

# Video Recommendation System that Arranges Video Clips Based on Pre-defined Viewing Times

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**Abstract.** The popularization of video-viewing systems enables both adults and children to endlessly watch countless video clips. But such long-time video viewing might cause health problems especially for children, but rule-making tendencies are weaker among video-viewing systems than for watching television. Children have difficulty voluntarily curbing their watching of rich video clips because they are so attractive. In this study, we propose a video recommendation system that arranges video clips based on pre-defined times to support parental-mandated video-viewing stops. Our proposed system enables parents to limit the video-viewing time in advance and provides video clips that are arranged to finish exactly at pre-defined times. In this paper, we targeted adults to confirm the effectiveness of our approach. The results suggest that our proposed system increases post-viewing satisfaction.

**Keywords:** Childcare · Recommendation system · Motivation · Smartphone · Voluntary

## 1 Introduction

Smartphones are becoming a childcare support device used by parents. For example, they often give their smartphones to children as a video viewer, which even toddlers can control to watch YouTube videos by themselves. In fact, in Japan as of March 2014 the diffusion rate of smartphones among adults in their 20s was 83.7 % [1]. They are also spending more time on the internet than watching television [2]. Their lifestyles are also changing their childcare styles.

However, giving smartphones to children is creating several childcare issues. It is difficult to assume that children will voluntarily curb their smartphone use. Eyesight

might be harmed by long-sustained smartphone use, which is one serious problem for both parents and children. Even if parents set rules to prevent long-sustained use, such a tendency is more weakly applied to smartphone use than watching television [2]. Japanese mothers are relatively reluctant to intervene in the television-watching habits of their children [3]. The number of children using smartphones is also increasing more and more. It is also difficult to realize punctual smartphone use by children and planned stops. The unlimited contents provided by smartphones are too enticing for children. Such video contents are generally used with smartphones by children [2]. In this study, we propose a system with which parents can limit the duration of the video content watched by children on smartphones, tablets, and other digital devices in a video-viewing context.

Our study has three objectives. Objective one, providing uninterrupted viewing for children. For example, our system engages children's attention while their mothers are busy with housework and unable to give attention to their children. Objective two, children should stop viewing at a pre-set time. Children have difficulty turning off smartphones, and parents often fail to set rules to prevent long-sustained use. Therefore, our system encourages children to stop watching videos. Objective three, they must be satisfied. Although it is also possible to mandatorily stop video-viewing, we disagree with such a method.

## 2 Related Works

Many video recommendation systems have been studied. For example, Deng et al. [4] proposed a personalized video recommendation system based on cross-platform user modeling. Xu et al. [5] proposed a personalized recommendation algorithm for online contents including videos and predicted user interest based on attention times to online contents acquired by eye-tracking. These systems improved recommendation accuracy and provided many suitable videos to users. In contrast, we propose a recommendation system that considers waiting time to discourage children from excessive video viewing.

Some research has focused on the time limitations of video-viewing. CastOven [6], which is a microwave oven with a LCD display that enables people to watch videos while they are cooking dinner, automatically delivers media contents for leisure time. Although they focused on the time limitations of video-viewing, they didn't focus on the video-viewing ending time. We focused on the ending time and self-motivated video-viewing stops for children.

## 3 Voluntary Stop Support

As mentioned in the introduction, parents are concerned about preventing long-sustained video viewing for various health concerns for their children. Without usage rules for smartphones or other digital devices, many children will constantly use them. We believe that one factor that explains why children cannot stop video viewing is the well-designed recommendation systems of video-sharing websites, whose

endless recommendations are designed to encourage more video-viewing based on viewing histories. If we stop using such well-designed systems, children might stop watching videos; however, such an approach would not encourage voluntary stops and children would not be satisfied. We must consider the satisfaction of both parents and children.

Based on these considerations, we developed a system with two approaches to support parental-mandated video-viewing stops. In one approach, a system displays to users appropriate videos that respond to their viewing times. Our proposed system, which reduces endless video-viewing by establishing automatic time limits, is the opposite of existing video recommendation systems that encourage video-viewing. In our second approach, our system makes a video playlist based on keywords and video-viewing time durations input by a parent and provides playlists to children. This function is elaborated in Sect. 4. Our system encourages voluntary stops within limited times set by parents.

## 4 System Architecture

Figure 1 shows the architecture of our system that uses the YouTube API to show videos to children. This system consists of a controller for parents and a viewer for children. First, the controller sends requests to the viewer to make playlists based on inputted keywords and time durations controlled by parents. Second, based on such information, the viewer searches for appropriate video candidates by accessing YouTube. Finally, the viewer makes an appropriate playlist, which includes videos based on keywords (Fig. 2). The controller and viewer are directly connected to each other, i.e., a peer-to-peer approach. Moreover, we use HTML and JavaScript to build a platform-independent system. The parents control the playlist properties through the system, which has functions to control the volume and to search for candidate videos using keywords and time durations through YouTube’s API. Since the system shows a

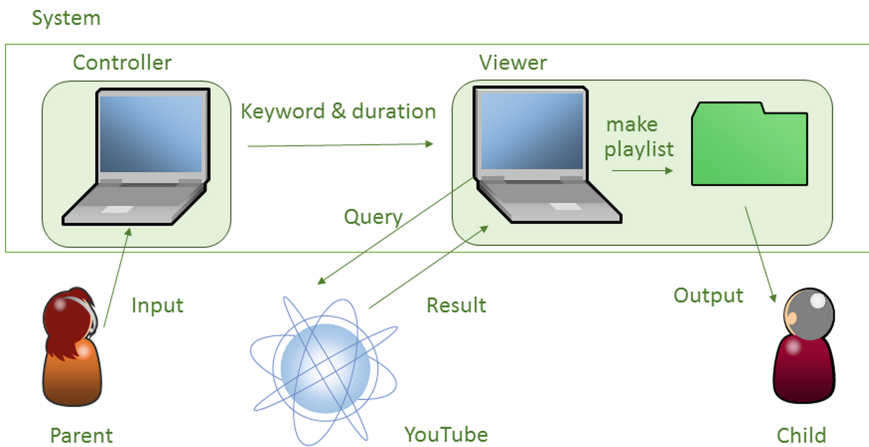


Fig. 1. System architecture

Duration = 10 (minutes)



Fig. 2. Example of playlist

snapshot image of the video being played on the controller, parents can stop the video if its content is inappropriate. The system displays the duration and the playback status of the playlist in the controller. Parents can determine the remaining playback time and decide when the playback will end. For this purpose, the system stores the current playback time and a playlist’s ending time. Figure 3 shows a snapshot of our system.

The system also has a function that dynamically remakes the playlist if network delays or video interruptions occur by storing the current playback and the ending times (Fig. 4). If such stoppages happen and the end time of the playback exceeds the playlist’s inputted time duration, the system remakes the part of the playlist that was played-back after the interruption and compares the playback’s ending time and the playlist’s inputted time duration when each video playback is almost finished. If the playback’s ending time exceeds the playlist’s inputted time duration, the system remakes it and restarts its playback. Since users cannot detect such remaking, they can still enjoy seamless playlist playback. The ending time of the playback doesn’t exceed the time duration of an inputted playlist.

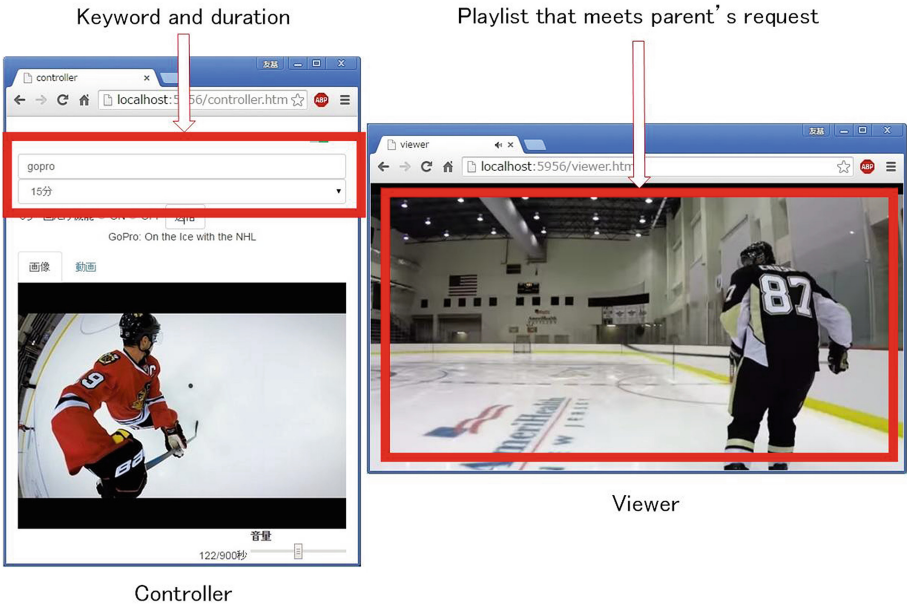
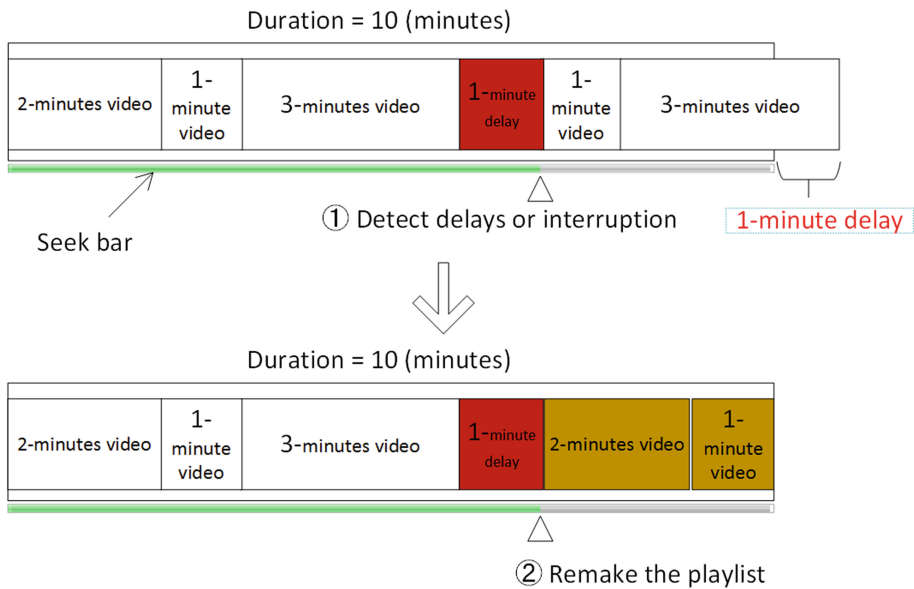


Fig. 3. Snapshot of system



**Fig. 4.** Remaking playlist due to information delays

## 5 Experiment

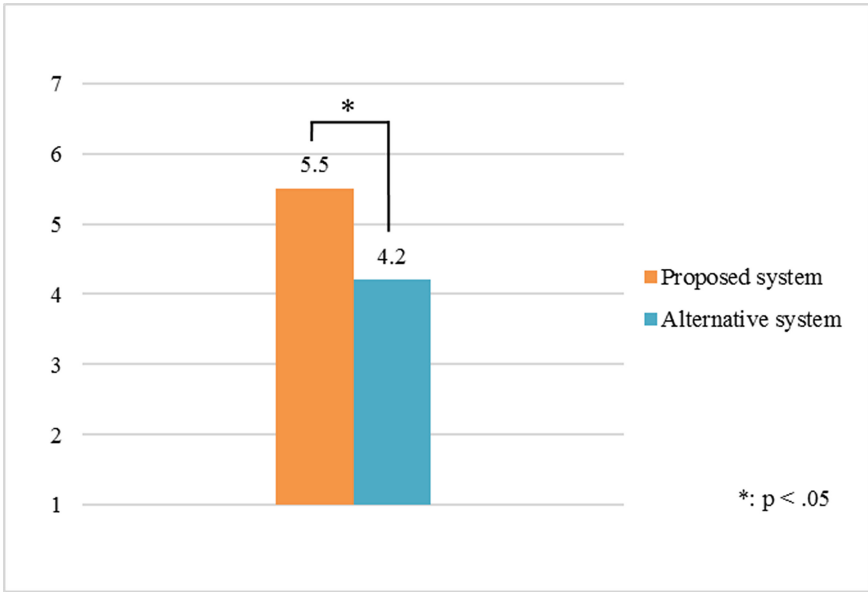
We experimentally targeted adults to confirm our approach's effectiveness. Our participants were 22 college students who viewed videos for ten minutes with both the proposed and alternative systems. Our proposed system makes a playlist based on the inputted time duration and its playback ends at a specified time. The alternative system makes a playlist without considering the inputted time duration and playback doesn't end at a specified time. Instead, users of the alternative system are told the end of video-viewing during playback by the experimenter. Our experiment examined whether participants are satisfied with the video-viewing ending time. To investigate their impressions, we prepared the following 7-point scale questionnaire item and a free description form.

- Were you satisfied with the video-viewing end-timing?

We evenly split the participants into two groups. One group used the proposed system first, and the other used the alternative system first. Participants didn't know whether they were using the proposed or the alternative system. The video-viewing time was ten minutes. They could freely input video search keywords. After they finished using each system, they answered the 7-point scale questionnaire item and a free description form.

## 6 Results

Figure 5 shows the questionnaire item results for which we conducted a paired t-test. We identified a significant difference among the conditions ( $t(21) = -2.493$ ,  $p = .021$ ,  $d = 0.72$ ), indicating that participants were satisfied with the video-viewing ending time.



**Fig. 5.** Questionnaire item: Were you satisfied with the video-viewing end-timing? (Color figure online)

We gathered much free description feedback that contained many favorable remarks about the video-viewing ending time, including “The ending time of the video-viewing was good,” and “The ending time felt neither too quick nor too slow.”

## 7 Discussion

### 7.1 Implications

We experimentally verified the effectiveness of our proposed system that encourages video-viewing stops. It received favorable feedback about the ending time of the playback: “The playlist ended with nice timing” and “The ending time of the playback was good, because it was nicely timed as the video finished.” Participants seemed to have such feelings because the proposed system made a playlist based on the inputted time duration and its playback ended at a specified time. The alternative system condition received much negative feedback: “I didn’t like being forced to stop viewing in

the middle of a video” and “I wanted to see the rest of the video.” Participants seemed to have such feelings because they were told the end of video-viewing while they were watching the video. These results suggest that our proposed system creates good ending time for viewing and increases post-viewing satisfaction.

## 7.2 Limitations

We also got much feedback about the similarity of the displayed videos. Our system doesn’t include identical videos in a playlist and it doesn’t evaluate such contents. Although some children will repeatedly watch the same video, the viewing motivation of adults might decrease. Future work will consider video contents when making playlists.

In addition, we got feedback about the poor relationships between the inputted search keywords and the displayed videos. Two main causes might explain this problem. First, there were not enough suitable videos for the inputted search keywords on YouTube. The duration of videos often depends on keywords, and if the time duration of many well-related videos to the keywords exceeds the set times of playlists, the candidate videos don’t include enough appropriate videos. If there are insufficient well-related videos, YouTube includes poorly related videos in the search results. The system also includes the result in the playlist and displays videos that are unrelated to participant demands. To prevent this problem, we must consider not only a keyword but also a category that provides broader information about user demands while the system makes playlists. The system also uses too many candidate videos to make a playlist. Candidates consist of videos that are ranked in the top 100 YouTube search results, and low-ranked videos are often poorly related to keywords. As a result, playlists sometimes have too few well-related videos that depend on keywords. To prevent this problem, the system must decrease the number of candidate videos for making playlists. If it decreases the number of candidate videos, playlists are more likely to have many well-related videos.

If the number of candidate videos is insufficient, a playlist is more likely to have many well-related videos, but the temporal accuracy of making playlists decreases. Machines face difficult problems achieving good balance between increasing the satisfaction level of playlists and temporal accuracy.

## 7.3 Future Work

Future works will investigate the effects of video durations and the number of video contained in a playlist toward children’s satisfaction. In our experiment, since the system randomly selects videos and makes playlists based on pre-set times, no effects of video duration and number were revealed. Moreover, using the video-viewing history of each child to control playlists might be useful to find appropriate videos. By gathering and analyzing these data, our system could make improved playlists. Related to this topic, sensing children’s emotions and behavior might be useful for personalizing videos services. If children are strongly interested in specific videos, the system might recognize them and change playlists.

Another future work is to investigate our system's social acceptance. Shiomi et al. reported that the social acceptance of childcare support systems with sensing or robotics technologies is lower than such popular childcare support technologies as anesthesia during labor and baby food. But they also reported that the experiences of actually using new technologies increased their social acceptance [7]. We believe that the social acceptance of our proposed system will be relatively low during its initial situations, but the actual using experiences will also increase it.

## 8 Conclusion

We developed a system that restricts children's video-viewing based on parental time limitations and focused on video viewing using YouTube. Our system, which consists of a controller for parents and a viewer for children, makes and shows an appropriate playlist based on keywords and time durations input by parents. Unlike traditional recommendations for video-viewing systems, our proposed system arranges video clips based on pre-defined times to support parental-mandated video-viewing stops.

In this paper, we experimentally targeted adults and identified a significant difference among the conditions, proposed and alternative system, in satisfaction with the video-viewing ending time. This result indicates that our proposed system increases post-viewing satisfaction needed to encourage voluntary stop of video-viewing. We are set to experimentally target children and their parents and verify the effectiveness of our proposed system.

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