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Towards a gestural 3D interaction for tangible and three-dimensional GIS visualizations

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The last decade has been characterized by a significant increase of spatially dependent applications that require storage, visualization, analysis and exploration of geographic information. GIS analysis of spatiotemporal geographic data is operated by highly trained personnel under an abundance of software and tools, lacking interoperability and friendly user interaction. Towards this end, new forms of querying and interaction are emerging, including gestural interfaces.

Three-dimensional GIS representations refer to either tangible surfaces or projected representations. Making a 3D tangible geographic representation touch-sensitive may be a convenient solution, but such an approach raises the cost significantly and complicates the hardware and processing required to combine touch-sensitive material (for pinpointing points) with deformable material (for displaying elevations). In this study, a novel interaction scheme upon a three dimensional visualization of GIS data is proposed. While gesture user interfaces are not yet fully acceptable due to inconsistencies and complexity, a non-tangible GIS system where 3D visualizations are projected, calls for interactions that are based on three-dimensional, non-contact and gestural procedures.

Towards these objectives, we use the Microsoft Kinect II system which includes a time of flight camera, allowing for a robust and real time depth map generation, along with the capturing and translation of a variety of predefined gestures from different simultaneous users. By incorporating these features into our system architecture, we attempt to create a natural way for users to operate on GIS data. Apart from the conventional pan and zoom features, the key functions addressed for the 3-D user interface is the ability to pinpoint particular points, lines and areas of interest, such as destinations, waypoints, landmarks, closed areas, etc. The first results shown, concern a projected GIS representation where the user selects points and regions of interest while the GIS component responds accordingly by changing the scenario in a natural disaster application. Creating a 3D model representation of geospatial data provides a natural way for users to perceive and interact with space. To the best of our knowledge it is the first attempt to use Kinect II for GIS applications and generally virtual environments using novel Human Computer Interaction methods.

Under a robust decision support system, the users are able to interact, combine and computationally analyze information in three dimensions using gestures. This study promotes geographic awareness and education and will prove beneficial for a wide range of geoscience applications including natural disaster and emergency management.
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