Painting in Public Doodle Space with Cam-Phone Brush

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Abstract

In this paper, we present a novel interactive application on public displays, Doodle Space, which allows multiple participants collaboratively painting 3D objects on a projected wall using personal cam-phones. An image based algorithm is used to estimate the movement parameters of cam phones. Users control a virtual brush naturally by moving their phones in the air. Participants' experiences show that it is intuitive, convenient and enjoyable to paint in Doodle Space by our interaction techniques.

Keywords

doodle, multiple users, movement detection, Bluetooth

ACM Classification Keywords

H5.2. Information interfaces and presentation (e.g., HCI): User interfaces

Doodle Space

Recent years have witnessed a phenomenal growth in the usage of public displays。Meantime, smart phones have been increasingly indispensable in daily life. For these two popular availabilities, we envision an ubiquitous application paradigm in which people can easily access public displays with their pervasive personal devices [1]. To explore more details, we build the Doodle Space application, aiming at enabling multiple users simultaneously doodling on public

display by moving their cam-phones. Comparing to previous works, our design combines four advantages: easy deployment, remote manipulation, nature interactive capability and high accessibility.

The Doodle Space follows a client-server model: the phone client software, which calculates the parameters of the cam-phone's movement and sends them to the server via Bluetooth channels, and the server software running on a PC, which receives messages from multiple phone clients and manages stroke rendering. Doodle Space provides two modes for users to draw: Paint Mode and Edit mode. In Paint Mode, users can draw naturally with brushes of different colors and textures, while in Edit Mode, users can reposition, scale and rotate objects represented by multiple strokes. Phone buttons are employed to switch between two modes and to choose brush attributes: texture and color. Not only can users doodle by themselves but also can collaboratively painting with others.

In order to capture phone's movement parameters: translation, zooming in/out and orientation, we track the feature points, extracted from camera image sequences, to calculate translation by implementing sparse iterative version of Lucas-Kanade optical flow in pyramids. By calculating the deviation of distances between the feature points and their center, the system detects zooming in/out for scaling [2].

Each phone client is assigned a unique Bluetooth channel to transmit information to the server, which results in no communication confliction and hence multi-user manipulation is well supported.
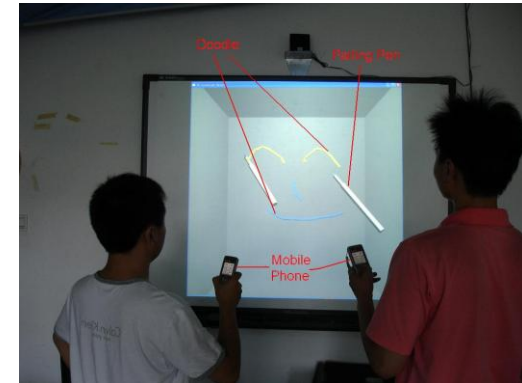

figure 1. Two people doodle a smile face with different colors on the public display collaboratively by camera phones.

When a new cam phone user wants to join in, he simply downloads the phone client software via Bluetooth and then starts it. The whole setup procedure can be completed about one minute. Participants report that it is intuitive, convenient and enjoyable for them to paint in Doodle Space using cam-phone. What's more, Doodle Space indeed creates a better chance for people, some of whom may hardly know each other before, to have fun, or even to make friends with each other.

References
[1] Jaana Leikas , Hanna Stromberg , Veikko Ikonen , Riku Suomela , Juhani Heinila, Multi-User Mobile Applications and a Public Display: Novel Ways for Social Interaction, *In Proc. Percom2006, p.66-70*

[2] Liang Zhang, Yuanchun Shi, Mingming Fan, UCam: Direct Manipulation using Handheld Camera for 3D Gesture interaction, *In Proc. ACM Multimedia'08, p.801-804.2008*