An Approach of Instigating 3D City Model in Urban Air Pollution Modeling for Sustainable Urban Development in Malaysia

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SUMMARY

Urbanization growth in Malaysia is like in any other developing countries, it contributes to the negative impact of the urban environment. As Malaysia is on its mission to be a developed country by the year 2020; it realizes that dealing with air pollution is one of the indicators headed towards it. Air pollution modeling is crucial for micro-scale environment area (i.e. high density urban area) since deploying air quality monitoring stations for area less than 2km is not practical and manageable. Instigating 3D city model for urban air pollution modeling seems promising for sustainable development planning and practice. It can expand the visualization and analysis capabilities of Geographic Information Systems (GIS) on cities, and they can be developed using web standards. However, these 3D city models with air pollution dispersion modeling consume much more storage compared to two dimensional (2D) spatial data. They involve with extra geometrical and topological information together with semantic data. Without a proper spatial data clustering method and its corresponding spatial data access method, retrieving portions of, and especially searching these 3D city models, will not be done optimally. In this research, we propose an apposite data constellation technique of space-filling curves for 3D city model data. We extend the Hilbert's space-filling curve to one higher dimension for 3D city model data implementations. The query performance was tested using a 3D city model dataset of 1,000 city objects and the results are presented in this paper. The advantages of implementing Hilbert's curve for 3D city model data are that it improves data retrieval time by means of optimized 3D adjacency, nearest neighbor information and 3D indexing.