Demo: An Augmented Reality Based File Transfer System for Mobile Users Using Smart Phones

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ABSTRACT

In this paper, we design an augmented reality based file transfer system called ShareAR. The ShareAR system only needs a single-finger action that drags the file icon to the target face on the screen of a mobile device. The dragged file can be transmitted to the target receiver who gets the file immediately as her/his mobile device is on-line or receives the file later after connecting to the Internet. Through ShareAR, users do not need to know the target account in advance. In addition, users do not need to input account information by themselves. Furthermore, users can select a specific target among multiple candidates from the camera of a mobile device. ShareAR reveals an innovative user interface to transfer files between mobile devices. We have implemented an Android-based ShareAR system that outperforms existing schemes in experimental results.

Categories and Subject Descriptors: C.2.1 [Network Architecture and Design]: Network communications

Keywords: Augmented Reality; Cloud Computing; Face Recognition; File Transfer; Mobile Device

1. INTRODUCTION

Growing popularity of mobile devices with Wi-Fi/3G communications has made file sharing without desktop/laptop computers possible. A specific file can be immediately transmitted to other people through mobile devices. However, most of file sharing systems for mobile devices have to obtain the target's account information or session key in advance, such as E-MAIL [1], Bluetooth [2], Dropbox [3], etc. In addition, users have to input it by hands before transmitting files to the target receiver. The procedures of manual intervention may increase the time and inconvenience of file sharing between mobile devices.

Currently, Wi-Fi/3G [3, 4, 5] or Bluetooth [6] communications are usually adopted for file transfer between mobile devices. There are several limitations in Bluetooth communications. First, the distance of the sender and receiver have to be less than ten meters. Second, the target Bluetooth device has to be searched and then selected. Third, the sender/receiver has to obtain the session key and input it for device pairing. Finally, the transmission time may be quite long due to the low data rate of Bluetooth. On the other hand, Near Field Communication (NFC) has been employed to simplify the connection procedures of Bluetooth for device pairing [6]. The steps of manually searching and selecting the target Bluetooth device can be omitted by NFC. However, the sender and receiver have to put their mobile devices together. In particular, only hi-end mobile devices have built-in NFC tags.

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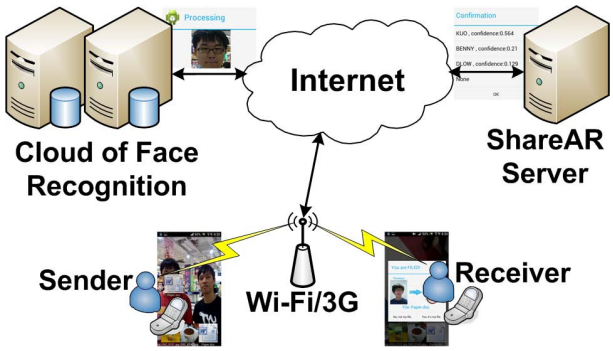

Figure 1: System architecture of ShareAR.

Similarly, there are several limitations in Wi-Fi/3G communications. First, the sender and receiver have to connect to specific Web sites or download dedicated Apps to share files. Second, the sender has to query the receiver's account in advance. Third, the sender has to input account information into Apps or browsers for sending files. It is inconvenient and time-consuming to obtain and input the target's account or file download link in existing file transfer systems [1, 3, 4, 5].

To improve file sharing for mobile users, we design and implement the ShareAR system for file transfer between mobile devices based on augmented reality and cloud computing. Users just need to drag the file icon to the target face on the screen of a mobile device. The contributions of ShareAR are four-fold. First, mobile users do not need to know the receiver's account in advance. Second, mobile users do not need to input account information by themselves. Third, mobile users can select a specific receiver among multiple candidates from the camera of a mobile device. Finally, the total consumption time of file sharing between mobile users can be significantly reduced.

2. SYSTEM DESIGN

Fig. 1 shows the system architecture of ShareAR. On the client side, mobile users use a smart phone with a dedi-

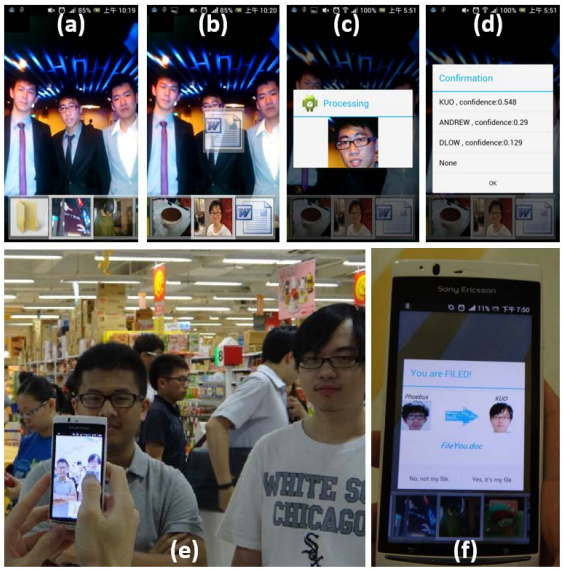

Figure 2: System implementation of ShareAR.

cated ShareAR App to login the ShareAR server through Wi-Fi/3G communications. The sender focuses the camera of the mobile device on the target receiver. Next, the sender drags the file icon to the receiver's face on the screen and then the face photo of the receiver is sent to the ShareAR server. On the server side, the receiver's face photo is forwarded to the cloud of face recognition and then recognized by the cloud servers to obtain the registered ID of the receiver. Next, the dragged file sent from the sender is forwarded to the identified receiver. The file can be immediately obtained by the dedicated ShareAR App running in the receiver's mobile device.

Using the cloud of face recognition, ShareAR can prevent users from querying the receiver's account and avoid keying account information by hands. Using the dedicated App, ShareAR can allow users to drag a file to the receiver's face on the screen in an augmented reality manner for file sharing. Using the ShareAR server, the face photo can be forwarded from the sender to the face recognition cloud for ID identification and the dragged file can be sent to the target receiver. The goal of ShareAR is to minimize the number of manual operations and total consumption time in file sharing between mobile users.

In ShareAR, the file transfer process between mobile devices is optimized as follows. First, the target face can be detected correctly as mobile users drag a file to a specific receiver among multiple candidates from the camera of a mobile device. Second, the target face can be transmitted rapidly and recognized successfully to obtain the receiver's identifier through the cloud servers of face recognition. Third, the receiver's identifier can be confirmed properly by mobile users as the target information is recognized by the cloud servers of face recognition. Finally, the file can be transmitted to the receiver even if her/his mobile device is not connecting to the Internet or without launching the dedicated App.

3. SYSTEM IMPLEMENTATION

We have developed an Android-based ShareAR system. The ShareAR App consists of file browsing and camera preview interfaces, as shown in Fig. 2(a). Users can use their

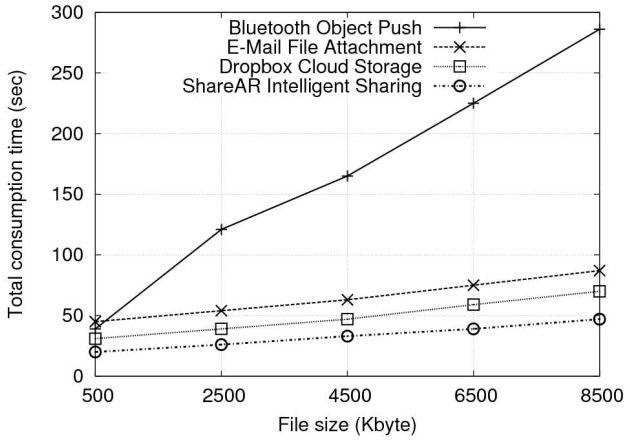

Figure 3: Comparison of existing systems and ShareAR.

fingers to press the file on the screen, drag it to a specific face from the camera, and release the dragged file on the target face, as shown in Fig. 2(b) and Fig. 2(e). To minimize the transmission and recognition time of the face photo, target face detection is implemented on the client side to upload the detected face photo instead of entire image, as shown in Fig. 2(c). For face recognition, the ShareAR server invokes the cloud APIs provided by Mashape and Lambda Labs. Using Mashape cloud APIs, the ShareAR server can send a photo for face recognition, and then receive three registrant IDs with highest face similarity. Then, the ShareAR server sends these registrant IDs returned by Mashape cloud APIs to the ShareAR App, as shown in Fig. 2(d). Once one of returned registrant IDs is confirmed as the target receiver, the dragged file can be received immediately by the ShareAR App in the registrant's mobile device, as shown in Fig. 2(f).

Fig. 3 shows comparisons of total consumption time to share files with different sizes. Each experimentation is repeated 10 times by realistic trial and we take the average value. For E-Mail [1], Bluetooth v2.0 [2], and Dropbox [3], the durations to query and input the account/session information are set to 0 and 8 seconds, respectively. Specifically, the total consumption time using E-Mail, Bluetooth, or Dropbox is a lower bound without considering the query duration that could be tens of seconds, even minutes. From Fig. 3, we can observe that ShareAR has the lowest total consumption time with all file sizes. It is because ShareAR users do not need to know and input the receiver's account beforehand, which can save large amounts of time. In contrary, E-Mail, Bluetooth, and Dropbox users need to take considerable time to obtain and input the target account.

4. ACKNOWLEDGMENT

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