Visualizing 3D Models in Aid of Public Consultation

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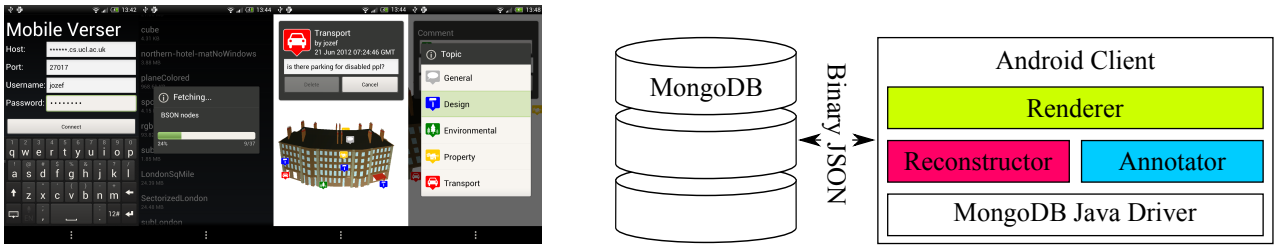

(a) 3D Android App (b) System Overview

Figure 1: *We present a novel mobile visualization platform. In (a) the user logs in to a 3D repository, retrieves a model, previews existing comments and commits his comments back to the DB. Conceptual overview (b) shows the system components. Data is communicated as Binary JSON documents over a TCP connection, reconstructed into a 3D scene and visualized on the client.*

1 Introduction

We present a novel approach to visualizing 3D models in aid of public consultation. 3D assets of architectural and engineering proposals are decomposed into individual constituents and uploaded to a NoSQL database (DB). A newly developed Android application visualizes such centrally stored assets on mobile devices. Localized comments are pushed back to the DB for subsequent analysis. This concept is expected to improve the public engagement and significantly reduce the costs of running such events.

When developing land or transportation systems, it is a legal requirement to host a public consultation or inquiry during which the general public can voice their concerns. Such an event can incur significant costs and for very large projects it risks not reaching the key stakeholders. In order to mitigate these problems, Arup's Collaborative Map project[1] displays localized comments as an overlay on 2D Google Maps. We take this concept one step further and develop a 3D platform that collects user annotations placed directly in 3D space. Initially, our application will be presented on tablets at physical events and if successful, deployed as a web-based service.

To overcome the bandwidth limitations of mobile devices Li et al. [2011] developed a system with a server-side rendering, where the frame's depth, color and normal buffers are decomposed into a set of textured polygons and recombined on the client side. This technique offers high frame rates, but relies on view distortions and does not scale well to a large number of users. In contrast, we take the advantage of the clients' rendering capabilities and serve a compressed scene representation from a centralised repository.

2 Our Approach

We extend our earlier work on the revision control of 3D assets [Doboš and Steed 2012] and reuse the 3D repository[2] built atop of a NoSQL database MongoDB as the basis of our mobile visualization platform. NoSQL databases offer significant benefits over their relational counterparts, such as non-rigid table structures and optimization for large read-write operations. Various 3D file formats are therefore stored as a decomposed unified scene graph representation inside MongoDB where each node is preserved as a Binary JSON (BSON) document in a flat collection (table) of documents. The native Java driver for MongoDB relies on the BSON documents to facilitate the querying and data transfers over a TCP connection. We port this driver onto the Android platform and add a custom rendering engine that queries scene graph components and updates user annotations via its 3D view, see Fig. 1(a). Once loaded, the user can freely navigate the space and read and post comments at any location. These are divided into five main categories identified by distinct icons. An overview of a model shows hotspots where there were many comments posted.

3 Conclusion

Our solution automatically serves models from a centralized repository and records annotations alongside the assets and their individual revisions. In order to offer a scalable visualization platform, we stream decomposed assets onto client devices, reconstruct their 3D representation and display them for viewing. Given our direct DB connection, the scalability of MongoDB and its built-in support for geospatial indexing, we believe that this approach offers significant benefits over alternative techniques such as geographic information systems (GIS). Our NoSQL-based solution can be extended to support various data types including the building information modeling (BIM) or other representations. In the future, we plan to modify our system to take into account current GPS coordinates of the mobile device and provide an augmented view over existing building site.

References

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[1] http://www.collaborativemap.org
[2] http://3drepo.org

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