CHILDREN OBSERVATION SUPPORT SYSTEM USING MULTIPLE CAMERAS COSS-MC

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ABSTRACT

In this article, a children observation support system using multiple cameras, named COSS-MC, is proposed. The purpose of COSS-MC is to observe children in kindergartens and nursery schools. COSS-MC uses multiple video recorders. Each recorder records the children’s environment from one direction. Furthermore, all cameras record motion pictures simultaneously. After recording, schoolteachers can select appropriate segments and build one streaming video for each child. COSS-MC consists of three main parts: the capturing part, which captures the motion picture and records the time and camera ID of the capturing operation; the editing part, which edits the sequences of motion pictures and builds one streaming video title; and the distribution part, which distributes the edited video stream on the Internet. We have finished developing a prototype of COSS-MC on a Linux operating system. An electronic bulletin board system (BBS) is combined with the video stream in COSS-MC.

KEYWORDS

Streaming Video, Video Editing, Bulletin Board

1. Introduction

This article deals with a proposal for a state-of-the-art children observation support system in kindergartens and nursery schools.

Currently kindergartens and nursery schools are required to improve the quality of childcare. Services to the parents are among the most important ones, and live motion picture distribution has now become popular. In order to distribute a live motion picture, a web camera and motion picture server are used. A web camera is usually installed a classroom or playroom. Captured motion pictures are distributed by the server. Parents can watch the motion picture on personal computers or mobile phones. By using a live motion picture distribution service, the parents can watch their children at anytime.

A conventional motion picture distribution service distributes motion pictures continuously. Therefore, inappropriate pictures are sometimes distributed. Furthermore, nursery teachers often said that they felt observed by the parents. Additionally, usually
only one camera is installed in a live picture distribution system, and the camera angle is fixed. **COSS-MC** is equipped with multiple cameras. All cameras capture motion pictures from different angles, and all cameras are synchronised. Therefore by comparing all motion pictures, teachers can watch the children’s activities from various viewpoints at the same time. Furthermore, COSS-MC has a motion picture editing tool. Before distributing the motion picture, the user of **COSS-MC** can edit the motion picture stream. The editing tool can connect the fragments of the recorded motion picture. Users select the appropriate fragments and connect them to create one motion picture stream.

This article first describes the general architecture of COSS-MC. Then details of each component are shown. Finally, the state-of-the-art technology and future plans will be explained.

2. Brief summary of **COSS-MC**

This section briefly describes **COSS-MC** from a technical point of view. Figure 1 illustrates the architecture of **COSS-MC**. There are three tools in **COSS-MC**.

![Figure 1. Architecture of **COSS-MC**](image)

The first tool is called the **capturing tool**. This tool captures the motion picture. The capturing tool consists of pairs of handheld video recorders and laptop computers. Each video recorder is connected to a laptop computer. Each laptop computer stores the captured motion picture. Motion pictures are recorded as sequences of short-term fragments. From the start of recording, the laptop stores all motion pictures as sequences of fragments.

The second tool is called the **editing tool**. This tool edits the sequences of the motion pictures. As mentioned previously, all motion pictures are recorded as sequences of short-term fragments. Therefore the term *edit* in this system means the rearrangement and connection of appropriate fragments of motion pictures. The edit tool selects and connects the fragments of motion pictures end to end and builds one video stream.

The third tool of **COSS-MC** is named the **distribution tool**. This tool manages and distributes the edited motion pictures. Distribution is conducted
through the Internet. Any participant can watch the motion picture with PCs or mobile phones that support motion picture play.

3. Details of parts of COSS-MC
3.1 Capturing Tool
As described in section 2, the capturing tool consists of video recorders and laptop personal computers. Currently four video recorders are used to capture motion pictures. Each video recorder is connected to a laptop computer. All captured motion pictures are stored in the laptop computers. Each laptop has one software switch. Figure 2 is a dialog window of this software switch. Each laptop has its own switch. In this figure, (1) is a selection of the length of the motion picture fragment. Currently, one, two, three and five minutes are selectable. (2) is the start button for the capturing system itself, (3) is the button to stop capture, and (4) is the button to start capture.

![Figure 2. Dialog window of software switch](image)

The capturing system continuously stores the motion picture. Because the file size of a long motion picture is enormous, each one is divided into certain intervals. The length of the interval can be controlled with (1) in the dialog window shown in Fig. 2. Each divided short-interval motion picture is called a “fragment” of the motion picture. When the capture button ((4)) is clicked, the time will be recorded. All recorded times will be sent to the editing tool after capturing is finished. The editing tool will use this time information for rearrangement of the fragments of the motion picture.

3.2 Editing Tool
The editing tool provides the editing function for the motion picture. As mentioned in section 3.1, all motion pictures are recorded as sequences of fragments. Therefore the main function of the editing tool is the rearrangement and connection of fragments of the motion picture.

Figure 3 shows the look and feel of the editing tool. This tool runs on a web browser. There are three panes in the editing tool. They are the date and group setting pane, the editing pane, and the comment pane. Figure 4 is a conceptual illustration of the editing pane. As shown in the figure, users select the appropriate fragments of the motion picture by clicking the radio button. After the selection of appropriate scenes, all fragments will be connected. Then a new single streaming video will be generated, and this generated video data is sent to the distribution server.
3.3 Distribution Tool

The distribution tool is a normal streaming server with electronic bulletin board support. The bulletin board system is connected to the streaming video. People who access the streaming video can submit comments in the bulletin board system. The system stores all comments and uses them for retrieving an appropriate scene in the video data. Figure 5 shows the user interface that the distribution tool provides. The right half of the interface provides the bulletin board system and the lower left area (shown as a black rectangle in Fig. 5) shows the streaming video.

4. Prototype Development

A prototype was developed on a Windows server. One of the key functions is the connection of selected motion picture files. In order to develop the prototype quickly we used free software named asfbin, which connects the ASF and WMV files. Because asfbin runs on the Windows operating system, all software was developed on Windows using the PHP programming language. Table 1 is the list of software used in development. The size of the software is about 6000 lines.
Table 1. List of software

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<th>Name of software</th>
<th>Version</th>
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<td>phpSQLiteAdmin</td>
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</table>

5 Experiments and conclusion
5.1 Experiment
In order to evaluate the functions, some experiments were conducted. The following four cases were set.

Case 1: Two cameras were used. The experiment duration was three hours, and the capture button was clicked 10 times.

Case 2: Three cameras were used. Experiment duration was two and a half hours, and the capture button was clicked six times.

Case 3: Two groups of cameras were formed. Each group included two video cameras. Recording time was 2 hours 45 minutes, and the capture button was clicked eight times.

Case 4: After the Case 3 experiment, all four cameras were merged into one group. Recording time was two hours, and the capture button was clicked four times.

After the experiment, some comments were collected. In all cases, the software worked correctly. No trouble occurred while capturing and editing.

5.2 CONCLUSION

In this article, children observation support system with multiple cameras named COSS-MC is proposed. In this system, multiple cameras are used for recording the activities of children. All recorded data are divided into certain fragment. After recording the video data, the user such as the teacher of nursery school or kindergarten can edit the recorded data. The editing is simple: only selecting the appropriate fragments of video data and connects them. The edited video data will be distributed by web server. Guardian such as parents and other teachers can observe the video data and discuss the childcare by watching the video.

Currently, the prototype system of COSS-MC is under construction. From the April of 2007, this system will be used in some kindergarten and nursery school. Furthermore, COSS-MC will be used for the class of kindergarten teaching education department. Students of the department can discuss by using the real video data.

References
