Outdoors Monitoring of Elderly People Assisted by Compass, GPS and Mobile Social Network*

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Abstract. We explore the use of mobile social network technology combined with modern mobile phone hardware as a platform for programming applications in the elder care area. An application that covers two use cases for outdoors monitoring and detecting disorientations of the elderly is introduced. The system leverages on standard mobile terminals (Android G1) equipped with GPS and compass devices and on LibreGeoSocial, a mobile social framework we are developing.

1 Introduction

The assisted living technology is gaining momentum in the last years [3][4], specifically in the field of caring elderly people. Most of the active care practices to assist elderly people makes them dependant and it is not cost effective. Generally speaking, assisted technology is based on simple pendants with buttons that must be pushed by users in order to activate alarms in a central system. We call these alarms passive alarms. The user then needs to wait an answer of the system to know what to do.

Currently, standard mobile terminals can show images and sounds with high quality and provide alternative user interfaces like vibration signals, voice and video that can be used to explain the user what is happening and how to solve his problem. In particular we are interested in situations where the users are disoriented in outdoor environments. In these platforms active alarms can be implemented to assist the user as soon as a problematic situation is detected. Mobile terminals that know the outdoor position of the elderly through a GPS device can be used in situations where old people get lost. In these situations alarms can be sent to caregivers who belong to the social network of the user.

This paper presents ongoing work to help elderly by using standard mobile terminals equipped with GPS and compass devices. Social network technology is used to provide support for the social environment of the user. The architecture of the mobile and social infrastructure will be described in the section 2. We detail the application that we have developed to try solve some problems relating to the disorientation of the elderly in section 3. Finally we list conclusions and the further work in the section 4.

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2 Architecture

This section describes the infrastructure designed to support applications running on Android phones and a mobile social network as a partial solution to the problem of actively monitoring elderly people in outdoors environments. We use the social network to keep in touch the user with his caregivers.

2.1 Android Mobile Phone

In October 2008 T-Mobile began the distribution in the United States of the HTC G1 mobile phone, the first one incorporating the Google Android FLOSS (Free Libre Open Source Software) operating system. Its user interface is based both on a keyboard and a touch screen that allows to swipe and scroll with the fingers. The Android mobile phone incorporates 2G, 3G, Bluetooth and WiFi radios. Its display can show big graphical and customizable elements designed for visually impaired people. It is possible to show big buttons that are easy to push, or big maps and pictures that enable lost people to locate themselves. Through a simple api, maps and pictures of streets can be incorporated in applications to assist aging people and caregivers.

The Android phone incorporates two devices for geolocation. Firstly, the GPS (Global Positioning System) apis provide latitude and longitude coordinates. And secondly, the magnetometer/compass can be used to provide direction relative to the earth magnetic poles though an api.

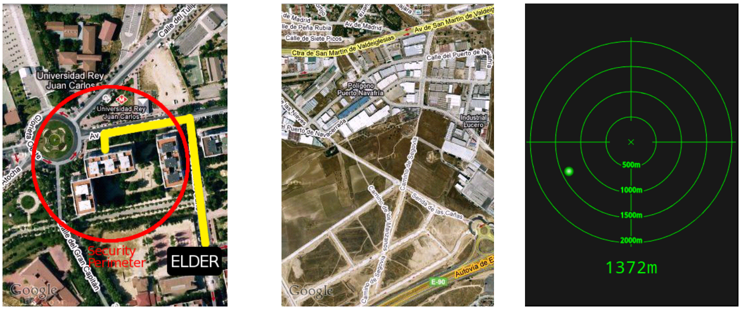
2.2 The LibreGeoSocial Mobile Social Network

Nowadays social networks are increasingly being used from mobile terminals [2] iPhone or G1 Android phones. They have big touch screens and powerful microprocessors, but it is specially the geo-location information provided by GPS what enables new interesting functionality of mobile social networks that is not available in the desktop.

We are developing a FLOSS implementation of mobile social networks called LibreGeoSocial. This social network engine is implemented in Python, providing a REST API to access information through Internet. A key feature of this social network is that all nodes of the social graph are stored alongside its geo-location coordinates. LibreGeoSocial is being designed as a generic framework that can be used to build multiple applications. Applications such as monitoring elderly people [1] are one of the targets. LibreGeoSocial provides methods for listing, adding and removing friends, consulting their location, uploading text notes and pictures, all of them geo-located. For the special requirements of elder care and in particular outdoor monitoring we are adding functionality to establish a security perimeter around the elder that can be monitored by its caregivers.

3 Outdoors Monitoring of Elderly People

The focus of this paper is to present two initial use cases (the second one, still in development) that will be used to assess the utility of the LibreGeoSocial



(a) (b) (c)

Fig. 1. (a) The way back to his house is shown when the elder is lost. (b) Scenario where street information is not relevant or unavailable. (c) The system shows a radar with the position of the lost elder.

framework in the area of elder care and in particular for outdoor monitoring. Age-related decline of cognitive capabilities and partial loss of retrospective and prospective memory can cause disorientation in elders when they are walking outdoors. We try to provide a partial solution to this problem through assisted technology based on the usage of a mobile social network, GPS and compass information.

A virtual community in the mobile social network is created containing the elder, his family, and in general his caregivers. This virtual community of people access the mobile social network functionality through Android mobile phones. Only certain prefixed members of the social network of the elder can set alarms and security perimeters around the elder.

In the first use case we assume the elder lives alone in his house and every morning takes a walk. The caregivers know the possibility that the elder gets disoriented, so they set a security perimeter around the elder's house, as shown in the figure 1(a). Periodically the elder mobile phone gets the current position through the GPS device and checks if the elder person is outside the perimeter. When the system detects that the elder person is outside the perimeter some alarms are fired. First, an urgent message is sent to caregivers through the mobile social network. They can see the exact position of the elder in a map and then call her through the phone by directly pressing a button on the screen. Then, the elder mobile begins ringing loud and vibrating, showing him a map with the way back to home, as shown in the figure 1(a).

In the second use case we want to know how far away is the elder from a particular caregiver who is actively monitoring him. Typically this situation occurs when a caregiver must monitor a group in a residence where the elder people and the caregivers are moving; in the previous use case only the elder is moving while the elder's home is static. Then, when any elder is too far away from the caregiver or from other elder people being monitored, the caregiver receives an alarm in his mobile showing the elder's position. In the elder's mobile a map appears on the screen with the caregiver position and instructions of how to reach him. All the alarms and communications are routed through the mobile social network.

In residential areas where there are no streets or where no maps are available, it is difficult to give directions to the lost elder or to the caregiver (figure 1(b)). In these situations our system uses the combination of the GPS and compass information to show the direction through a graphical element we call image radar (figure 1(c)). This system presents many limitations such as the short life of batteries when the GPS is used and that we can not ensure that the elder carries the mobile all the time.

4 Conclusions and Further Work

We have presented a partial solution based in FLOSS that assists elderly people and their families in situations where they can be lost in outdoor environments. Our solution is based in the use of a mobile social network to create a virtual community to communicate caregivers with the elder. By using the compass and the GPS of the mobile phone we can assist the elder even in situations where we can not depend on street information to provide guidance.

As future work we have begun the integration of vital sign devices in the architecture, collecting data from the Android mobile and keeping the caregivers informed through the mobile social network. We plan also to exploit other mobile devices to detect dangerous situations for the elderly such as using the accelerometer to be able to detect potential falls in the elderly. We also plan to discuss the ethical aspects of the application (when, who and how are monitored to the elderly). Finally, pilot experiments are being arranged with end user elder communities.

References

1. Chang, Y.-J., Liu, H.-H., Peng, S.-M., Wang, T.-Y.: Potential of mobile social networks as assistive technology: a case study in supported employment for people with severe mental illness. In: Assets 2008: Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility, pp. 239–240. ACM, New York (2008)
2. Counts, S., Fisher, K.: Mobile social networking: An information grounds perspective. In: Proceedings of the 41st Annual of Hawaii International Conference on System Sciences, Janurary 2008, p. 153 (2008)
3. Kleinberger, T., Becker, M., Ras, E., Holzinger, A., Müller, P.: Ambient intelligence in assisted living: Enable elderly people to handle future interfaces. In: Stephanidis, C. (ed.) UAHCI 2007 (Part II). LNCS, vol. 4555, pp. 103–112. Springer, Heidelberg (2007)
4. Nehmer, J., Becker, M., Karshmer, A., Lamm, R.: Living assistance systems: an ambient intelligence approach. In: ICSE 2006: Proceedings of the 28th International Conference on Software Engineering, pp. 43–50. ACM, New York (2006)