Gesture-based Mobile Communication System Providing Side-by-side Shopping Feeling

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ABSTRACT
This demo is a gesture-based communication framework designed for an immersive joint shopping scenario. It focuses on enhancing the mobile human-to-human interaction between two geographically separated users: an in-house user and an in-store user. By exploring the uses of depth-based tracking techniques and the integration of head-mounted displays and the spherical camera, we (1) construct an immersive virtual shopping environment for the in-house user remaining in a house and (2) offer a novel way for the users to achieve a real-time gestural communication in the physical shopping environment which the in-store user stays in, while (3) the latter gets an augmented reality experience. Through this demo, both users could share a feeling that they go for shopping side by side in the same place.

Author Keywords
Remote collaboration, Gesture communication, Immersive shopping

ACM Classification Keywords
H.5.1. Information Interfaces and Presentation: Multimedia Information Systems.-Artificial, augmented, and virtual realities.

INTRODUCTION
Currently, mobile communication techniques and high-speed network service make it possible to keep in touch with someone in distance. Nonetheless, existing commercial video communication systems mostly only provide a capture of users' face. This places obstacles for the context of the other information like body language or the ambient, especially when a complex environment is involved, for example, a shopping scene in which usually gestural communication is needed. With only verbal description, it might be challenging for users while they want to describe objects or directions [1, 2, 3]. Such constraints make it difficult for users to get a common perception or achieve smooth interactions.

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(a) The in-house user (b) The in-house user's view

Figure 1. The in-house user has an immersive shopping experience with free hand gestural performance in the venue.

(a) The in-store user (b) The in-store user's view

Figure 2. The in-store user gets an AR experience and has a side-by-side view of the in-house user's gestures

In this demo, what we are targeting is helping the users in separated positions achieve a free hand gesture communication in a complex physical shopping environment. An in-store user walks in an actual physical environment which would be shared, like a store or supermarket, while an in-house user would like to experience a virtual shopping in such shared world (Figure 1 and Figure 2). The in-house user might have some expertise to assist the in-store user, or just need the surrounding to be part of the communication, for example, someone is unable to go outside but want to shop in somewhere far away. It finally simulates the situation that the two of users go shopping side by side in the same physical environment being supported with free hand gesture communication.

DEMO DESIGN

Immersive Shopping Experience
Different from the traditional capture techniques, with a spherical camera, the in-house user accesses the real-time shopping

Figure 3. Panoramic browsing of the shopping environment

venue with a 360°panoramic browsing, both vertical and horizontal without missed information. The in-house user wears a head-mounted display (HMD) to see and manipulates independent viewpoint naturally by head movements, just like one truly goes for a shopping (Figure 3).

Gestural Communication

For the gesture recognition, we use a depth-based approach, which allows the in-house user performs the air gestural input freely without wearing any device or sensor on hands. A depth camera attached to the front side of the HMD is to used to extract not only the rotation and orientation of the user's fingers but also the subtle changes of their spatial positions. Matching the depth data to a pair of 3D human hand models we built, the system reappears the free hand gestures of the in-house user in the virtual sightseeing precisely. Once the user changes the hand postures or moves the hands, the models change to match the same gestures almost instantaneously (see Figure 1).

The panoramic capture of store world for the in-house user includes the view of in-store user's hands and profile face. The in-house user could directly see the hand gestures of the in-store user in the scenery (Figure 4).

With augmented-reality glasses, the in-store user could see the real-time hand models of the in-house user directly, which present on the left side of the field of vision superimposing on the physical world, viewing the surrounding clear at the same time (see Figure 2). Such side-by-side perspective simulates watching the hand gestures of the partner from the side. It enhances the feeling of staying together while the in-store user still gets a good view of the physical world without being disturbed by the overlapping hand models.

Awareness Assistant

This demo supports two awareness assistants to enhance the communication: an avatar representing the in-house user and a pointing arrow (Figure 5).

Avatar

Since the in-store user could not see the in-house user in the shopping venue, we construct an avatar to help the user

Figure 4. The in-house user's view: seeing the in-store user making gestures

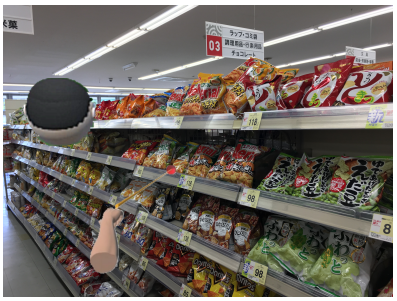

Figure 5. The visualization of the in-store user's view

understands partner's viewpoint. This avatar tracks and reveals the in-house user's head movement, showing on the left side of the in-store user's GUI.

Pointing

A point arrow is created to show the precise direction which the user is pointing at. With such indicator, the in-house user could easily show specific objects or directions in the surrounding directly to the in-store user and create potential conversation topics.

CONCLUSION

In this demo, we introduce our prototype for an immersive shopping between an in-store user and an in-house user who actually far apart. By providing free air gestural input in the physical shopping environment with awareness assistant subsystem, we realize the intuitive gestural communication for users to simulate the situation that they are together side by side in a place for shopping.

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