

Augmented Reality and Urban GIS: towards closing the loop between acquisition and visualization of geographical data

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Abstract

Sustainable development is raising new issues in urban data modeling, processing, acquisition and visualization: not only are data getting 3D and time-evolving but they are also coming from heterogeneous sources at different scales. Queries also evolve as demands become more complex: for instance, we have to face the construction of comfort indicators at the intersection of lighting, wind and acoustic phenomena. In this paper, we will try to show how Augmented Reality (display of synthetic information onto the real world) can help acquiring and visualizing urban data. Augmented Reality raises new challenges for which we propose some solutions and discuss remaining issues.

Major issues with 3D data are acquisition and visualization. In the first case, data is acquired on site, geo-referenced and then introduced in the urban GIS later. In the latter, the lack of landmarks and the difficulty of representing physical phenomena (3D+t semiology) in classical virtual environments are the most common issues. Therefore, we propose to use Augmented Reality to solve some of these issues. Both acquisition (including geo-referencing) and visualization of urban data can be performed on-site, thus overcoming previous difficulties. However, it introduces a new difficulty, as outdoor AR is a difficult challenge. It is not possible to use classical markers and registering with image databases is too costly both in space and time. We believe that the link between images of the site, the 3D urban GIS can be seen as a closed loop: not only geo-referenced images are used to build 3D GIS but the GIS can also be used to geo-reference images [1]. We will show how we geo-reference images and compute AR-suitable poses from those images thanks to GIS information.

For visualization, beyond classical on-site visualization of invisible data (underground features or simulation results), we propose “augmented maps”. We assume that some difficulties are due to the unnatural 3D interaction with virtual environments but that it will be easier to use real maps. We show how, using a Document image retrieval algorithm, we can compute the pose of a camera filming a real map and then register the image and the GIS [2]. We are now able to augment the map and display overriding features such 3D buildings or simulation results.

Yet, there remain several issues that we are simply starting to study: a 3D+t semiology for urban representation has not been defined yet. As far as desktop representation is concerned, we think that NPR (non-photorealistic rendering) has an interesting potential as it renders some places in a way that is more recognizable than some equivalent textured models. More globally, classical GIS interfaces (layers, textual queries) have to be redefined in an AR context (both for AR-maps and on-site AR). AR needs other interaction paradigms that classical WIMP (Windows, Icons, Menus, Pointers) and this might allow to address the difficulty of GIS-spreading among local authorities deciders. Another problem is that our approach for geo-referencing images for VR is failing when the GIS is not up-to-date, which is quite frequent with urban data.

References

[1] Bioret, N.; Servières, M. & Moreau, G (2008), Outdoor Localization based on image/GIS correspondence using a simple 2D building layer, *2nd International Workshop on Mobile Geospatial Augmented Reality*, Québec, Canada.

[2] Uchiyama, H.; Saito, H.; Nivesse, V.; Servières, M. & Moreau, G. (2008), AR representation system for 3D GIS based on camera pose estimation using distribution of intersections, *18th International Conference on Artificial Reality and Telexistence*, pp 218-225, Yokohama, Japan.

Related illustration

- AR maps (ICAT 2008)
 - http://jp.youtube.com/watch?v=VF0ZzoZ6_Q0