Natural interaction without marks

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Abstract. In this paper we present a natural interaction system that simulates an interactive mirror behavior where a subject or object can appreciate in real time the effects of external agents over themselves and the causes or actions that trigger these effects. It is a low cost system and easy to use, personalize and configure, which makes it extensible to different operating sectors, especially on the education area for interactive demonstrations. The system does not use marks and realize the detection and projection of effects in real time. For the system development a technology was invented and developed that originated the patent request ES200901210.

Keywords: HCI, Natural Interaction, Adaptive interfaces, Augmentative reality

1 Introduction and proposal

Currently there are various devices and processes for content generation, animation or visual effects within an area bounded by the silhouette of an object or subject. These devices and processes allow the user to know, for example, the appearance of the object or the same user when certain conditions are changed. Thus, an individual can see how you feel, for example, a certain glasses without the need for physically the same, but shown on a screen would look if you use them. Similarly, are used for interaction with different types of hair, or clothing. Using this type of system has many uses in automotive to observe the internal or external appearance of a vehicle color, trim, having only a single physical element. However, these devices have the disadvantage that visual effects displayed or do not fit subjects or objects when they are in motion or for motion detection is necessary that the subject or object has certain clothing marks as a particular color, body sensors, etc. [1,2,3, 4,5,6]. Other systems use a database from images that provide reference points associated with the subject, using external devices such as "marks" the subject that identify the area where the act [7,8,9]. These systems are used for visualization of interventions with augmented reality [10]. In this case, as well as stereoscopic vision requires a preprocessing of the images again makes reference to the object / subject for gesture recognition.

The above works differs from our proposal both in the approach to transform a skeleton outline, identifying body parts and creating a vector that analyzes the amount of movement considering these parts, as in the use of techniques and filters to obtain the proposed solution (linear Hough transform, Kalman filter to track time Fourier transformer for extracting and frequency characteristics of movement, etc.).

Our proposal is based in a system that allows the application of visual effects in objects or subjects static or in movement in real time without need of marks, archiving a natural interaction between the object or subject and the input and output devices for which computer vision techniques are used to detect, analyze and apply the different visual effects on the images in real time.

As a technical advantage should be mentioned that the interaction between objects or subjects and the input and output devices its done without marks on the objects or subject, so it is non-invasive and non-intrusive. Thus the object or subject interacts with its own body and with its natural movements if it is moving.

This technology can be applied to generate content where an external observer, or the object/subject itself appreciate how act external agents or actions realized in/with/on the body. Example given it is possible to generate visual effects related with the clothes, so a subject see the aspect of a clothing on the figure and how it adjust to the movement the subject realize. It can also show aspects related to hair, inner anatomy of the human body or any other event, graphic effect or animation desired. Said events graphic effects or animations are applied on the body in real time.

For the system to function the application of different algorithms that are part of each filter implemented in the real time image processing and movement detection module is necessary. There are two fundamental filter types: detection filters and projection filters. Where the "detection" filters are: a) a filter that allows the detection of the zone occupied by the subject and b) a filter of movement that allows the detection of the subject movements/actions. On the other hand, the projection filters that had been developed are: a) halo effect, b) desaturated effect, c) show animation in subject or object zone and movement tracking effect.

All filters are initialized with a series of parameters that can vary according to conditions of light, size and effect to achieve. It is possible to include from 1 to n filters and configure them. For visualization, they are again scaled to the adequate resolution for the used output device in each case.

2.1 Case of application: ACTIMEL functionality demonstration

The system allows the application of visual effects on objects or static or moving subjects in real time without the need for marks.

The main objective in the case of ACTIMEL product demonstration is to show how the digestive system of a person before and after drinks a given liquid substance, so the person can see in the output device an animated visual effect of the body insides. Then the subject is placed in the scenario and positioned in front of the camera taking as reference the display in front of the LCD projector that the subject interprets as if it were a mirror. The subject image is projected. Then apply the detection subject filter, by cutting the background figure. This mask is used as a reference subject to filter visual effect "desaturated", creating the impression in the subject of a loss of color, which is imaginary interpreted as a possible dehydration. Then the subject must perform the action of drink the liquid, for which grabs a bottle and brings it to the mouth. This action is detected by the movement mask filter. Drink action is interpreted by the start and end pre-selected positions points in the frames, as noted above in the explanation of the filter operation. When detecting the action, it triggers the application of the visual effect animation playback filter within the subject area and motion tracking. Within the area of reproduction, the desired animation is shown, for example, a ball falling through the body and its expansion into of the body (drop down the throat to the intestine and there are expanded), as shown in Figure 1. The subject can move on stage and the animation will follow your movement and will readjust to its size thanks to the previous filter. When this animation ends, it triggers the next filter, the "halo" visual effect, where a colored halo draws the silhouette of the subject with predefined characteristics, such as shown in Figure 2. At all times the subject can move in the scenario and the effects are adjusted to their movements. This is because the image analysis and processing are made frame by frame in real time.

Fig. 1. Projection of animation effect with automatic adaptation to the user's characteristics.

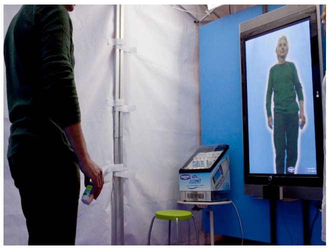

Fig. 2. Effect "halo" projected on the user

Validity was determined from the laboratory to the implementation of the system on the market with different user profiles (child, adult, senior) and different effects on their image. The sample consisted of 34 individuals aged between 10 and 60 yr, 12 women and 22 men. The tests gave highly satisfactory results in terms of robustness of the system and user satisfaction regarding its use. Moreover, the Mirror Effect system was put on the market in May 2009 at the Mall ALCAMPO La Villa, La Orotava, and Tenerife. It is estimated that an average of 100-130 people made use of the system per day during the months in operation. Between May 2009 and July 2010 the system was taken to various shopping malls in the island of Tenerife (Carrefur, ALCAMPO La Laguna, etc..) and on the island of Gran Canaria, obtaining similar results in their reception. Moreover, the company found DANONE Canary increases Actimel product sales during the promotional periods.

3 Conclusions

In this article we have presented a system that allows the application of visual effects on objects or static or moving subjects in real time without marks through the following detection filters: a) a filter object that allows the detection of the area occupied by the object and b) a motion filter that allows detection of movements or actions developed by the object.
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