Synchronized 2D/3D GIS Data Visualization Using Google Maps and Unity 3D Game Engine

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ABSTRACT

Data visualization is one of the most important aspects in Geographic Information System. Not only the data must be adequate and accurate, but it also needs to be represented in a clear and easy to understand way in order to convey information to the users. There are many approaches for GIS data visualization both two and three dimensional. 2D maps have their advantages such as representing spatial data, data distribution, and small-scale visualization. Though, they lack large-scale details and, obviously, the height of the terrain and surface objects which can only be represented in 3 dimensions. 3D game engines can be used as GIS data visualization tools to compensate for the shortfalls of 2D maps. However, they are not suitable for large extent viewing. By combining 2D and 3D views, we can get the best of both worlds. This paper proposed an approach for a synchronized 2D and 3D data visualization tool using Google Maps and Unity 3D game engine. The users can see their whereabouts and related spatial data on a 2D map while they can immerse into a 3D virtual world, navigate through the terrain, and see the surroundings in high level of details. The 3D virtual world is not made just to be aesthetically pleasing, but it is created from real GIS data to provide geographic accuracy as well. Since both Google Maps API and Unity 3D game engine have a free version, the cost of implementing this data visualization software is almost nonexistent. This software tool can be beneficial and practical for using with many applications related to GIS data. It has been proven to be a valuable tool in developing various virtual simulators at the Defence Technology Institute of Thailand.

Keyword: GIS Visualization; 3D Game Engine; GIS Data Management; Google Maps; Unity 3D

1. INTRODUCTION

The creation of maps has an objective to convey messages to intended map viewers. Whether they are an abstract of a real world or a model of an expected outcome, they need to tell a story and lead to much comprehension of the information (Kumsap, 2010). It is this directive that map makers should keep in mind during their map making processes. An approach has advanced to three dimensional representations of geographic entities upon landscape (Guo-lan, 2009). Adding one more dimension to the already memory-greedy processing is widely recognized and increasingly aware, and the solution to achieve the significant reduction of the huge amount of data was introduced by taking advantage of LOD concepts and a predictive approach to anticipate user navigation (Zhang, 2009). Though the approach achieves satisfied handling of geometries and texture, it lacks means to convey such additional information contained in attributive data. The richness from the GIS capability in modeling reality was utilized in (Chalainanont, 2014) to extend GIS attribute data to an unmanned vehicle mission planning. The GIS and Game Engine were interfaced via data management and manipulation to inherit military intelligence with help from written scripts. However, the focus was placed more on threat information towards UAV mission and less on terrain realism and visualization. Furthermore, the data visualization was intertwined by