Querying Moving Objects in GeoPQL

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In recent years, spatio-temporal databases are receiving considerable attention due to the extensive amount of applications dealing with objects that change their spatial characteristics over time.

Another important research topic concerns the development of friendly and simple query languages that allow to ask for temporal changes in spatial situations.

Motivation and aim of the paper is:

To gather the previous two challenges by proposing an extension of the Geographical Pictorial Query language (GeoPQL)

The main contribution is the representation of queries on moving objects in a three-dimensional space where the spatial dimension is described by a two-dimensional layer and the temporal dimension is the third dimension of this space and, therefore, the overlap of layers allows to represent the temporal changes of spatial situations.
Several aspects have been considered:

Different visual techniques, adopted to represent the concepts of interest of the query, and the spatial, temporal and spatio-temporal operators: map overlay, blackboard, icons and balloon


3D visualization techniques: mapping techniques, presentation techniques and dynamic techniques
GeoPQL queries representation

GeoPQL allows to specify queries using Symbolic Graphical Objects (SGOs) consisting of the three classic types of shapes: point, polyline and polygon (www.irpps.cnr.it/M3L/Geopql).

The current version of GeoPQL algebra consists of twelve operators, among which seven topological operators (Geo-disjunction, Geo-touching, Geo-inclusion, Geo-crossing, Geo-pass-through, Geo-overlapping and Geo-equality), four logical operators (Geo-union, Geo-difference, Geo-alias, Geo-any), and one metric operator (Geo-distance).

This set has been enlarged considering both temporal and spatio-temporal operators. More specifically the present work introduces eight temporal operators (T-before, T-after, T-meets, T-overlap, T-starts, T-during, T-finishes and T-equals) and six spatio-temporal operators (Geo-growing, Geo-shrinking, Geo-merging, Geo-splitting, Geo-appearing and Geo-disappearing) of objects in order to allow temporal and spatio-temporal queries.
The need to express, at the same time, bi-dimensional spatial constraints and one-dimensional temporal constraints requires the use of a 3D representation of the query. The different temporal layers allow to represent how spatial properties evolve.
GeoPQL queries representation (3)
Let us consider an example of query involving temporal information for moving objects. Suppose the user is interested to select the faster path to reach the airport starting from her/his office on 3rd of March 2008 at 7,00 a.m.
This Figure visualizes the results obtained
The paper try to create a continuum between the querying phase (and its visualization) and the result visualization. What are the perspective on this general objective considering multimodal interaction?

Can this approach make applications, such as geographical query systems, mainly used today by expert users accessible tomorrow to no expert users?