The Ambient Tag Cloud: A New Concept for Topic-Driven Mobile Urban Exploration

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Abstract. Today's mobile phones are increasingly used as mediators between the real world and georeferenced digital information. However, common 2D maps as the most often applied visualization method are bearing inherent limitations when presenting a vast amount of data on a small screen. Therefore, in this paper, we propose 'ambient tag clouds' as an abstract alternative visualization approach for spatial information. Ambient tag clouds are designed as an extension of their Web counterparts exploiting the context-awareness of mobile devices. In our prototype implementation this novel concept has been combined with a gesture-based interaction method and thus enables mobile users to scan their current surroundings and make summarizing snapshots of adjacent areas.

Keywords: Mobile Spatial Interaction, Visualization, Tag cloud, Location-based services.

1 Introduction

Beyond their original purpose of communication on the move, mobile devices are nowadays increasingly used also for interaction with our physical environment. They provide information about our surroundings, they guide us to remote places, and let us communicate with real-world objects. This trend is strongly supported by the massive growth of georeferenced data. Large community websites attract hundreds of thousand user-submitted and geotagged photos, and countless websites make use of map mashups. However, exploring these masses of data on the spot with a present-day mobile phone application often will result in a disappointing experience, mainly because static 2D maps with georeferenced points of interest (POIs) bear inherent limitations: the more information is presented, the more difficult it is for a user to overview, browse and search suitable information [1].

Therefore, we propose 'ambient tag clouds' as a visualization technique that we believe to be better suited for addressing this challenge, especially for mobile urban exploration. Usually, tag clouds are used for visualizing the most-assigned tags on a website in the form of a weighted list of tag names, while the textual attributes such as size, weight and color, as well as the word placement may indicate a specific tag's properties. In the most common implementation, a tag's frequency is represented via its font size: the larger a tag name is visualized, the more often it has been assigned.

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Our key idea is to transfer this broadly known visualization concept to mobile devices and to make such clouds dynamically adapt to the current spatial surroundings. To prove this concept, we have built a prototype that displays a weighted list of tags that are associated to the portion of the environment where the user is pointing to with her mobile device. When the user turns around or moves along, this ambient tag cloud dynamically morphs according to the changing information landscape delivering a foretaste of what the user can expect in that area. If a tag of interest is selected, a conventional map of this area helps to explore the corresponding POIs.

The remainder of the paper is structured as follows: First, we report on related work and define the concept of ambient tag clouds. We then describe our current prototype implementation, and finally highlight some upcoming research issues.

2 Related Work

Tagged user-generated data and tag clouds recently have become subject of scientific research. Examples include studies to measure a tag cloud's effectiveness for various tasks such as presented by Rivadeneira et al. [6]. A novel visualization approach which combines common 2D maps with tag overlays resulting in so-called tag maps has been proposed by Jaffe et al. [4]. Slingsby et al. [8] defined an exploratory cycle for filtering content via a spatial map as well as via an aspatial cloud representation. Nevertheless, scientific work investigating the use of tagged data and its representations in a mobile spatial context is scarce. A representation technique similar to tag maps is proposed by Jones et al. [5] where the authors placed recently conducted Web search queries of nearby mobile users on a map providing insights into a location's character. Yahoo's ZoneTag is a well-known project supporting mobile users with location-aware tagging suggestions for submitted photo [9].

Natural ways to interact with spatially referenced content are investigated in the research field of Mobile Spatial Interaction (MSI) [3]. In early work Egenhofer [2] proposed the concepts of so-called Smart Compasses pointing the user into the direction of a particular geographic object and Smart Horizons presenting additional information beyond the user's current field of view. More recent work such as presented by Simon et al. [7] includes real-world applications investigating the use of pointing gestures to fetch digital content attached to a real-world object.

3 Ambient Tag Clouds

As already mentioned above, conventional tag clouds are used to arrange the most-assigned tags on a website. Our proposed 'ambient tag clouds' are based on an underlying set of georeferenced tagged items. Therefore, they serve as an abstract visualization for a given area's digital content. Just as their counterpart on the Web [6], ambient tag clouds may provide advantages for several generic types of exploration, as compared to conventional map- or list-based POI presentations.

- **'Gisting'.** Getting the gist of what is available is certainly one of our main needs when starting to explore a new place. Ambient tag clouds appear to be an ideal tool for such purposes, as they aim at recapitulating the information on one single screen while providing a unique picture of its currently prevailing key aspects.

- **Browsing.** Exploration of the urban surroundings is often inspired by an overall interest in learning more about the surrounding objects and related opportunities. In such a rather unspecific browsing attitude, the 'topic-orientation' offered by ambient tag clouds may be more appropriate than the usual 'target-orientation' with a map.
- **Searching.** Also in more targeted search, such as when a user is looking for a popular restaurant in the area, the efficient selection among a multitude offers can be a considerable challenge. The weighted and overview tag descriptions could be advantageous compared to generic category listings. In addition, pre-selection of tags promises to be a relatively intuitive and direct filtering method to reduce the number of POI on a map.

Moreover, the application of such tag clouds on a mobile device enables the additional integration of contextual information to further tailor the appearance of the cloud. Thus, location-aware devices are able to restrict a cloud's underlying items to the currently nearby ones. Built-in compasses even allow the restriction of items to a certain direction of view.

Due to the dynamic nature of the involved data, the resulting ambient tag clouds are not static as their conventional website counterparts but constantly change their appearance according to the underlying items and new contextual information.

Based on these features, we define and summarize the concept of ambient tag clouds as follows.

- Ambient tag clouds are based on georeferenced items, therefore providing an abstract location description for a given area.
- Ambient tag clouds are context-sensitive with emphasis on location- and orientation-awareness. Thus, they are usually applied on mobile devices.
- Ambient tag clouds present their dynamic nature in a suitable way in order to visually notify the user about context changes.

4 Prototype Implementation

We have implemented this new visualization approach as a prototype which combines the concept of ambient tag clouds with a gesture-based interaction method as follows. While the user holds the mobile device parallel to the ground as depicted in Figure 1, the application is running in 'scanning mode': The displayed ambient tag cloud is consistently updated according to the device's current location and orientation. Thus, the user may 'scan' her environment by pointing and turning at the same time while pursuing the changes on the display. Note that, in order to support the experience of 'scanning' and conspicuously visualize these adaptations, an appropriate ambient cloud does not simply pop up but the former cloud gradually turns into the new one: old tag labels may disappear, new ones may be revealed, remaining ones may change their appearance (cf. Figure 3).

As soon as the user is content with the ambient cloud's structure and interested in more detailed information about the visualized area, she usually moves her mobile closer to her face. Therefore, tilting the device in a more upright position as depicted in Figure 2 disables the scanning mode, i.e. the application ignores further changes of the device's location and orientation in order to allow additional interaction with the currently visible ambient cloud.

Fig. 1. Scanning the environment by pointing and turning

Fig. 2. Disabling scanning mode by tilting the mobile

Fig. 3. Morphing from source to target cloud

At this stage, the cloud's tag labels may be selected via the touch screen. The touch of a tag switches from the cloud view to a common 2D map. Turning the former abstract and aspatial cloud visualization into this spatial map representation now reveals the tag's underlying POIs with their corresponding positions for detailed search and browsing tasks.

Pressing the appropriate hardware button brings the user back to the current ambient tag cloud; tilting the device forwards re-enables the scanning mode.

5 Conclusion and Outlook

The concept of 'ambient tag clouds' presented in this paper enables topic-oriented exploration of a user's urban surroundings. It combines dynamic tag cloud visualization with mobile spatial interaction techniques to provide quick and individual snapshots of areas and directions of interest in the user's immediate surroundings.

Our prototype is deliberately designed for experimentation. The natural next step is now to systematically investigate the benefits and usage practices related to such an abstract, topic-based exploration and to evaluate its complementarity to conventional target-based map visualizations. In addition, we aim at better understanding how to

realize the most innovative aspect of the ambient tag cloud, i.e. the dynamic morphing of abstract visualizations due to a user's spatial movements. For example, recommendations are needed regarding an optimal style of tag rearrangement that is dynamic enough to support fine-grained context-adaptation but stable enough to support efficient tag selection.

The current ambient tag cloud prototype is devised for accessing volunteered geographic information organized by user-assigned tags. However, in principle, ambient tag clouds complementing standard maps with more abstract information representations might serve as a worthwhile exploration tool for other information types as well, such as extracted commercial travel and restaurant guide recommendations. Grounding ambient tag clouds on a broader information basis thus provides a viable promising direction for further research.

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References

1. Chittaro, L.: Visualizing Information on Mobile Devices. IEEE Computer 39(3), 40–45 (2006)
2. Egenhofer, M.J.: Spatial Information Appliances: A Next Generation of Geographic Information Systems. In: 1st Brazilian Workshop on GeoInformatics, Campinas, Brazil (1999)
3. Fröhlich, P., Simon, R., Baillie, L.: Mobile spatial interaction. Personal and Ubiquitous Computing 13(4), 251–253 (2009)
4. Jaffe, A., Naaman, M., Tassa, T., Davis, M.: Generating summaries and visualization for large collections of geo-referenced photographs. In: Proceedings of the 8th ACM international workshop on Multimedia information retrieval (2006)
5. Jones, M., Buchanan, G., Harper, R., Xech, P.: Questions not answers: a novel mobile search technique. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI 2007, pp. 155–158. ACM, New York (2007)
6. Rivadeneira, A.W., Gruen, D.M., Muller, M.J., Millen, D.R.: Getting our head in the clouds: toward evaluation studies of tagclouds. In: Proceedings of the SIGCHI conference on Human factors in computing systems (2007)
7. Simon, R., Fröhlich, P., Obernberger, G., Wittowetz, E.: The Point to Discover GeoWand. In: Krumm, J., Abowd, G.D., Seneviratne, A., Strang, T. (eds.) UbiComp 2007. LNCS, vol. 4717. Springer, Heidelberg (2007)
8. Slingsby, A., Dykes, J., Wood, J., Clarke, K.: Interactive Tag Maps and Tag Clouds for the Multiscale Exploration of Large Spatio-Temporal Datasets. In: Proceedings of the 11th International Conference Information Visualization (2007)
9. Yahoo! Research Berkeley: ZoneTag (June 16, 2009), `http://zonetag.research.yahoo.com`