Demo: *El-pincel* - A Painter Cloud Service for Greener Web Pages

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ABSTRACT

Due to their thin size, vivid colors, high contrast and power efficiency, OLED and its variants such as AMOLED screens are increasingly replacing traditional LCD screens in mobile phones (eg. Google Nexus One, Samsung Galaxy S phones). However, the power efficiency of OLED screens greatly depends on the luminance and colors of the displayed contents on the screen. Web browsing is one of the most widely used applications in mobile devices. We demonstrate our cloud service, which intelligently re-paints the web pages in real-time with *power efficient colors* and *tone mapping techniques* without adversely affecting the user experience in reading the page and the identity of the page. *El-pincel* service does not add any additional overhead (processing, energy…) to the mobile device.

Categories and Subject Descriptors

H.5.2 [User Interfaces] Screen Design; I.3.2 [Computer Graphics] Graphics Systems; I.4.3 [Image Processing] Enhancement

General Terms

Design, Human Factor, Performance, Measurement

Keywords

Power Management, Tone Mapping, OLED Display, Color Wheel, Human Visual System

1. SYSTEM DESIGN

The components of *El-pincel* are shown in Figure 1. The Client Analyzer gets information about the client such as client device type, screen type (eg. LCD, OLED), screen size, client's remaining battery power, user specific requirements (eg. power save aggressiveness), the page requested.

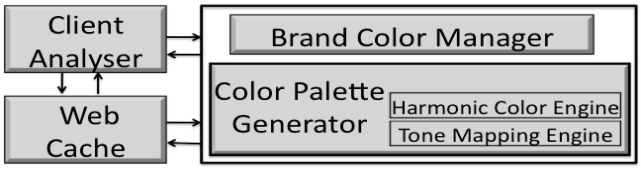

Figure 1 Components of *El-pincel*

The Brand Color Manager gets the key image (eg. favicon, logo) associated with the page request and generates one or more base colors for the page using the following algorithm.

Algorithm Color_Pick:

1. *Create a RGB histogram of the key image.*
2. *Quantize to 4096 web safe colors (256x256x256) colors.*
3. *Rank the colors and select the top 'n'.*
4. *With RGB_Power model [*Figure 2*], select 'm' colors from 'n', which are power efficient.*

These 'm' colors are *base colors*.

The Color Palette Generator selects a color from 'm' *base colors* based on the requirements from Client Analyser (ep. level of power saving required). Then using the color wheel [Figure 3] it selects set of monochromatic (from types I,V,T) and complementary colors (from types I, Y, X) for the color palette [1]. The monochromatic colors are used as background colors and the complementary colors are used as foreground colors to ensure sufficient *chromatic contrast*. These colors are used to generate new CSS after assuring W3C recommended amount of *achromatic contrast* between them for good legibility.

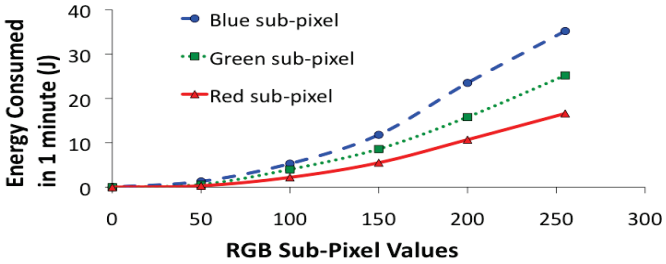

Figure 2 RGB Pixels Power Model(Google Nexus One- OLED)

The dynamic range of images is reduced to appropriate level using *tone-mapping techniques* without loosing *image fidelity*. The entire page is rendered using new CSS. Using the RGB power model total power consumption of the page is computed and approximated to client's screen size. If it satisfies the client's requirement, the page with new CSS is sent the client. If not, the search is repeated with next higher/lower power consuming *base color*.

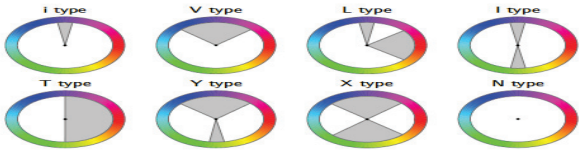

Figure 3 Color Wheel (Types)

2. RESULTS

Results for a sample mobile pages is shown in Figure 4.

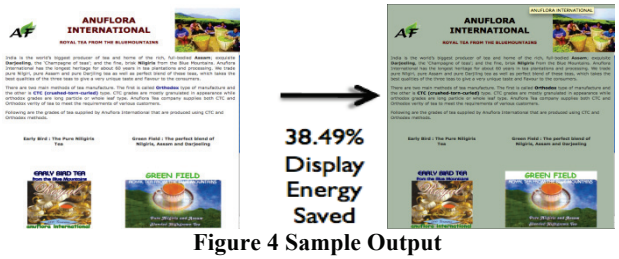

Figure 4 Sample Output

Work-in-progress: Converting Video, Flash and other contents. Adapting to other display type. User study to evaluate quality.

REFERENCES

[1] Daniel Cohen-Or, Olga Sorkine, Ran Gal, Tommer Leyvand, Ying-Qing Xu, Color Harmonization. *Proceedings of ACM SIGGRAPH 2006.*

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