the Platform

As illustrated in Figure 1, the platform undertakes a filtering process that begins in the 'Copresence' module. This module identifies users who are in the same location at the same time – users who are copresent – using location data aggregation over a given time window. Next, the list of users is passed to the 'Social Network' module that identifies social ties between the users from their device contacts book and email contacts.

The module groups the users according to these social ties and passes the groups to the 'Planning' module. Here, the calendars of the users in each group are searched for data relating to the current time. Results of this search are used to identify the current group event and estimate its duration. Finally, the user group is passed to the 'Event' module that declares the event 'ready' for the services to function.

Using the example at the top of Figure 1, if five friends are in a bar together for John's birthday, we would detect them as copresent. We could find social ties between them from their device and email contacts, and we may, for example, find an entry entitled 'John's Birthday Drinks' in one calendar with 'John's Birthday' in another. We can then identify the event as 'John's Birthday' at the bar, due to last for a certain period of time, with the five friends attending.

We have implemented this platform design on an HTTP server using PHP as the scripting language, MySQL as the data engine and a REST API interface for device communication over HTTP.

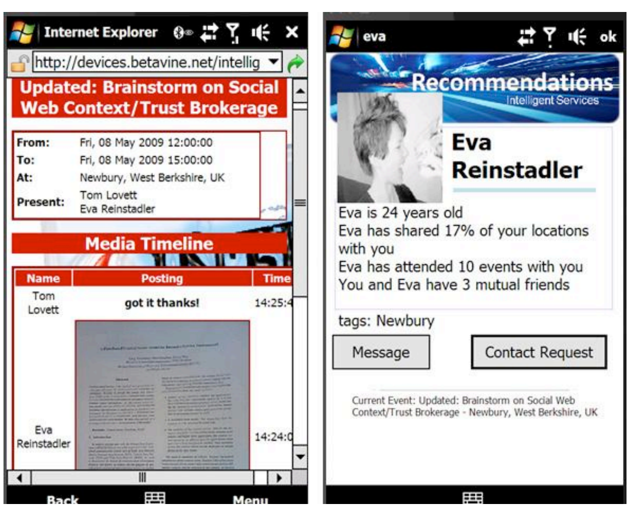

Figure 2. Device screenshots showing the web output of the event photo sharing and Twitter services (L) and an example output from the recommendation service (R).

2.2 Mobile Social Network Services

Once an event is detected, the associated context-related services can function. To exemplify and test the platform, we have designed and built three prototype social network services: a mobile photo sharing service, a people recommendation service and a mobile Twitter service. Each service is implemented in .net on Windows Mobile and has been tested on the HTC Touch HD, HTC Touch Diamond and Samsung Omnia handsets.

2.2.1 Event-Based Mobile Photo Sharing Service

This service allows the user to take and upload photographs from her mobile device to her online Flickr and Facebook accounts. The photographs are time stamped and can be uploaded during or after the event. The remote photo destinations (e.g. a Flickr URL) are stored and a web timeline is automatically created for the event with the event metadata attached; see Figure 2 (L). The photos are displayed in the timeline and are viewable by users who are identified as part of the event social network.

2.2.2 Event-Based Mobile Twitter Service

This service is modelled on the photo sharing service. Using the same methods, the user can post status reports to her online Twitter account from her device. The remote destination of the status is stored, allowing the status to be retrieved from Twitter for display to the event attenders. As with the photo sharing service, the status reports can be added to the event timeline and displayed chronologically along with the photographs. Figure 2 (L) shows an example timeline consisting of a photograph and Twitter status, with the event metadata displayed above.

2.2.3 Mobile People Recommendation Service

Designed for use both during an event and outside specific events, this service analyses various metrics output from the history of events: co-presence ratio (a measure of how often users are identified as being together), mutual contacts, personal data, shared events and auto-tags. Personal data includes information such as date of birth, taste in films, music etc. Auto-tagging creates common tags based upon event metadata and data from event attenders such as personal interests.

A list is produced of recommended people who are not currently contacts but frequently share user context i.e. 'familiar strangers' [7, 9]. The user is able to view the matches and the reasons for recommendation on the mobile device; see Figure 2 (R). She can make a request to the recommended contact and, if the contact accepts, a social tie is made between the user and contact. The details of the user and the contact are then added to each other's devices.

3. RELATED WORK

This section describes some of the related work that has informed our work on our platform and applications. Xie et al. [12] have studied the concept of event detection and mining in multimedia streams. They provide an overview of various event detection systems and discuss the role of context in relation to events. We also use data types in a similar, albeit simpler, event model to that of Westermann and Jain [11].

Detailed work on the analysis and use of social context has been undertaken by Adams et al. [1], with a section on the identification of copresence. CoMedia [6] was developed to combine real time event detection and media sharing for a better spectator experience at large scale events, while MediAssist [8], an application that identifies people in personal photo collections, uses image data to detect events as part of its context analysis.

ContextPhone [10] is a mobile platform built to enable context-aware technology such as the ContextContacts application that lets users represent and exchange presence information with their mobile device contacts. The Connector application [3] uses a series of sensors and techniques for sophisticated context detection in order to intelligently connect people. The Friendlee application [2] uses call records and contextual data to infer the user's immediate social network, before reordering the device contacts accordingly.

Shozu[1] is an application that runs on a mobile handset and facilitates mobile media sharing through many different hosts, including Flickr and Facebook. Rhub, a prototype social networking application that facilitates group communication using the device context, has been reported in an empirical study [5].

4. DISCUSSION AND FUTURE WORK

We have developed techniques that attempt to identify basic individual and group context through event detection. We have implemented a prototype platform that uses these techniques to allow our example mobile applications to provide their service.

With such a range of contextual data being processed, there are many privacy implications. At present, our services are provided within a subscriber framework, i.e. users must opt in to use them. One area of future research will be to establish a dynamic privacy model that could automatically adjust the sharing of data according to the strength of the ties in the social network.

Another area of research will consider failure management. If the system must make decisions in order to infer context then there is risk of error due to ambiguous or poor quality data, e.g. excluding copresent users due to poor location resolution. Procedures to deal with ambiguous or absent data will be investigated.

There are also questions regarding the granularity of an event. A conference is a large event, for example, consisting of smaller presentations that may also be classed as events or 'sub-events'. A distinction should be made between the two, using deeper analysis of the available contextual data.

Our platform currently tries to detect events as they occur in real time, but it would be useful to employ basic prediction methods and models with calendar data to make the platform aware of possible future events. More sophisticated means of temporal data detection could be developed, such as the monitoring of activity levels to approximate event start and end times.

Assuming the event detection process is good enough to accurately approximate the event social network, we could analyse a series of events over time in order to build a virtual social graph for each user. This could lead to more intelligent services that use social network metrics to function, as well as allowing the user to view an interpretation of their 'real-world' social network. We are also interested in short-lived self generating services that are formed during the event, and operate only when needed. Just as the event is 'created', such services would be created from templates and distributed to the appropriate event attenders for the duration of the event; prior to self removal when no longer required or the event is declared closed. Finally, we hope to use data from the platform to investigate the technical problems of media sharing within social networks, e.g. identifying on what bases a user chooses to share only certain photographs with certain people in her social network.

[1] http://www.shozu.com

5. ACKNOWLEDGMENTS

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