View & Share: A Collaborative Media Viewing and Sharing Framework for Projector Phones

Andrew Greaves, Enrico Rukzio
Computing Department, Lancaster University, UK
{greaves, rukzio}@comp.lancs.ac.uk

ABSTRACT

The limited screen size and resolution of mobile phone screens makes it difficult to view media in a group setting. Co-present media sharing is currently not easily supported by mobile phones. Typically, media sharing is orientated around the media owner who has to perform several tasks to send a single photo per recipient. Moreover, group formation and collaboration to support media sharing is also not supported by mobile phones. Projector phones, mobile phones with integrated projectors, provide a new way to collaboratively view and share mobile media. We present View & Share, a collaborative mobile media viewing and sharing framework using such phones. Within the framework two roles are supported, the presenter of the media and the viewers of the media. The framework utilizes a viewer initiated interaction technique whereby the focus of sharing media is shifted from the media owner and performed by the media viewer(s). A presenter initiated interaction technique facilitates sharing to the entire group using an intuitive gesture. Using this technique the issue of viewing inappropriate or private content in public is solved by utilizing the personal mobile screen of each member within the group. The framework also supports the temporary sharing of the projected display for viewers without a projector phone.

1. INTRODUCTION

With the forthcoming of accessory projectors [1] (a small battery powered projector which can be connected to mobile devices) and projector phones (mobile phones with embedded pico projectors) it may be possible to dynamically project high resolution media content anywhere and potentially any size. Microvision in cooperation with Motorola [1], Texas Instruments [2] and 3M [3] are for instance currently working on accessory projectors and their integration into mobile devices. It is expected that these devices shall emerge in the market place as soon as 2010 if not before [4]. Through the advent of embedded pico projectors, the mobile phone may now become a truly mobile media rich platform that can now be used to its full potential in supporting social collaborative applications.

Several approaches to viewing media on small screen devices have been presented in the past [5, 6]. Although having such a small screen, the mobile phone appears to be an attractive platform for viewing media, specifically video [7]. From a recent study it was also apparent that in certain scenarios the mobile phone was the preferred choice even when large screens were available, for example a television [7]. Co-present viewing of pictures and video seems to be highly desirable but problematic. The result of a study by Kindberg in camera phone usage stated that most co-present image sharing regularly took place on the phone screen accounting for a third of sharing cases [8]. This type of sharing is more specifically sharing through viewing rather than sharing by direct file transfer and typically this involves crowding around the display anxiously trying to view the picture or passing the mobile phone from person to person. Using large screens in public places to display media is one possible solution however, they are often not readily available and accessible in the environment as we would want. A projector phone tackles the inherent issue of the small mobile screen for co-present viewing of media allowing multiple people to simultaneously share the viewing experience without having to crowd around the small screen. We believe collaborative co-present media viewing with friends using a projector phone will be a highly adopted scenario; specifically it permits co-present viewing without the issues identified above. Frohlich depicts that communication of experience is the main reason for sharing photos [9]. We believe that projector phones will revolutionize this overall viewing experience.

The ability to turn any potential projection surface into a collaborative display providing ‘big screen’ viewing we believe will be very appealing in many contexts not just media viewing and sharing. Our initial thought and insight into projector phone usage highlights some of the following scenarios: browsing pictures, watching music videos and films, web browsing, playing games, map interaction and content creation. This involves dynamically creating new content from existing content, for example, annotating a digital map with a hand drawn route.

Frohlich also reports that co-located sharing is a desirable activity being the most common and enjoyable [9]. However, co-present group sharing is not currently or easily supported by mobile phones. It involves a large number of user actions to simply send a single picture, it is time consuming and frustrating. Sharing using group centric semantics has been the focus of a large amount of research in the last few years [10, 11, 12]. A common approach is to use buddy lists facilitating automatic or controlled sharing within a group. Problems may arise in the event of people joining or leaving the group and the ability to omit recipients from the group or any kind of filtering may not be permitted. Furthermore, these previous approaches require the owner of the media to perform the sharing process. Repeating this rigorous process time and time again we perceive could possibly become a burden and negatively influence the owner in sharing media, the owner may become less reluctant to share.

We present a conceptual collaborative framework View & Share to support the co-present viewing and sharing of media using a projector phone. Our framework utilizes an interaction style that provides two interaction techniques focusing both on the owner of the media and the intended recipients to view and share media. Through a group sharing technique we solve the issues of co-present viewing of inappropriate or private media in a public environment. Furthermore, our framework allows individuals who do not own a projector phone to project their media.

2. FRAMEWORK OVERVIEW

Figure 1 illustrates the View & Share framework. We start by briefly describing a typical scenario and then describe the individual aspects of View & Share.

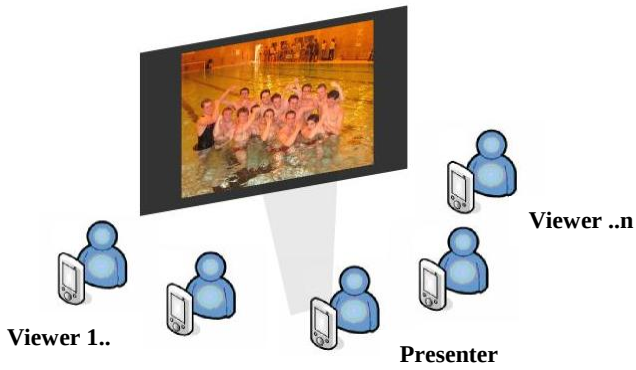

Figure 1 – The View & Share framework

Whilst in a café on his lunch break Rob takes out his projector phone and looks at the pictures he took with his friends Ben and Matt the previous evening. Whilst projecting the pictures onto a wall Ben and Matt join Rob for lunch. As they approach Rob they physically touch their mobile phones with Rob's projector phone. Rob projects a photo with Ben jumping over a wall, everybody laughs because while jumping over the wall Ben tore his trousers and this is reflected in the photo. In the height of laughter Ben performs a flick gesture using his phone indicating that he would like to receive the photo from Rob. A moment later Ben's mobile vibrates and a short tone plays indicating he has received the picture. Ben looks down at his phone to see a picture of himself jumping over a wall. To relive the experience Matt also decides that he would like a copy of the photo, shortly after pressing a button on the keypad Matt also receives the photo which is also displayed on his phone.

2.1 View & Share Roles

Within the framework users belong to one of two specific roles:

Presenter: The user with a projector phone is classified as the presenter and is responsible for projecting his or her media content for co-present viewing and sharing purposes. The formation of a group occurs when one or more viewers gather around a presenter and collaborate. It is also possible that the framework could potentially support multiple presenters who combine projections, however, at present we shall just focus on a single presenter.

Viewer: Viewers are users who view the presenter's media content and are also recipients of shared media. There shall be no limit except from technical limitations that limit the number of viewers currently collaborating. We assume that the viewers currently collaborating are friends and it may often be the case that when viewing a picture for example, the majority of viewers are actually in the picture when it was taken. This assumption provides implications for the design of privacy controls within the framework and the formation of the collaborative group as discussed below.

2.2 Establishing Collaboration

The View & Share framework permits the formation of a dynamic collaborative group of mobile users in an attempt to view and thus share media. Specifically, the framework supports a disconnected nature; viewers are free to connect and disconnect at any given time, at the point of disconnection the state of any active transfers shall be saved and resumed at a future time upon reconnection. Furthermore the framework facilitates an automatic connection mechanism for users who have previously used View & Share with a particular presenter. The presenter is the dominant role within the framework, they fundamentally control and own the projected display.

2.3 Viewing Media

View & Share supports several sources of media. This includes user captured content, images and video captured through an integrated camera. Streaming of web content, for example video clips and music videos from websites such as YouTube and also media stored on a memory card. This could include films and television shows that have been recorded, purchased or downloaded, for example through iTunes.

To view the media, the presenter simply has to browse through his or her collection of media and select it. An intuitive user interface to support easy browsing is supported by the framework. This includes the categorizing of media by content type and the provision of an abstraction mechanism for finding media. Simply, all media shall appear as a single unit stored together even though it may be physically stored in different locations on the mobile phone. Hopefully this interface provisions ease of use and limited search time in finding content. Media stored on a PC which was transferred onto a memory card with the intent to project we assume shall be stored in a hierarchy in the form of albums. The framework shall allow the viewing of this type of media using a slideshow, in this case the presenter does not have to perform continuous browsing actions.

2.4 Sharing Media

View & Share presents an interaction style that utilizes two very different interaction techniques in support of co-presently viewing and sharing media between multiple users within the group. The two techniques are described below.

2.4.1 Viewer Initiated Sharing

This is an interaction technique whereby the role of sharing, typically content owner orientated is shifted and undertaken by the viewer. For sharing to take place the viewer performs a sharing action, as described in section 2.6. When recognized the media is transferred automatically from the presenter to the viewer, see Figure 2. This interaction style provides the following benefits:

Ownership passing: The sharing of media is removed from the owner and passed onto the receiver; the owner is now able to solely concentrate on presenting the media and not about sharing, this is especially important if the presenter is busy describing a projected picture for example.

Group Sharing: Group sharing is easily facilitated allowing sharing with the entire group or specific members of the group. Potential issues with sending to a group for example if a person joins or leaves are not experienced.

Viewing experience: The projection is not obscured by dialog boxes and notifications as is the case when currently sharing media when using a mobile phone, for example when selecting a recipient.

2.4.2 Presenter Initiated Sharing

This interaction technique permits the sharing of media with the entire group on behalf of the presenter. It provides a simple and effective means to deliver content to the entire group. This is applicable in two circumstances. Firstly, to support group viewing of unsuitable or private material. In this case the material maybe either unsuitable or the group may wish to restrict the viewing to only the members of the group. Sharing is now achieved through viewing on the personal mobile screen by each viewer. Secondly, to support group media sharing if the presenter feels that everyone within the group should or interest is expressed by everyone to have a copy of the currently projected content. In this case several viewer initiated interactions are replaced with a single presenter interaction to complete the same goal.

For both interaction techniques described above it is possible to perform sharing of a single file (default case) per interaction or a batch share per interaction. The batch share prevents either the presenter or the viewer from having to continually perform a sharing interaction over and over again for related media content, this is significant when viewing photo albums.

2.5 Sharing the Projection

For simplicity within the group we assume that there only exists one presenter. A viewer can elect to push his or her content onto the projection allowing others to view and share his or her media. Access to push media content on to the display is at the discretion of the presenter. If permitted to do so the viewer acting as a temporary presenter will have control over the display. At any time the control of the display can be retained by the presenter.

2.6 Sharing Actions

In an attempt to provide an easy intuitive mechanism to share media the presenter and viewer orientated interaction techniques are performed using a user dependant sharing action. Ideally the sharing action would be capable of executing without requiring the users visual attention on the mobile phone screen and thus away from the projected display. However, this is dependent on the input capabilities the mobile device provides. We describe four possible techniques:

Keypad Based: The keypad is a very familiar input mechanism and typically consists of a joystick. Through dynamic key assignment the user can specify the trigger button that performs the transfer of media using a single button press.

Gesture Based: Sensing technologies are establishing their presence in mobile phones with access available to the developer. The Nokia N95 for instance includes a three axis accelerometer and would be an effective means in recognizing user dependant gestures. Figure 2b illustrates a viewer shaking their mobile phone. Furthermore the use of a gesture doesn't require the user to focus on the mobile phone screen. Alternatively the use of a multi-user tracking system could be used to track the movement of the mobile phone as a gesture is performed and would be applicable for capturing multiple simultaneous gestures.

Camera Based: The user could physically take a picture of the currently projected media item. The capturing of the image could be used as a trigger to indicate the intended recipient and to start the sharing process for that media item.

Touch Based: By using a NFC capable phone, for example the Nokia 6131, the physical touching of two devices could be used to share media. The act of touching is very novel and intuitive and is an unambiguous method indicting the target of the transfer as well as the intention to share.

The use of audio or haptic feedback shall be available to directly inform the user of a successful or unsuccessful interaction and to inform the user to look at the display in the case of viewing private content.

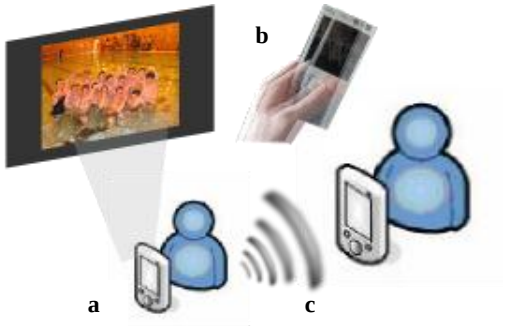

Figure 2 Viewer Initiated Sharing: The presenter projects the media (a), the viewer performs a shaking gesture to indicate the intention to share (b) and the picture is transferred from the presenter to the viewer (c).

2.7 Privacy

Viewing and sharing images typically occurs with family and friends. Within these circles privacy issues appear not to be a major concern, in the general case people feel comfortable sharing media [9]. However, we think that the framework should provide privacy controls for which the presenter can use at their own discretion. This could include the use of contact information stored in the mobile phone or localization information to determine if a user is actually within the collaborating group.

3. IMPLEMENTATION

This section describes the provisional hardware and software approach in implementing the View & Share framework. It will be implemented as a combination of Java SE to handle the backend and a Java ME application (MIDP 2.0, CLDC 1.1), these standards are very popular in the majority of modern mobile phones, in theory this allows many people to use the View & Share framework.

Currently projector phones are not commercially available, considering this we will simulate this device using the same approach described in our previous work [13, 14]. This involves connecting a small handheld projector to a laptop computer. Bluetooth shall be used to provide communication between devices within the group. This includes sharing requests, facilitating the forming of the collaborative group and to transfer media content. Transferring large media files from one device to another could potentially take some time using Bluetooth. Considering this, we shall also implement sharing using Wi-Fi.

For viewers to form a collaborative group they must first acquire the unique Bluetooth address of the presenter's phone. We propose and shall implement a Touch & Connect principle which

was recently explored using RFID [15]. Viewers with an NFC capable phone can intuitively touch the presenter's device to transfer the Bluetooth address from the presenter to the viewer which can then be used to form a connection between the two. It shall also be possible for one viewer to transfer the presenters Bluetooth address to another viewer using this principle. This allows for new members to join the group without the need physically make contact with the presenter. The N95 is not an NFC capable mobile phone however it may be possible to augment the N95 with NFC functionality [16].

To simulate future tracking technologies that we could possibly find in mobile phones we will use the OptiTrack optical tracking system [17] with the Rigid Body Toolkit. The tracking system provides 6DOF tracking information for all mobile phones currently being tracked. By augmenting a mobile phone with three passive retroreflective markers we shall be able to recognize gestures performed by the mobile phone which infer the intention to share media. Furthermore, the tracking information can also be used to recognize further gestures and interactions such as browsing media using a forward and previous approach by tilting the mobile phone. Privacy controls can also be implemented using information about the orientation of the mobile phone. For example if the mobile phone is tilted at a 45 degree angle this could imply that the user is looking at private information and in which case the projection should be disabled. Furthermore, the location of mobile phones relative to each other could indicate those who are currently collaborating from those who are not.

The presenter's custom user interface will be implemented using the Java ME Canvas class. Media shall be displayed in a thumbnail fashion organized my content type allowing for quick browsing. The JSR-75 File Connection API shall be used to provide access to media stored internally and on external storage.

4. CONCLUSION

View & Share provides an alternative interaction style using two interaction techniques in the support of co-presently viewing and sharing media using a projector phone while collaborating within a group. Projecting media from a mobile phone solves the problems of viewing pictures, video and web content that we currently see as a result of the small screen. At present, co-present group sharing is either limited or not available using a mobile phone. By performing a gesture any user in the group can intuitively share media individually using a viewer initiated technique or via the whole group using the presenter orientated technique. We also provide a solution to allow the viewing of private media by utilizing the personal mobile phone screen of each user. Projector Phones will bring great promise to viewing all types of media in a 'big screen' fashion potentially any size and place, and also provide great insight into new collaborative social applications.

In our future work we aim to implement View & Share and shall conduct a detailed comparative user study in order to evaluate the success of the framework in supporting collaborative mobile media viewing and sharing. We shall also explore the use of multiple projector phones and how the combination of more than one of these devices can provide new interaction techniques and methods of exchanging media and information between peers in a group, for example, by overlaying multiple projections.

ACKNOWLEDGEMENT

This work is supported by the NoE INTERMEDIA funded by the European Commission (NoE 038419)

5. REFERENCES

[1] Microvision SHOW Pico Projector Prototype http://www.microvision .com/pdfs/show_specs.pdf

[2] Texas Instruments DLP Pico-Projector Demo. YouTube. http://www.youtube.com/watch?v=sT1mhSRich

[3] 3M Mobile Projection Technology http://www.3m.com/mpro/index.html

[4] Meyer, D. Mobile-friendly projector debuts at CES. 7.1.2008. http://news.zdnet.co.uk/communications/ 0,1000000085,39291949,00.htm

[5] Liu, H., Xie, X., Ma. W,-Y., Zhang, H,-J. Automatic Browsing of Large Pictures on Mobile Devices. Nordic Mobile Media 2003, Berkeley, California, USA

[6] Patel, Dynal., Marsden, G., Jones, S., Jones, M. An Evaluation of Techniques for Browsing Photograph Collections on Small Displays.

[7] Kenton, O. H., M. April Slayden, et al. (2007). Consuming video on mobile devices. Proceedings of the SIGCHI conference on Human factors in computing systems. San Jose, California, USA, ACM.

[8] Kindberg, T., Spasojevic, M., Fleck, R., Sellem, A. The Ubiquitous Camera: An In-Depth Study of Camera Phone Use. IEEE Pervasive Computing Vol. 4, No. 2 April-June 2005.

[9] Frohlich, D., A. Kuchinsky, et al. (2002). Requirements for photoware. CSCW '02: Proceedings of the 2002 ACM conference on Computer supported cooperative work, ACM Press.

[10] Risto, S., V. Mikko, et al. (2004). MobShare: controlled and immediate sharing of mobile images. Proceedings of the 12th annual ACM international conference on Multimedia. New York, NY, USA, ACM.

[11] Scott, C. and F. Eric (2004). Supporting social presence through lightweight photo sharing on and off the desktop. Proceedings of the SIGCHI conference on Human factors in computing systems. Vienna, Austria, ACM.

[12] Ah Kun, L. M., Marsden, G. Co-Present Photo Sharing on Mobile Devices Mobile HCI 2007, September 9-12 2007, Singapore.

[13] Greaves, A., Rukzio, E. Picture Browsing and Map Interaction using a Projector Phone. In Proceedings of Mobile HCI 2008. Amsterdam, Netherlands.

[14] Hang, A., Rukzio, E., Greaves, A. Projector Phone: A Study of Using Mobile Phones with Integrated Projector for Interaction with Maps. In Proceedings of Mobile HCI 2008. Amsterdam, Netherlands.

[15] Kim, S., Choi, E. Y., Choi, J., Hong, J. Sung. Touch and Share: Intuitive Peer Selection. PERMID 2008,May 19th 2008, Sydney2008, Australia.

[16] Twinlinx http://www.twinlinx.com/

[17] OptiTrack http://www.naturalpoint.com/optitrack/