INTEROPERABLE APPLICATION OF 3D GEO-BASED FEATURES ON MOBILE AND WEB

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ABSTRACT : At the stage of content convergence into cell phone, technologies for geo-spatial information sharing and searching are being developed. Currently, 2D portable navigation map for mobile navigation is provided by communication companies, but geobrowers for 3D geo-information in cell phone are under developing. In this study, 3D feature transformation among X3D-M3G-KML, on mobile and web environments, is dealt with as the first stage for the further mobile 3D web application. As well, it is possible to real-time interoperable 3D geo-information exchange issues within both environments.

KEY WORDS: M3G, KMZ, X3D, Mobile Graphics, Web Graphics

1. INTRODUCTION

Mobile 3D graphics is regarded as one of the emerging field in GIS field, as well as web 3D graphics. At the beginning development stage of mobile graphics and web graphics, these are different industrial needs. Mobile graphic is from 3D game and entertainment market, whereas web graphics is for the realization of virtual world on internet.

As those markets are grossly growing for the 4 or 5 years, non-profitable API (application programming interface) and file structure in international de-facto standards are emerged. Among many freely available mobile 3D graphic APIs, three standard APIs are widely adopted for the purpose of mobile 3D application development: Open GL ES (Embedded System), M3G (Mobile 3D Graphics) for Java ME (Micro Edition), and Direct 3D mobile. Especially, M3G API provides mobile 3D file format as m3g, contrary to other APIs.

As for web 3D, since the first release of VRML (Virtual Reality Modelling Language) and its browser was used for web 3D applications, linkage with XML technology is the important milestone. X3D is an international standard for web 3D graphic format.

While, Google Earth is the third big wave, in 3D graphic application. Through the dynamic linking with Google mapping services on web client, this is regarded as a kind of killer web. Also it contributes to wide expansion of the web 2.0 paradigm. Recently, KML file format used to model and store geographic features for display in Google Earth is official standards of OGC (Open Geospatial consortium, Inc.). Furthermore, Android, Google's new mobile OS, is supposed to be support Google map services in mobile web, so that technologies in mobile graphics and web graphics are more tightly related to geo-spatial applications using 3D GIS and web GIS.

In this study, as a first step for these trends, a strategic work about file exchange or transformation between mobile 3D and web 3D is performed.

2. MOBILE 3D, WEB 3D, AND KML

M3G API is known to JSR (Java Specification Request) 184. This API provides 3D functionality in a compact package for CLDC (Connected Limited Device Configuration) and MIDP (Mobile Information Device Profile). They are specifications of a framework for J2ME applications running on cell phones and a specification to define the minimum hardware, software, and network requirements for an application to run on an embedded device, respectively. The API provides two methods for displaying 3D graphics content. The immediate mode API makes it possible for applications to directly create and manipulate 3D elements. Layered on top of this is a scene graph API (Fig. 1), also called retained mode, that makes it possible to load and display entire 3D scenes that are designed ahead of time. Applications are free to use whichever approach is most appropriate or to use a combination of the retained mode and immediate mode APIs. The JSR 184 specification also defines a file format for scene graphs (Pulli, 2004).

By means of a retained mode, M3G supports for a scene graph as a tree structure to represent in a compact

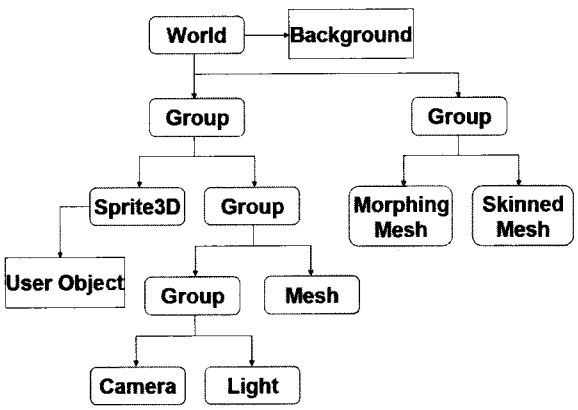

Fig. 1. M3G SceneGraph Model.

and hierarchical one with respect to all the elements of a 3D scene, as the rendered result. The key classes in M3G are World, Graphics3D, and Loader. World is a scene graph root node, and Graphics3D is for 3D graphics rendering context containing global state: frame buffer, depth buffer, viewpoint, hints. Loader can load individual objects and entire scene graphs in a file format with extension of m3g (Pulli *et al.*, 2005, 2008).

X3D (Extensible 3D) is a royalty-free open standard file format to represent and communicate 3D scenes using XML. X3D is a delivery format intended to contain the information needed for interactive applications. X3D includes both a specific run-time model that enables picking, viewing, navigation, and scripting, and an API to manipulate the scene graph at run-time. X3D focuses on the visualization of 3D assets within applications.

KML (Keyhole Markup Language) is an XML-based language for managing 3D geospatial data in the program Google Earth, and it focused on geographic visualization, including annotation of maps and images (Purvis *et al.* 2006). Geographic visualization includes not only the presentation of graphical data on the globe, but also the control of the user's navigation in the sense of where to go and where to look. KML files are often distributed as KMZ, zipped KML files. The KML file specifies a feature such as a placemark, image, or polygon. It contains a basic description of the place, longitude, latitude, tilt and other information. Open Geospatial Consortium (OGC) officially adopts KML Version 2.2, as OGC implementation standard (Wilson, 2008).

3. IMPLEMENTATION STRATEGY

In this study, freely distributed web development environments are basically used.

Fig. 2 shows general scheme for a virtual web application with various user interaction through two-tier structure. Backend side in this view can be composed of LAMP, and frontend is web client of normal web browser and mobile browser. Both clients can be handled with XHTML document.

Fig. 3 demonstrates one case of the current mobile applications running on Google Mobile. In this scheme, area searching can be possible by using Google Maps and Google Earth. Other attributes such as photo, text, or blog can be searched and retrieved.

However, these cases are not support 3D feature manipulation till now, and this work focuses on this issues. At the first step of this work, implementation for 3D file exchange and transformation is carried out.

The three kinds of target file structure are considered: M3G, X3D, and KML. Thus, the following scenario using this exchange process can be applied. Users create their own 3D model feature with geo-coordinates in a certain authoring tool. Then they can store them into X3D. After that they want post their data sets to mobile clients. For this purpose, two approaches can be affordable.

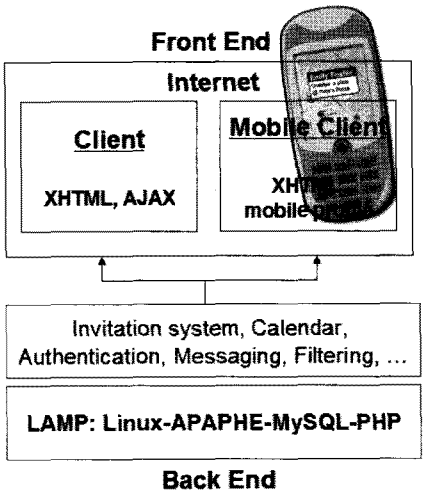

Fig. 2. Clients in Internet based on LAMP

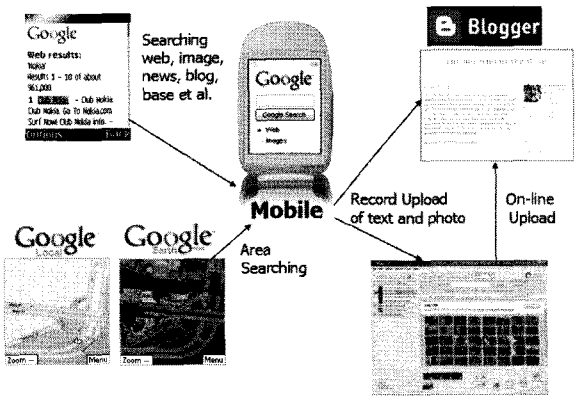

Fig. 3. Searching and retrieval scheme in Google Mobile: General view. Edited from Han (2005). Web 2.0 : The Next Generation Web Technology and Culture.

The first is generation of KML from X3D. This KML is on Google mobile or Google Earth. The another is transformation of X3D into M3G.

For M3G file transformation in this study, JDK 1.5.0_15, Netbeans IDE 6.01 mobility pack, and WTK 2.52 (CLDC1.1/MIDP2.0) were used. Decoding and encoding of KML and X3D was implemented as a window application. Further, through translation between KML and X3D, KML can be translated into X3D so that content creators can add animation, lighting, special effects and operations to create powerful presentations, interactive advertisements and even fully immersive navigation of virtual environments.

Fig. 3 shows a simple case of this implementation, representing that 3D features in KML on Google Earth is transformed into M3G. This M3G file is ported and rendered on cell phone.

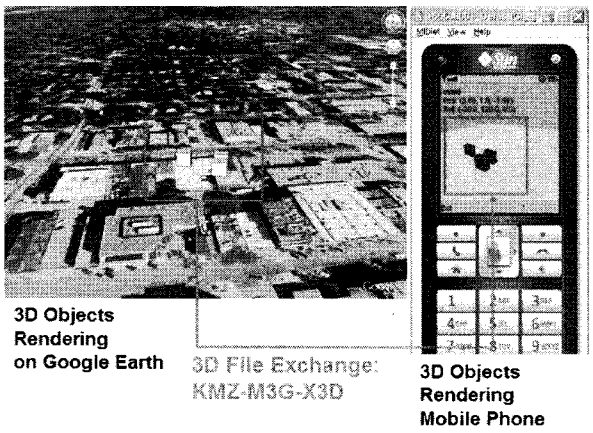

Fig. 5. 3D file transformation: KMZ (Google Earth)-M3G(Mobile 3D: JSR184).

4. CONCLUDING REMARKS

In these days, as mobile device and mobile telecommunication technology develop, users' needs are rising for new services on mobile device like cell phone. KML and X3D is an XML language, cross-operation between the two is theoretically possible. M3G and X3D consists of similar scene graph structure in the there visualize ways. Scene graph visualizes the object through the node. It's possible that the respective nodes of M3G and X3D. Consequently, KML and M3G are directly to difficult conversion. But, X3D is a medium for the conversion of them.

In this study, 3D feature transformation among X3D-M3G-KML, on mobile and web environments, is dealt with as the first stage for the further mobile 3D web application.

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