Chapter 10
Visualizing Pathway on 3D Maps for an Interactive User Navigation in Mobile Devices

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ABSTRACT

3D maps have become an essential tool for navigation aid. The aim of a navigation aid is to provide an optimal route from the current position to the destination. Unfortunately, most mobile devices' GPS signal accuracy and the display of pathways on 3D maps in the small screen of mobile devices affects the pathway architectural from generating accurate initial positions to destinations. This chapter proposed a technique for visualizing pathway on 3D maps for an interactive user navigation aid in mobile devices. This technique provides visualization of 3D maps in virtual 3D workspace environments which assists a user to navigate to a target location. The Bi-A path-finding algorithm was used for establishing dynamic target location in Voronoi diagram/Delaunay triangulation. This approach could navigate more than two users in a 3D walk-space and at the same time showing their whereabouts on 3D projections mapped. The map shows the users' location in the scene to navigate from source to the target and the target also moves to the source to meet on the same physical location and image plane.*

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INTRODUCTION

There are misconceptions in scenarios where an individual found himself/herself asking Where am I? Where can I find a certain location? These are the typical questions that might arises whenever a person visited a new environment. Even though individual will be able to know the name of the location of interest, but how to go there from certain location, for some new comers are not that easy, especially in finding the shortest path. 3D maps provide a full range of fundamental requirements of an effective visualization of the scene, built around a geometric representation of an area. Therefore, its representation in handheld GPS tools will enable people to identify the precise latitude and longitude of their present locations, even in the most remote of places. Evidently, the introduction of GPS technology for in-car navigation offers new solutions for finding one's way in urban areas and on the highway. Consequently, the social dynamics involved in traveling on the road have been transformed (Leshed et al., 2008). However, people still get lost or are unable to follow given directions to reach a particular destination. In certain unfortunate situations, a wrong turn can cause a serious accident (Ellard, 2009). Technically, the role of 3D maps is to offer more detailed information than what is available on conventional maps. Although geographic maps represent any space, real or imagined, without regard to context or scale, they have certain drawbacks. The information these conventional maps contain is limited due to fixed representation ratio and lack of interaction with the user. They usually require the translation of added symbols and legends, which may call for a certain level of expertise on the part of the user. The perception and interaction of 2D representations are limited to the interpretation of symbols explained in the legend which not every user knows how to use efficiently. Some works offered to use landmarks to assist in guiding users in their navigation (Ohm et al., 2016). In the case of a 3D map, proper reading is generally much easier and symbols are more straightforward. 3D representations are able to produce more realistic visualizations of navigation fields. A realistic 3D representation has strengths its 2D counterparts do not possess, for example, they are much more precise. The key benefit of a 3D representation is the higher potential for accuracy in presenting spatial data. Besides that, it offers a better platform for multiple cues and small-scale features, which are better suited for pedestrians to locate and identify unknown places. Therefore, a 3D map representation downloadable on a mobile device which represents a certain area in more detail helps the user to identify locations and decide which course to navigate to, at an instant. The accuracy of the generated model by sampling points on the reconstructed realistic 3D model and measuring each point's distance to the closest point in the ground truth models. The accuracy of a reconstruction can be defined as the percentage of points whose distance is in a given threshold (Schöps, 2017).

This paper presents pathway analysis for 3D mobile interactive navigation aid. Bent function, Voronoi diagram and its dual Delaunay triangulation are the algorithms used for establishing user positions and paths to a target destination. The motivation for providing the most favorable locations and path determinations is due to the condition of today's world, where mobility and communication have become essential. People may frequently find themselves asking: 'Where am I right now?', 'How do I get from X to Y?', and 'How can I tell Z from A?" Well-defined path determination and position are deemed as a method that can provide an accurate answer to these questions. This work is part of an integrated application in developing an Intelligent Environment. The goal is to make user interaction with the computer easier in a smart environment where technology spread throughout (pervasive), computers are everywhere at the same time (ubiquitous), and technology is embedded (ambient) in the environment. The technology development needs not to be difficult, tedious or need hard learning to the user. It should potentially be safe, easy, simple, and enable new functionality without a need to learn for a new technology.