WallShare: A Collaborative Multi-pointer System for Portable Devices

P. Gonzalez-Villanueva, S. Romero, R. Tesoriero, J. A. Gallud
LoUISE Research Group,
University of Castilla-La Mancha, Albacete (Spain)
pedrogovi@gmail.com, {ricardo.tesoriero, jose.gallud]@uclm.es

Abstract. We introduce a new system to improve the collaboration possibilities among the participants in face-to-face meetings and working groups. The system provides a shared zone that is displayed by a projector over a wall. Users can collaborate through the shared zone using their own mobile devices, such as mobile phones, PDAs, laptops and so on. To use the shared zone, users have their own cursors that allow them to share any kind of files, such as images, or documents.

Keywords: HCI, Groupware, mobile devices

1 Introduction

Mobile devices are highly available among consumers motivating the emergence of novel interaction devices mainly on the entertainment market. Traditional devices such as keyboards, screens and mice seem to belong to an ancient age and they are being gradually substituted by new devices that support ways of interaction such as natural or gestural interaction.

Many IT researchers keep trying to answer the question of how technology can improve people life. This project focuses on how to improve the collaboration on face-to-face meetings or working groups by means of portable devices.

In this paper we present the WallShare application, a new collaborative system that is controlled by portable devices. WallShare allows mobile users to collaborate by means of sharing the same desktop to perform collaborative activities like sharing documents, images or videos in the same place at the same time.

The solution exposed on this paper is organized as follows. Section 2 describes the related work. Section 3 introduces the description of the system. Section 4 discusses some benefits and finally, Section 5 presents the conclusions and future work.

2 Related work

This work covers two research fields: The design of new interaction devices and the design of groupware applications.

From the design of new interaction devices point of view, this work covers both the software and hardware perspectives and most relevant works on this line are described in the next lines.

The ReacTable is a new tangible device based on a tabletop interface to compose music [2]. Similar devices have appeared during the last months. For instance, Touchpad Pro [6] allows users to control a pointer. However, multi-pointer is not supported.

Another alternative that follows the same goal is Control Mac [1], which uses the iPhone to control presentations remotely.

Microsoft Multipoint [3] is another similar device. It allows users to control a remote pointer using mouse devices.

In [4] an interaction system based on RFID technology allows mobile users (users with a mobile device) to interact with interactive panels. These panels are traditional information panels that were enriched with RFID tags allowing both information retrieval and updating through user gestures.

Another interesting work is the one presented in [5], where a mobile application for improving the visitor's experience in museums is described. There are similar works that claim to solve the problem of positioning a user in indoor spaces using different technologies.

From the collaborative system point of view, we have to highlight the design electronic meeting systems (EMS) [7] that allow meeting participants to perform collaborative tasks through electronic devices that are embbebed in the room.

Besides, most the mentioned work related to interaction devices is usually applied on collaborative applications.

3 System description

In this section we describe the WallShare system. We first introduce the software functionality, then we describe the architecture of the system and, finally, we expose some details about implementation issues.

3.1 System functionality

WallShare is a system based on a shared zone that is projected on a wall or screen, which is clearly visible by the participants of a meeting.

In order to interact with the system, each participant connects its mobile device to the system.

Once the connection procedure was accomplished successfully, a pointer representing the participant is shown on the wall or screen.

An interesting aspect of WallShare is the possibility of providing each participant with the capability of controlling the movement of its cursor on the screen by performing dragging gestures on the mobile device screen. Thus, users can use the mobile device as an enhanced X-Pointer device.

Therefore, connected participants can download and upload all kind of resources from and to the shared zone.

Thus, participants are able to share a resource just by uploading it to the shared space. To perform this task, users select a resource on the mobile device through the client application and upload it performing a simple gesture. When the resource was uploaded, it is shown on the screen.

In order to download a shared resource from the shared zone, a participant has to point the resource with the cursor and select it. Once the object was selected, the user has to perform a double click on the mobile device screen. As result of this action, the user receives the selected resource in the mobile device.

Figure 1 shows the shared zone with the presence of different users.

Fig. 1. WallShare shared zone with different pointers representing different users.

3.2 System architecture

The WallShare is a client-server application (see Figure 2).

Client application run on user mobile devices that is connected the server via a Wi-Fi or Bluetooth connection.

Thus, when the user gets connected to WallShare he/she receives a double feedback, a sound on his/her device and a pointer representing the user is drawn into the screen.

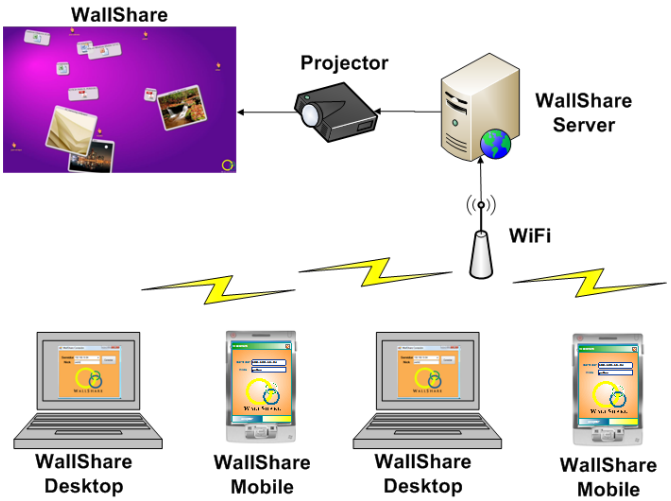

Fig. 2. WallShare shared zone.

Fig. 3. WallShare mobile client.

To access WallShare, users download and install the client application into the mobile device from the WallShare server. The client application is shown on Figure 3. This application is automatically updated whenever a new version is released in the server. The server application controls the shared zone. It manages the client connections and pointers representing each user. While the upload and download resource operations are implemented through Web Service technologies, real-time operations such as pointer movement, are managed through basic socket communication.

3.3 Implementation issues

The prototype has been implemented using mobile devices running Microsoft Windows Mobile and Microsoft Windows XP operating systems.

The desktop application has been developed using the Microsoft .NET Framework 3.0.

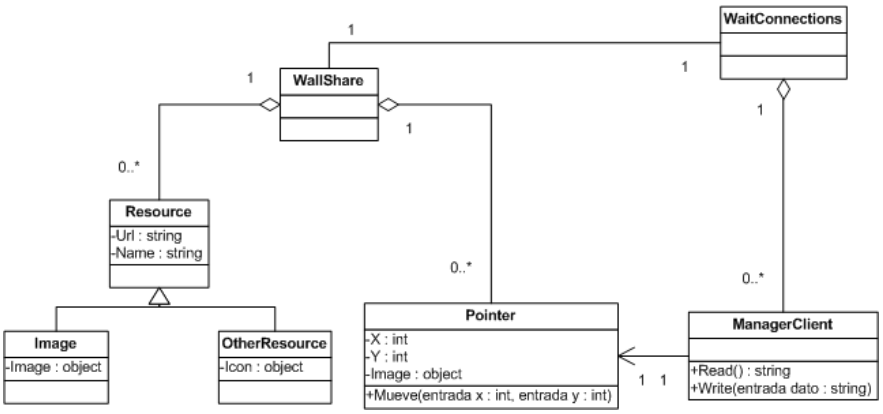

Fig. 4. WallShare class diagram (server side).

Fig. 4 shows the class diagram of the server application. The WallShare application model is composed by two main elements:

1. Resources (represented by instances of the Resource class)
2. Pointers (represented by instances of the Pointer class).

While pointers represent users on the shared area, resources represent the objects (i.e. images, text documents, spread sheets and so on) that are exchanged through the application.

Images are shown directly on the shared zone. The other documents are shown using a representative icon.

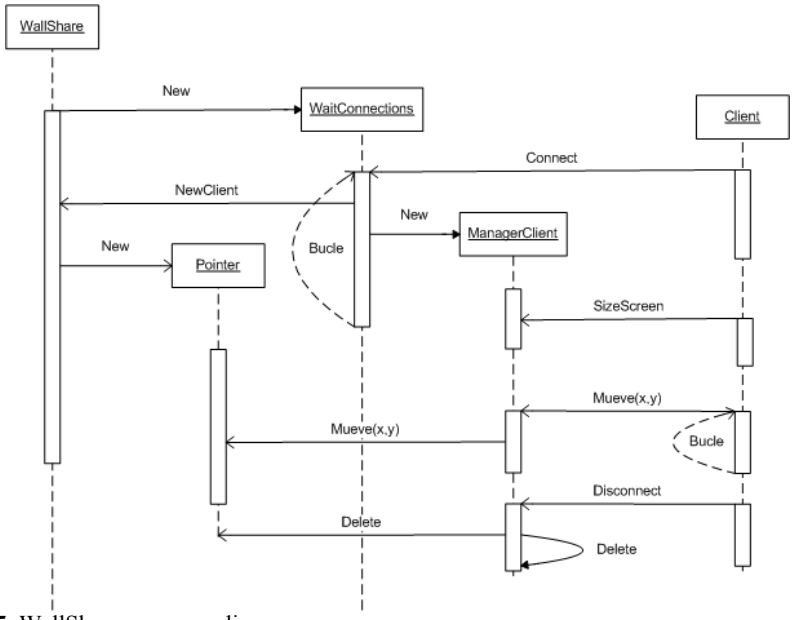

Fig. 5. WallShare sequence diagram.

The sequence diagram showed on Figure 5 explains how a connection is established between the server and a client, focusing on the connection manager object.

From hardware infrastructure point of view, the WallShare server requires a video projector, a projection zone, like a wall or a screen, a Wi-Fi or Bluetooth access point and a server machine.

The client applications can be deployed on any portable devices, such as mobile phones, PDAs, laptops and so on supporting Bluetooth or Wi-Fi connectivity. A PC with Wi-Fi connectivity support can be used as well.

4 Benefits and expected results

WallShare improves the interaction and collaboration among participants of meetings or working groups.

In particular, some remarkable advantages of this approach are the following:

- WallShare has multipointer support
- WallShare works on mobile devices and also on laptop and PC's
- WallShare extends the functionality of mobile devices
- WallShare allows users to share resources: documents, video and audio.
- WallShare is intuitive and friendly: it employs natural interaction

The response time of the system is good enough as light movements of the user's mobile pointer correspond with movements of the remote pointer in the shared zone. Actions, such as double click on the mobile device screen, are mapped to similar commands in the shared zone (select, share, etc).

The deployment of the client application is easy. It is performed downloading the application directly from the WallShare server to the mobile device.

WallShare has been tested with real users and some feedback has been obtained. This information was used to improve the first specification of the application. Besides, WallShare enhances existing proposals, such those exposed on Section 2, including the possibility to share resources, or using a Wi-Fi network to get connected to the system instead of using mouse devices.

WallShare is being tested with non technical users following the methods proposed by international standards.

5 Conclusions and future work

This paper presents an innovative collaborative system to improve face-to-face meetings or working groups.

By means of WallShare, a group of people participating in a meeting or working group could share documents using a simple gesture on his/her mobile device. WallShare has been designed, implemented and tested with real users with good results.

WallShare is one of these applications that extend the functionality of everyday devices, as mobile phones or PDAs.

Future work includes the deployment of a new version for running other platforms other than Windows Mobile.

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