UNIVERSITI TEKNOLOGI MARA

SECURITY ANALYSIS USING 3D GIS

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ABSTRACT

Security aspect during public events is becoming serious issues which merit special attention especially when there is a presence of a very important person (VIP). The monitoring of public security during public event has been continuously debated worldwide. Shooting is one serious aspect to security since its poses a great threat to public security and can cause instant death. The advancement of spatial technology has generated great interest and currently is intensively being used for security purpose. The conventional method of security analysis in Malaysia which is based on manual observation and summation of the information gathered from various sources can be considered as less effective and would not be able to simulate the actual environment condition. The availability of 3 Dimensional (3D) building models generated from Light Detection and Ranging (LiDAR) data which gives exact information on real terrain are bringing new perspectives to security hotspot location assessment. The objectives of this study are to i) review the existing method in defense security field, ii) to test the accuracy of LiDAR data, iii) to identify and rank identified areas for all possible threats for security purposes using viewshed, distance and multi-criteria analysis and iv) to generate and simulate the security level relative to the generated 3D objects and conditions of surrounding area with the identified targeted area. Merdeka Square and the surrounding 1 kilometer which is situated in the heart of Kuala Lumpur are selected as study area. Two locations marked as Location A and Location B were used as the simulated targeted area. LiDAR data was used to generate the 3D urban city model and Digital Orthophoto was used as the background of the virtual constructed world. The main method used in this study was the viewshed and distance analysis combined with multi-criteria analysis. Interviews with Special Action Unit, Bukit Aman were carried out to gather information regarding VIP body guarding procedures during public event and to validate the study as a relevant method for security purpose. Three types of firearms were selected in this study, which were the handgun, rifle and sniper rifle. The firearms were chosen based on their capabilities in shooting on different effective range and their resulting damage. Analysis of data and an accuracy assessment using Root Mean Square Error (RMSE) were done to both horizontal and vertical planes over LiDAR data to test the accuracy of the data. The RMSE for horizontal plane is 1.310 meter while for vertical plane is tested 1.708 meter with 95% confidence level with no outliers. After applying the multi-criteria analysis, 20 main buildings with hotspots were identified at location A and 21 buildings with hotspots identified at location B. After performing the multi-criteria analysis, sniping spot quality was made on these buildings in order to determine which building was best suited for sniping. In addition, rainfall effect analysis was also made to determine how much rainfall could affect the usage of assault weapon based on the visibility. Relative vertical profiling was also made to each building identified to confirm the reliability of the analysis. Possible shooting location was ranked, highlighted and mapped out in impressive 2D and 3D viewing GIS environment. As a conclusion, 3D GIS enhance the capability for security analysis.

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