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Dynamic Backlight Scaling Optimization

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Abstract: With the increasing variety of mobile applications, reducing the energy consumption of mobile devices is a major challenge in sustaining multimedia streaming applications. This paper explores how to minimize the energy consumption of the backlight when displaying a video stream without adversely impacting the user's visual experience. First, we model the problem as a dynamic backlight scaling optimization problem. Then, we propose algorithms to solve the fundamental problem and prove the optimality in terms of energy savings. Finally, based on the algorithms, we present a cloud-based energy-saving service. We have also developed a prototype implementation integrated with existing video streaming applications to validate the practicability of the approach. The results of experiments conducted to evaluate the efficacy of the proposed approach are very encouraging and show energy savings of 15-49 percent on commercial mobile devices.

Keywords: Energy-efficient optimization, dynamic backlight scaling, multimedia streaming applications, cloud services, mobile devices.

I. INTRODUCTION

With the increasing variety of mobile applications, reducing the energy consumption of mobile devices is a major challenge in sustaining multimedia streaming applications. This paper explores how to minimize the energy consumption of the backlight when displaying a video stream without adversely impacting the user's visual experience. First, we model the problem as a dynamic backlight scaling optimization problem. Then, we propose algorithms to solve the fundamental problem and prove the optimality in terms of energy savings. Finally, based on the algorithms, we present a cloud-based energy-saving service. We have Also developed a prototype implementation integrated with existing video streaming applications to validate the practicability of the approach. The results of experiments conducted to evaluate the efficacy of the proposed approach are very encouraging and show Energy savings of 15-49 percent on commercial mobile devices.

Mobile consumer-electronics devices, especially phones, are powered from batteries which are limited in size and therefore capacity. This implies that managing energy well is paramount in such devices. Mobile devices derive the energy required for their operation from batteries. In the case of many consumer-electronics devices, especially mobile phones, battery capacity is severely restricted due to constraints on size and weight of the device. This implies that energy efficiency of these devices is very important to their usability.

Hence, optimal management of power consumption of these devices is critical. Modern high-end mobile phones combine the functionality of a pocket-sized communication device with PC-like capabilities, resulting in what are generally referred to as Smartphone. These integrate such diverse functionality as voice communication, audio and video playback, web browsing, short-message and email communication, media downloads, gaming and more. The rich functionality increases the pressure on battery lifetime, and deepens the need for effective energy management.

II. LITERATURE SURVEY

Privacy is an enormous problem in online social networking sites. While sites such as Face book allow users fine-grained control over who can see their profiles, it is difficult for average users to specify this kind of detailed policy. In this paper, we propose a template for the design of a social networking privacy wizard. The intuition for the design comes from the observation that real users conceive their privacy preferences (which friends should be able to see which information) based on an implicit set of rules. Thus, with a limited amount of user input, it is usually possible to build a machine learning model that concisely describes a particular user's preferences, and then use this model to configure the user's privacy settings automatically.

Even though the Social Networks today, have the restrictions on the users who can post and comment on any user's wall, they do not have any restrictions on what they post. So, some people will use the indecent and vulgar words in commenting on the public posts. Providing this service is not only a matter of using previously defined web content mining techniques for a different application, rather it requires to design ad hoc classification strategies.[1]

This article we investigate energy-efficient offloading policy for transcoding as a service (TaaS) in a generic mobile cloud system. Computation on mobile devices can be offloaded to a mobile cloud system that consists of a dispatcher at the front end and a set of service engines at

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the back end. Particularly, a transcoding task can be executed on the mobile device (i.e. mobile execution) or offloaded and scheduled by the dispatcher to one of the service engines in the cloud (i.e. cloud execution). We aim to minimize the energy consumption of transcoding on the mobile device and service engines in the cloud while achieving low delay. For the mobile device, we formulate its offloading policy under delay deadline as a constrained optimization problem. We find an operational region on which execution mode, that is, mobile execution or cloud execution, is more energy efficient for the mobile device. For the cloud, we propose an online algorithm to dispatch transcoding tasks to service engines, with an objective to reduce energy consumption while achieving queue stability. By appropriately choosing the control variable, the proposed algorithm outperforms alternative algorithms, with lower time average energy consumption and time average queue length on the service engines. The proposed offloading policy can reduce energy consumption on both mobile devices and the cloud jointly, which provides guidelines for the design of green mobile cloud.[2]

III. MOTIVATION AND PROBLEM STATEMENT

A video stream comprises a series of image frames. An intuitive way to reduce energy consumption is to treat a video stream as a collection of images and dynamically change the backlight by applying backlight scaling techniques to each image frame individually. However, in most video applications, the dimmest backlight level may vary significantly across consecutive frames, so changing the backlight abruptly over a number of frames may result in flickering effects and affect user perception. To resolve the issue, some approaches determine the backlight level for an image frame by considering the preceding frame's pixel values and backlight level. The scope of this project is to make an application that reduce the backlight of the screen and reduce the energy consumption of mobile device when streaming the video ,without users visual experience.The scope of this document will be limited to describing features of the software and constraints to be met, and therefore will not go into detail on any specific programming languages, development tools or design specifications. The final output of the project will be a dynamic backlight optimization engine. This optimization engine will use video frames similarities i.e. SSIM which includes luminance, contrast and structure similarities. For determining appropriate backlight levels of video. To develop an cloud based application that minimize the energy consumption of the backlight when displaying a video stream without impacting the user's visual experience.

IV. EXISTING SYSTEM

The drawback of this strategy is that switching the backlight level frequently may introduce interframe brightness distortion. Furthermore, the hardware requires some time to react and adjust the backlight, so it is necessary to reduce the frequency of backlight switching. To this end, the approach in groups the image frames of a video and determines a common backlight level for each group. As a result, the backlight of a scene may be changed suddenly if the frames comprising the scene are partitioned into different groups. In contrast, the approach in quantizes the number of backlight levels to eliminate small backlight fluctuations during a scene, and thereby prevents frequent backlight changes. The drawbacks of existing heuristics result primarily from determining the backlight level of each image frame based on only its adjacent frames (and itself), instead of having an overall consideration based on all the frames in a video. Approaches based on heuristic or empirical studies cannot provide a rigid theoretic framework for dynamic backlight scaling optimization.

V. PROPOSED SYSTEM

We model the problem of dynamic backlight scaling optimization that imposes three scaling constraints on the backlight changes over image frames. Second, we propose algorithms to solve the fundamental problem with different combinations of the constraints. The solution involves determining the appropriate backlight levels for image frames without violating the concerned constraints. We prove that the algorithms are optimal in terms of energy savings when the energy consumption is a strictly increasing function of the backlight levels. Third, we have deployed a cloud-based energy-saving service On a dedicated machine, where the proposed algorithms serve as the key technology for the service. We have also developed a mobile application program for Google's Android to validate the practicability of the approach studied in this work. When the program is installed, HTC Desire Smartphone can achieve a significant energy reduction (15-29 percent) when browsing video streams on YouTube, but users are not aware that dynamic backlight scaling is being applied. The experimental results provide further insights into dynamic backlight scaling on mobile devices for multimedia streaming applications.

VI. SYSTEM ARCHITECTURE

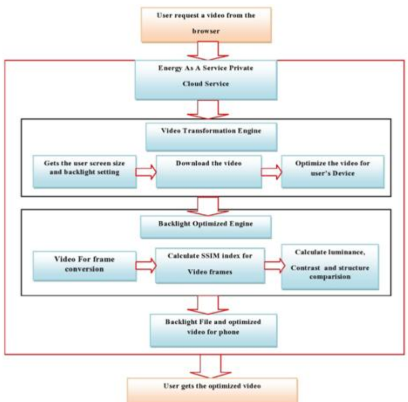

Fig 1 System Architecture

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We present respective scaling constraints that reflect some physical characteristics of video distortion, user perception, and hardware limitation. A streaming video comprises a series of N image frames, displayed in succession at a constant rate. Each image frame is represented by a grid of pixels. The perceptual luminance intensity of a pixel shown on a display subsystem is proportional to the product of the backlight level and the pixel luminance. The pixel luminance does not have a noticeable impact on the energy consumption2, but the backlight level is a decisive factor. Therefore, dimming the backlight level while limiting the image distortion or compensating for the loss of the perceptual luminance intensity by increasing the pixel luminance is considered an effective way to save energy for image display on mobile devices. A number of image distortion metrics and compensation techniques have been proposed to limit image distortion and/or maintain image fidelity of a single image.

Figure 1 shown above system architecture of our proposed system.

The basic fundamentals of dynamic backlight scaling optimization are divided into three parts user request, video transformation engine and backlight optimization engine. They discussed about the optimization of video for mobile application as per requirements. This parts are work together for the final desired output which gets after all the process.

1. User Request video from Browser

Users request a video from browser to cloud server along with the device configuration.

2. Video Transformation Engine

2.1 Download video on cloud server

Download the video from YouTube which link send by the user and store on the cloud server.

2.3 Gets the users screen size and backlight settings

Gets the users screen size and backlight settings of the user device.

2.4 Optimize the video for User's Device

Once got the screen size and backlight settings convert the video in to suitable formats.

3. Backlight Optimization Engine

3.1 Video to Frame Conversion

Downloaded video is spilt into number of frames for applying backlight optimization algorithm.

3.2Perform dynamic backlight scaling optimization on cloud server

Once the video is downloaded then apply the dynamic backlight scaling optimization algorithm Using this algorithm find SSIM index by comparing the Two frames of the video SSIM contain 3 parameters like three parameters as luminance, contrasts and structure. SSIM index is used for changing the brightness of the video.

4. Download video from Cloud Server:

Now user can download video from cloud server with optimized video along with the backlit file.

5. Manage database of uploading and downloading of video:

Manage the downloading and changing the brightness of the video on cloud server.

6. Minimize energy consumption of Users Device:

Using this algorithm save the Energy savings of 15-49 percent on commercial mobile devices.

VII. ALGORITHM

Algorithm1:

Video Distortion and User Perception Solve a restricted version of the dynamic backlight scaling problem

Input: A frame set F with critical backlight levels c (), a set of backlight levels B with power model P(), and a differential ratio r.

Output: A feasible assignment σ

Begin

Step 1: $\sigma \leftarrow c$.

Step 2: $Q \leftarrow F$.

Step 3: while $Q \neq \emptyset$ do.

Step 4: fi ← remove from Q a frame with the highest level

Step 5: if fi-1 € Q then.

Step 6: $\sigma[i-1] \leftarrow \max(\sigma[i-1], \mathrm{MinLv}(\frac{\sigma[i]}{1+r}))$

Step 7: if fi+1 € Q then

Step 8: $\sigma[i+1] \leftarrow \max(\sigma[i+1], \mathrm{MinLv}(\sigma[i] * (1-r)))$

Step 9: return σ

End

We propose an optimal algorithm to solve a restricted version of the dynamic backlight scaling problem. We consider only the distortion and differential constraints, and set the duration parameter d at 1. The algorithm will demonstrate the basic idea used to deal with the differential constraint when we solve the general version in a subsequent section.

Given a frame set F with critical backlight levels c ( ), a set of backlight levels B with power model P ( ), and a differential ratio r, Algorithm 1 determines a backlight assignment σ without violating the two scaling constraints. At the beginning, each frame is initially assigned with its critical backlight level.

Throughout the algorithm, we maintain a priority queue Q that initially contains all the frames in F, keyed by their current backlight levels. We repeatedly remove from Q a frame fi with the highest backlight level until Q is empty.

Whenever frame fi is extracted, its backlight level is determined and will never change. Then, the two adjacent frames, fi-1 and fi+1, are examined whether their backlight levels should be updated.

Algorithm 2:
Video Distortion and Hardware Limitation To solve another restricted version of the dynamic backlight scaling problem.

Input: A frame set F with critical backlight levels c ( ), a set of backlight levels B with power model P ( ), and a minimum duration d.

Output: The energy consumption for a feasible assignment σ.
Begin
Step 1: For i ←1 to N + d do
Step 2: T[i] ← ∞.
Step 3: return E (N + d).

Procedure E (i).
Step 1: if T[i] < ∞ then
Step 2: return T [i].
Step 3: If 1 ≤ i ≤ d then
Step 4: T [i] ← i * P (max1≤k≤i c(k))
Step 5: else
Step 6: T [i] ← minmax(1, i-2d)≤ j ≤ i-d {E(i)+NumFm (i , j) * P (maxj ≤ k ≤ i c(k))}
Step 7: Return T[i].
End

We present a dynamic-programming algorithm and its polynomial-time implementation to solve another restricted version of the dynamic backlight scaling problem. In this version, we consider only the distortion and duration constraints, and set the differential ratio r at ∞^3.The algorithm will demonstrate the basic idea of how we deal with the duration constraint, as used in a subsequent section to solve the general version.

Let E (i) be the minimum energy required to display first i frames in F without violating the two scaling constraints, provided that a backlight change is allowed at the subsequent frame fi+1. For ease of presentation, we introduce blank frames and append them to F. The critical backlight level of each blank frame is set at 0, i.e., c (i) = 0; ∀fi > N. It is assumed that the blank frames do not consume any energy regardless of the backlight levels applied to them.

VIII. ADVANTAGES OF SYSTEM

1) The use of this project can result in powerful services that can minimize the brightness of video without users visual impact.
2) It can save the energy of mobile devices.

IX. CONCLUSION

This paper proposes an approach that minimizes the energy consumption incurred by the backlight when users access i with the highest multimedia streaming on mobile devices. Specifically, the approach exploits backlight scaling and models a fundamental optimization problem with scaling constraints (to limit image distortion, reflect hardware limitation, and consider user perception).
To solve the problem, we propose two algorithms, and prove that they are optimal in terms of energy savings when the energy consumption increases strictly with the backlight levels. To validate the practicability of our approach, based on the algorithms, we have deployed a cloud-based energy-saving service, called the dynamic backlight scaling service, on a dedicated machine We have also implemented a mobile application program that enables Android smart phones to access the energy-saving service.

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