Floating 3D Video Conference

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Abstract. This paper proposes an improved algorithm based on Active Appearance Models (AAM) and applies on a real-time 3D video conference system with a novel 3D display device which can pop out an avatar out of the display in the air. The proposed algorithm utilizes an improved Adaboost algorithm [1] for face detection based on skin color information. Facial feature points are then tracked based on AAM [2] and we improved the algorithm to determine the rate of closing eyelid and the rotation angle of eyeballs. The novel 3D display device projects digital images on an actual human like object as an avatar and pops out a 3D image in the air via an optical module. With the proposed system, users can interactive intuitively with a popped 3D avatar. This system provides more realistic and representative visual effect for interaction in a video conference.

Keywords: Interaction, Floating, AAM.

1 Introduction

Human-Computer Interaction is a more important technique at this time. People hope to interact with computer via the movement of body instead of instructions. In order to detect user's movement accurately, we can utilize a sensor with special wavelength. When users attach the sensors, the system will get the movement of body by sensors and analysis it to execute the corresponding instructions. However, the attached sensors restrict the user. To avoid this, we will utilize a markerless tracking algorithm to detect the user movement and the user can interactive intuitively with system.

2 System Overview

In this chapter, we will introduce an improved algorithm based on Active Appearance Models (AAM) and Optic system. We will present the improved algorithm how to decrease the running time and detect eyes motion and the popped 3D image's features via the optic system.

2.1 Facial Expressions Tracking

Facial expression detection is an important part of Human-Computer Interaction. The system can use the result to detect the user's emotion and give him appropriate response. Active appearance models (AAM) fitting algorithm is a markerless facial

C. Stephanidis (Ed.): Posters, Part I, HCII 2011, CCIS 173, pp. 544–547, 2011.

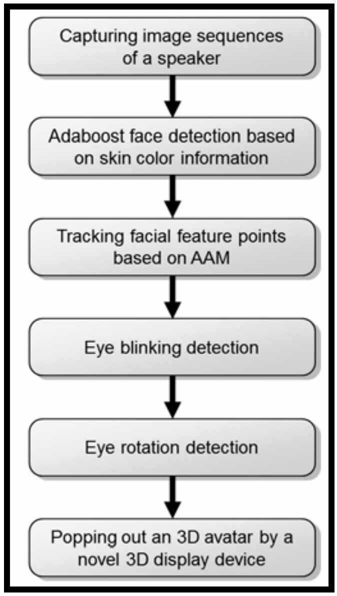

Fig. 1. The flowchart of the proposed system

tracking algorithm. Before tracking facial expressions, we have to select images with feature points and train database recording contour and color information of human faces. Utilizing the database information, system can fit the AAM to user's face and track user's facial expression by feature points. However, fitting an AAM to an image directly increases running time and error rate. The image includes not only human faces but also other things, but we only have to detect the area of human face. In order to detect the area of human face, the proposed system applies the Adaboost algorithm [1] for face detection. The detected result is often more than one candidate. Because we need to choose a candidate from the result and using this candidate to fit AAM, we will calculate the percentage of the pixel whose pixel value belongs to the range of human skin color. First, we change the image's color space from RGB to YCbCr so that we can remove the influence of ambient lighting. Second, we determine the region of human skin color in YCbCr color space. We will choose the highest candidate from the result to fit AAM. In this way, the running time and error rate are decreased substantially. However, the AAM algorithm can't track the rate of closing eyelid and the rotation angle of eyeballs. We propose a novel method based on AAM to detect eyeballs. We utilize the fitting result to get contours of eyes and calculate the gray level histogram. In order to remove the influence of ambient lighting, we set a special percent to detect eyeballs and accumulate the histogram from low to high. If the accumulative percent lower than the special percent, the value belongs to eyeball's color. In this way, we dynamic determine the threshold of eyeball's color and use the threshold to detect the rate of closing eyelid and the rotation angle of eyeballs. Utilizing information, user can do more interaction with the system (Fig.2-4).

Fig. 2. Facial expression with eyelid tracking

Fig. 3. Facial expression tracking result

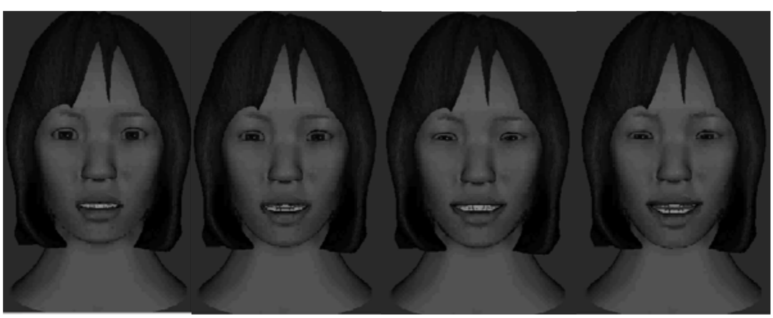

Fig. 4. Facial expression animation

2.2 Optic System

The novel 3D display device projects digital images on an actual human like object as an avatar and pops out a 3D image in the air via an optical module. Users can see the 3D image at 50 cm front of the system and interact with system. In this way, a vivid 3D object can be presented as a real image which is able to float in the air without causing crosstalk problems as traditional 3D display devices. (Fig.5)

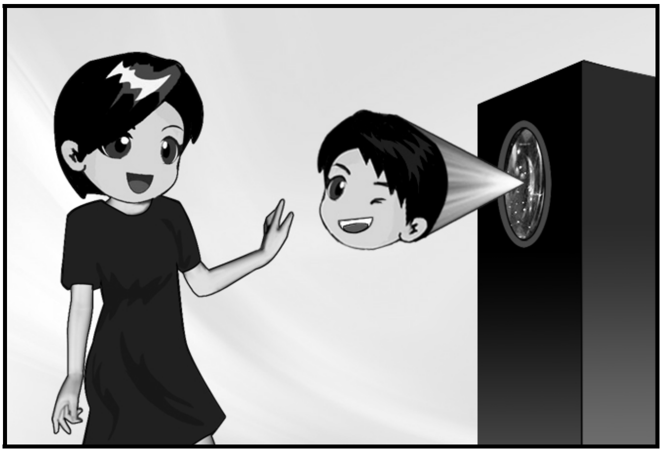

Fig. 5. Floating 3D objects presentation

3 Conclusion

With the proposed system, users can see a 3D avatar in the air without any crosstalk problems in the air and interactive intuitively with a popped 3D avatar, which is animated with facial expressions and eye rotation and blinking. This system provides more realistic and representative visual effect for interaction in a video conference.

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