MODELING 3D BUILDINGS OF LOD2 FROM AIRBORNE POINT CLOUD USING UNSUPERVISED CLASSIFICATION

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A project report submitted in partial fulfillment of the
requirements for the award of the degree of
Master of Science (Geoinformatics)

Faculty of Geoinformation and Real Estate
Universiti Teknologi Malaysia

AUGUST 2011

ACKNOWLEDGEMENT

It is my great privilege to express gratitude to my supervisor Prof. Dr. Alias Abdul Rahman, 3D GIS Research Lab and Dean of Faculty of Geoinformation and Real Estate for giving me the freedom to do my work at my own pace. I am deeply beholden for the constant encouragement and support to bring out my ideas and channelize them.

I am extremely thankful to Mr. Alex Rixon, Production Manager, AAM Group, Kuala Lumpur for helping me in this study by giving the data, software and his valuable ideas and allowing me to work in his office. I would also like to thank Mr. Ahmad Syuwari at AAM for helping me with the technical issues.

I wish my deep sense of gratitude to all the members of the 3D GIS Research Group for their support and sharing thoughts throughout my study. I would also like to thank the staff members of the Faculty of Geoinformation and Real Estate for their help and assistance. I would like to thank Wasiu, Toyin and all my postgraduate classmates and friends for their constant encouragement and support in one way or the other throughout my study.

Finally, I wish to express my heartfelt gratitude and love to my Mom, Dad and Brother for being with me right through my work and helping me in all possible ways.

ABSTRACT

A variety of applications utilize 2D data in some form or the other to complete their tasks. But we are living in a 3D world and in most cases 2D information is not sufficient. Today the need for 3D Geoinformation has increased rapidly mainly because there is a significant improvement in maintaining, processing and visualizing these data. A variety of applications have been introduced in relation to visualization like a 3D city model. A 3D city model includes buildings, vegetation, street furniture and other city objects. 3D city models can be generated from various sources of data like aerial images, CAD, satellite imagery, LiDAR and terrestrial laser scan. But LiDAR and terrestrial laser scan holds as the best source of data in terms of accuracy. With LiDAR accurate 3D models can be generated when compared to other conventional method like the photogrammetric technique. The data is collected as set of points called as point cloud. MicroStation with extension TerraScan was used to process these 3D point clouds from which the 3D models and the 3D surface model (DTM) were generated. This study aims to generate 3D city model from the airborne LiDAR and incorporate them in CityServer3D where the 3D geodatabase is created. All the generated models are based on the standard CityGML format. Each building is given an external code based on the CityGML format defined by the Open Geospatial Consortium (OGC). The models inside the CityServer3D can be visualized as well as queried. The Level of Detail of the 3D models is restricted to 2 without façade textures. This 3D city model will be of good use to the local authorities of Miri during times of flood because the study area is located relatively close to a river meeting the sea. This 3D city model can be improved by adding textures, increasing the level of detail which will be more virtual and realistic.

ABSTRAK

Pada masa kini, terdapat pelbagai aplikasi di dalam bentuk 2D digunakan di dalam menyelesaikan tugasan. Bagaimanapun, maklumat di dalam bentuk 2D sahaja tidak mencukupi memandangkan persekitaran di sekeliling berbentuk 3D. Kini, keperluan kepada geoinformasi berbentuk 3D telah meningkat kerana keupayaannya di dalam mengekalkan, memproses dan menggambarkan sesebuah data. Pelbagai aplikasi telah diperkenalkan di dalam menvisualisasikan sesebuah bandar di dalam bentuk 3D. Model 3D bandar termasuklah bangunan, tumbuhan, perabot jalan dan objek bandar yang lain. Model 3D bandar boleh dijana daripada pelbagai sumber data seperti imej udara, CAD, imej satelit, LiDAR dan imbasan terrestrial laser. Bagaimanapun sumber dari LiDAR dan imbasan terrestrial laser lebih tepat dan jitu. Model 3D yang dihasilkan dari LiDAR lebih tepat berbanding menggunakan kaedah konvensional seperti teknik fotogrametri. Set data yang dikumpul dikenali sebagai titik awan. Microstation dengan sambungan TerraScan digunakan di dalam proses 3D titik awan ini di mana model 3D dan permukaan 3D (DTM) akan dihasilkan. Kajian ini bertujuan untuk menjana model 3D bandar berasaskan data LIDAR udara dan menggabungkan data menggunakan perisian CityServer3D di mana akan membentuk geodatabase bagi model 3D. Model-model yang dihasilkan adalah mengikut piawaian dan format CityGML. Setiap bangunan akan dinamakan dengan kod luar berdasarkan format CityGML yang ditakrifkan oleh Open Geospatial Consortium (OGC). Model yang dihasilkan dari CityServer3D boleh digambarkan dan tahap perincian model 3D yang dihasilkan terhad kepada dua permukaan iaitu hadapan dan tekstur bangunan. Penghasilan model 3D ini seterusnya dapat membantu Pihak Berkuasa Tempatan Miri di dalam mengatasi masalah banjir kerana kawasan kajian terletak berhampiran dengan muara sungai. Model 3D bandar ini boleh diperbaiki dengan menambah tekstur, bagi meningkatkan tahap perincian agar model yang dihasilkan lebih realistik.

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LIST OF ABBREVIATIONS

2.5D	-	Two-and-a-half-dimensional
2D	-	Two-dimensional
3D	-	Three-dimensional
ALDPAT	-	Airborne LIDAR Data Processing and Analysis Tool
ALS	-	Airborne Laser Scanning
B-REP	-	Boundary Representation
CAD	-	Computer Aided Design
CSG	-	Constructive Solid Geometry
DBM	-	Digital Building Model
DEM	-	Digital Elevation Model
DSM	-	Digital Surface Model
DTM	-	Digital Terrain Model
GIS	-	Geographic Information System
GML	-	Geographic Markup Language
GPS	-	Global Positioning System
INS	-	Inertial Navigation Sensor
LIDAR	-	Light Detection And Ranging
LoD	-	Level of Detail
OGC	-	Open Geospatial Consortium
TIN	-	Triangulated Irregular Network
TLS	-	Terrestrial Laser Scanning
USDA	-	United States Department of Agriculture
USGS	-	United States Geological Survey

VRML	-	Virtual Reality Markup Language
W3DS	-	Web 3D Service
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