USER-ADAPTIVE MOBILE VIDEO STREAMING

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ABSTRACT

We describe the design of a mobile streaming system, which optimizes video delivery based on dynamic analysis of user behavior and viewing conditions, including user proximity, viewing angle, and ambient illuminance.

Index Terms — video coding, mobile video streaming, DASH, viewing distance, visual acuity, contrast sensitivity.

1. INTRODUCTION

The eventual destination of visual information rendered on mobile screen is the user who is looking at it. However, user viewing position may vary (see Fig. 1). User position affects the viewing angle and visibility of information on the screen. Ambient illuminance may also change significantly (see Fig. 2.). Ambient illuminance affects contrast ratio / dynamic range of visual information delivered to the user. Finally, user attention may also change dynamically, as he could be multitasking, distracted, etc.

In this abstract we show that many such factors and characteristics can be dynamically estimated and used for minimization of the bandwidth and power consumption of mobile video streaming applications.

2. DESCRIPTION OF PROPOSED TECHNOLOGY

We show the architecture of the proposed design of a mobile video delivery system in Fig. 3. As is customary for adaptive streaming systems, we apply simulcast encoding of video at multiple rates and resolutions [1]. These encodings are further segmented and stored on an HTTP server. We also produce and store an MPEG-DASH description file for these encodings [2]. The streaming client, residing in a mobile phone (UE) initiates a streaming session, parses this file, and then dynamically selects encoded segments to achieve continuous media delivery and playback.

In order to adapt to viewing conditions, the client uses sensors of the mobile device, including the front-facing camera to detect the presence of the user, his proximity, pose, and viewing angle. It also estimates illuminance. Using these estimates, as well as display characteristics, it then computes the range of visible spatial frequencies. This is done by using the contrast sensitivity function (CSF) [3]. This information is subsequently used to select sufficient resolution for the next encoded segment. In cases when the client detects that user is absent or not looking at the screen, the client stops playback of video while continuing normal delivery of the audio track.

We show that by using combination of these techniques our system can reduce bandwidth usage, increase battery life, and ensure consistent quality of user experience.

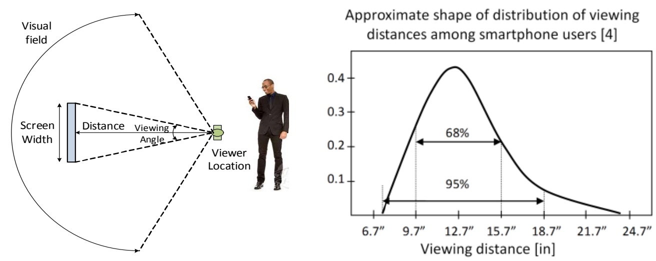

Fig. 1. Characteristics of mobile viewing setup.

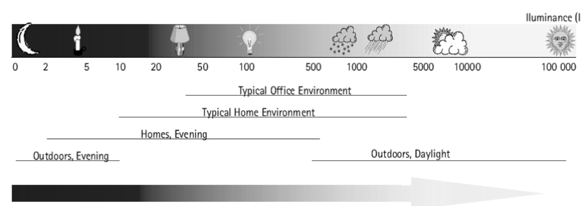

Fig. 2. Ambient illuminance in different viewing environments.

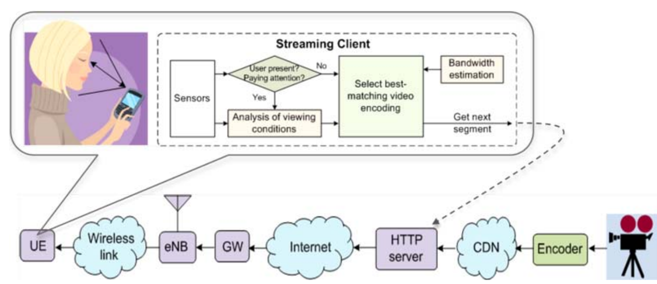

Fig. 3. Proposed adaptive mobile video streaming system.

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