UNIVERSITI PUTRA MALAYSIA

DEVELOPMENT OF OPTIMISED MODEL FOR POLYETHYLENE INFRASTRUCTURE MONITORING USING MOBILE LASER SCANNING TECHNIQUE

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By

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The daily infrastructure networks’ updates are very huge due to frequent new installations, replacements and enforcements which are subject to maintenance and operation on a frequent basis. The efficiency of the maintenance and operation workflow is strongly related to the geographical location of these infrastructure networks. Due to the huge daily updates of the infrastructure networks, the ability of collecting the updated locations using the current geospatial monitoring techniques is very difficult. This research brought forward a more efficient geospatial data updating technique for the infrastructure networks. The monitoring is needed to geospatially locate and update the physical infrastructure development which significantly enhances the performance of managing and maintaining the infrastructure assets.
The research concentrates on the polyethylene infrastructure materials, where power, water and communication networks are either covered or protected by polyethylene materials. The research conducted a technical comparison between the current geospatial data collection techniques and developed an overall performance evaluation in the sense of coverage capacity, objects extraction, data formats, time initialization of the systems and post processing time consumption. The use of mobile laser scanning technology had achieved the best evaluation performance. The evaluations were based on conducting a detailed data analysis, data collection, modelling and interpretation. Prior conducting the performance evaluation, the research investigates the mobile laser behaviour and recognition capabilities with respect to polyethylene infrastructure materials. Each material has different characteristics and accordingly has a different response (reflections and absorptions) to laser pulses, where this response is constant and only material dependent. The mobile laser pulses response constant for the polyethylene infrastructure materials has been concluded after analysing the pulses behaviour and its correlations with the mission ground speed and exposed scanned surface. The obtained mobile laser scanning constant for the polyethylene infrastructure material is 726 pulses/cm when the system ground speed is 16.49 km/h. The concluded mobile laser pulses constant were used to develop a mathematical method for re-planning the mobile laser scanning missions to obtain the best model for updating the polyethylene infrastructure networks. Mobile laser scanning using the improved planning missions can detect 97% of the polyethylene infrastructure networks in a very good performance.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi sebahagian keperluan untuk ijazah Doktor Falsafah

PEMBANGUNAN SEBUAH MODEL DIOPTIMIS UNTUK PEMANTAUAN INFRASTRUKTUR POLITENA MENGGUNAKAN KAEDAH PEINGIMBASAN LASER MUDAH ALIH

Oleh

MAHMOUD FAWZI AL-HADER

September 2011

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Pengemaskinian harian jaringan infrastruktur adalah amat sukar disebabkan pemasangan, penggantian dan pengkukuhan yang tertakluk kepada proses penyelenggaraan dan operasi yang kerap. Kecekapan aliran kerja penyelenggaraan dan operasi adalah berkait dengan lokasi geografik jaringan infrastruktur tersebut. Disebabkan pengemaskinian harian yang amat besar terhadap jaringan infrastruktur tersebut, pengumpulan maklumat lokasi pengemaskinian menggunakan kaedah pemantauan geospatial yang sedia ada adalah amat rumit. Penyelidikan ini mengemukakan suatu kaedah pengemaskinian data geospatial yang lebih cekap untuk jaringan sistem infrastruktur. Pemantauan ini adalah diperlukan untuk mencari lokasi geospatial dan mengemaskini pembangunan infrastruktur fizikal, lantas meningkatkan prestasi pengurusan dan penyelenggaraan asset-aset infrastruktur.
yang diperbaiki mampu mengesan 97% daripada jaringan infrastruktur polyethylene, prestasi yang agak memuaskan.
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I would also like to thank all who helped me during my research work.
I certify that an Examination Committee has met on to conduct the final examination of Mahmoud Fawzi Abdallah Alhader on his Doctor of Philosophy thesis entitled “Development of Optimized Model for Polyethylene Infrastructure Monitoring Using Mobile Laser Scanning Technique” in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the degree of Doctor of Philosophy.

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DECLARATION

I declare that the thesis is my original work except that for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or other institutions.

__________________________________________
MAHMOUD FAWZI AL-HADER

Date: 22 September 2011
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