Representing large visual contents in wearable ambient environments

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Motivation

Ambient environments are characterized by invisible computational power in everyday appliances populated by intelligence mobile and wearable devices. Many information contents to be communicated in ambient environments are still of visual nature. Although the aspect of ambience might not any longer require conventional screens, providing large amounts of information is still a domain of this traditional kind of User Interface.

This publication provides an overview about the properties of the different browsing approaches for large raster contents in wearable ambient environments. It is well known that wearable devices are subject of *limited computing power, bandwidth, screen space* and *means for user interactions.* This imposes critical issues, which have to be addressed throughout all phases and aspects of the development of applications and services. This publication identifies these issues related to representation of raster image contents regarding the following factors:

- The appropriateness of the image representation
- The resource requirements

Due to their applicability to other visual media, the proposed statements advance the understanding of, and contribute towards, Universal Access in Ambient Intelligence.

Image browsing with wearable devices

User Interfaces for image browsing should be designed to provide the user with contents he is currently interested in. Beside an *appropriate representation* of the contents, they often provide sophisticated *means for interaction* to allow their adaptation of his interests. The limiting factors in wearable hardware, however, strongly influence their appropriate implementation. This often imposes an *inappropriate image browsing* (screen space, hardware for interaction) and *long response rates* (computing power, bandwidth).

The first issue can be widely overcome by providing appropriate *content representations* and *means for interaction*. To achieve this, three main approaches have been proposed in literature. *Zoom&Pan (ZP)* techniques provide only content which fits to screen. This leads to many image parts to which no information is displayed. *Detail&Overview (DO)* techniques provide, beside a view to the currently interesting image region, also an overview to allow for orientation and navigation. *Focus&Context (FC)* techniques apply the lens metaphor to combine the currently interesting region with additional context information. A representative of each approach is shown in Figure 1.

To give an overview about their properties, pros and cons to each browsing strategy and component are stated. To increase response rates, also the required *computing power* and *bandwidth* are considered. The following list provides a brief overview on this.

Content representations An appropriate solution displays all contents required to solve a certain task.
ZP: All screen space is used for the interesting details vs. No context is provided
DO: Details and context are provided vs. Cognitive switches between the two views
FC: Details and context are provided; Lens metaphor vs. Context is strongly squeezed

Means for interaction An appropriate solution requires little interaction and applies natural interaction metaphors.
ZP: Intuitive navigation grid implementing natural interaction metaphors
DO: Overview and detail are linked vs. Many interactions due to covered image parts
FC: Applies natural lens metaphor

Computing power An appropriate solution requires little resources for representation.
ZP: Little demanding
DO: Little demanding vs. Requires scaling to provide the overview
FC: High demanding as many scaling operations to achieve lens view are required

Bandwidth An appropriate solution requires only a small amount of data.
ZP: Requires only data belonging to the displayed region vs. Data is highly detailed
DO: Data for overview is low detailed vs. Data for detail and overview is transmitted
FC: Small highly detailed focus vs. Data for detail and context is transmitted

Summary As shown, each browsing approach has its advantages and drawbacks, there is no technique outperforming others on all tasks, devices and contents. Thus, always a trade-off best matching the requirements of the current task at hand must be found.

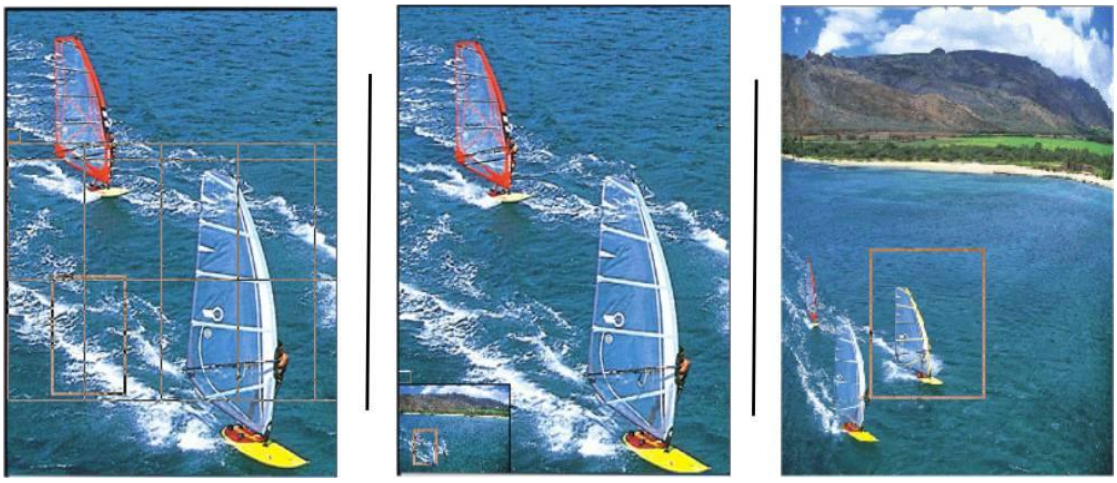

Figure 1: Grid-based Zoom&Pan (ZP, left), LargeDetail-View (DO, middle), and rectangular FishEye-View (FC, right) as representatives for the respective browsing approach.