EffecTV: a real-time software video effect processor for entertainment

Kentaro Fukuchi[1], Sam Mertens[2], Ed Tannenbaum[3]

[1]The University of Electro-Communications
1-5-1 Chofugaoka, Chofu-shi Tokyo, JAPAN
fukuchi@megaUI.net
[2]Vecna Technologies, Inc.
5004 Lehigh Ave / College Park, MD 20740 USA
smartens@vecna.com
[3]Crockett, CA 94525 USA
et@et-arts.com

Abstract. EffecTV is a real-time software video effect processor based on motion detection and image processing techniques. EffecTV was released in 2001 as an open source software, and has been growing the number of features and effects through contributions from the open source community. EffecTV has been used for various purpose - desktop toy applications, by visual jockeys (VJs), in theatrical plays and other stage performances. In this paper, we describe the implementation of EffecTV and some case studies.

1   INTRODUCTION

EffecTV[1] is a real-time effect processor runs on a usual PC with a video capturing device. It has more than 40 amazing effects based on various image processing and motion recognition techniques and employs some estimation algorithms (also known as "DEMO" code) to achieve real-time processing.

EffecTV processes a video input from a video camera connected to the PC in real-time, and the users can experience themselves on a display with various visual effects. Most effects are designed to reflect motion in a captured image, therefore, the users move their bodies to get more exciting visuals.

By default, EffecTV accepts 320x240 pixels digitized video input in 30 frames per second (FPS), the same as standard (NTSC) video input, and outputs images in the same screen size and FPS with a low latency. The latency depends on the hardware and has not been measured precisely yet, but we estimate it at less than 1/15 second, because both digitizing process and visual effect process costs at most 1/30 second.

EffecTV detects the motion of the participants in front of the camera and it is used to process a visual effect. Normally, the participant interacts with EffecTV only via the camera to enjoy visuals. EffecTV requires an additional device, however, such as

---

[1] The first version was released in 2001 with only 8 effects, and increased the number of effects under continuing open source development.

a keyboard or a joypad, to change the effect. In some cases, the effect can be changed periodically with a timer.

2 VISUAL EFFECT

We introduce a few of the visual effects for EffecTV. These effects were very popular for various situations and have high interactivity.

Fig. 1. Screenshots of QuarkTV, RadioacTV and OpTV.

- QuarkTV

QuarkTV makes a dissolve effect: a moving object is broken up into dots. Fig. 1 shows only the moving hands were affected, while the other part of the body and the background were not.

- RadioacTV

RadioacTV creates a spreading light effect surrounds moving objects (fig. 1). To detect the motion in input images, the last frame is used as a background frame against the current input frame and the difference of luminosity between those two frames is recognized as the motion.

- NervousTV

NervousTV is similar to QuarkTV, but makes a comical motion effect. NervousTV has 32 frames ring buffer and stores the last 32 input frames. For every output frame, it selects a frame from the buffer randomly. As a result, a sequential action is broken up and instead resembles a very quick or "nervous" action

- OpTV

OpTV is a combination of the real-time visual effect and an optical art (fig. 1). OpTV generates an animated black and white optical pattern (e.g. swirl, stripes, circles), and applies an exclusive OR operation to the image and a binarized input image.

3 CASE STUDIES

Since 2001 we have had a number of installations and demonstrations. We found there were different problems and achievements for different situations. We categorized those situations to some cases described in this section.

3.1   Interactive Toy

In this case, a camera aims to participants and the participants see themselves with a visual effect on a screen. Because the effect reflected their motion, they were encouraged to move their bodies to get more exciting results. We installed this style of EffecTV configuration in various settings. Here we describe three typical locations.

3.1.1   Open-air musical event

We had two installations at open-air musical events near Mt. Fuji in August and September 2003. We installed a video projector with a 4x4 meter screen, and an infrared camera to capture the image during the all-night dance event. An operator sat behind the screen and occasionally changed effects.

In this situation, the visitors tended to interact with their friends to show actions that had particular visual effect results to each other. Often they found new actions to achieve more funny results. For example, a visitor began juggling some balls in front of the screen, while other visitors performed a mock kung-fu fight like in some video games or TV animations.

3.1.2   Museum

We had a 4 days exhibition of EffecTV at Aoyama, Tokyo. EffecTV was installed in a small room and we used a video projector with a 2 meters height screen, showing a full-sized image of the visitors. The difference from the previous open-air situation is that the visitors were not as active in interacting with the installation. But, when an individual found a trick to achieve an interesting visual, he or she tended to show the trick to his or her friends.

This experience showed us that EffecTV serves not only as interaction between a human and computer, but also as interaction between humans. Sometimes the audience was not interested in EffecTV, but in their friends or a complete stranger to them; in those situations, the attention was on the impromptu performer, not on EffecTV. We believe this is one of the important characteristics of a good entertainment system.

3.2   Stage Performance

We installed screens on stages and video cameras aimed at performers on the stages. EffecTV was used to enhance the visual of performers and the operator controlled it along the progression on the stage. We describe 3 typical cases of this setting.

3.2.1   Visual Jockey

Visual Jockey (VJ) is a term used to represent a person who create live visuals based on a music, like a DJ (Disc Jockey) does to create live sound. Basically VJs perform pre-recorded visuals to display onstage. Recently some VJs have started to use real-time effect to enhance the visuals of musicians on the stages. Whether a musician was playing the guitar, drumming, or scratching the turntable, every motion was useful to create visuals synchronized to the music.

3.2.2 Dance Performance

We used EffecTV to enhance a dance performance on a stage in "Hatena 5th" party at Shinjuku Loft, March 12, 2004. A dancer in front of a screen performed on the music and EffecTV created visuals from the performance and was displayed on the screen. We mainly used OpTV for the visual.

We introduced a new visual effect called the "mirroring effect" which displays the mirror image of the dancer with the optical effect as seen in most fight of fig. 1, and it created the illusion that there was another dancer of the optical graphics on the screen, and both dancers interacted with each other.

3.2.3 Theatrical Play

EffecTV was used to add some special effects to a play on the stage in "Shitsuon (Room temperature)"(Kera, 2001) at Aoyama Round Theatre. The play was a kind of horror story, and the special effects were intended to frighten the audiences. Three screens were installed around a round stage and a video camera was set beside the stage. EffecTV used to add some visuals to the actors' motion.

Conventional visual effects for a play do not reflect the action of the actors, but put a pre-recorded video clip on the stage. The visual is synchronized to the action on the stage by the operator's control, and sometimes that synchronization is lost by an unexpected motion or poor timing. By contrast, our visual effects are created from the action of the actors directly; therefore there is no synchronization problem. Furthermore, there is no requirement to put any additional sensing devices such as an RF emitter on the actors to capture his position or pose.

4   RELATED WORK

Ed Tannenbaum's "Recollections"[1] series traces the participant's silhouette and creates an animation based on the recorded motion of the silhouette. He noted "[this artwork] is completed by the viewer; it is a collaboration. Even the most inhibited people seem to rise to the occasion and create beautiful images." We observed that the same thing happened during installations of EfecTV.

"p1k53l"[2] is an open platform to provide interoperability between real-time video processing software. We plan to port EffecTV's effects to the platform.

ACKNOWLEDGEMENT

We thank all EffecTV developers and users for their active contributions.

REFERENCES

1.   Recollections. http://et-arts.com/reco.htm.
2.   p1k53l http://www.piksel.no/