Geo-Multi-Agent System Based Webmapping Approach Using Multiple Representation and Generalisation Driven by Domain Ontology

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ABSTRACT

Geographic Information (GI) is currently available at any time, from anywhere on the surface of the earth, for any person connected to internet. Some applications of design, implementation, generation and dissemination of maps on the web are recognized as “Webmapping” application, geographic web services or more generally on demand-map making tools. All these web applications aims the satisfaction of user needs by providing personalized maps in a fast response time with a good quality. However, the complexity and diversity of aspects taking into account have lead researchers to focus on one aspect at the expense of others. Consequently, few works have addressed all these aspects simultaneously. The authors propose in this paper, a Webmapping approach organized into two main tasks: (1) query analysis driven by domain ontology in analyzing a query launched by a user on a web browser and (2) map generation process. The first step allows extracting and formalizing user needs through two map determinants factors: the Level of Detail (LoD) and Point of View (PoV) and the second, exploit an hybrid approach “Multi Representation and Generalization” in storing and generating geographical data with integrating Multi-Agent technology in all steps of processing. To evaluate the effectiveness of our proposal, a first tool prototype implementing our approach is so developed using a geographic vector dataset provided by national cartographic agency.

Keywords: Domain Ontology, Generalization, Geographic Database, Geographical Information, Multi Agent System, Multiple Representation Database, Webmapping

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INTRODUCTION

In the last decades, the utilization of Geographic Information (GI) on the web has quickly grown as a result of advent of digital mapping and powerful computing. In order to meet web user needs, many research issues have been addressed and which are focused on developing techniques related to acquisition, storage, structuring and handling of GI on one side and technologies of information and communication on the other side. Generalisation services or geographic web services (Foerster et al., 2010; Burghardt et al., 2010; Pornon et al., 2008), geographic search engine (Flora, 2011) and Webmapping (Cecconi, 2003; Bernier et al., 2005; Jabeur, 2006; Weibel et al., 2008; Burghardt et al., 2010; Guffuri, 2012) are examples of developed web-applications.

Webmapping is defined as “a set of dynamic and interactive mapping applications available on the Web allowing primarily a user to view maps containing more or less of geographic information” (Pornon et al., 2009). Mostly based on Multiple Representation (MR) and generalisation approaches, these applications are often structured around a main task, which is the search and generation of requested map.

Indeed, the large amount of handled GI available on the web comes primarily, from different Geographic Databases (GDB) designed independently of each other with a very high cost, in order to meet specific needs, although they relate to the same location. To model and manage a such information, a first class of approaches proposes the integration of these GDBs into a single one called for this purpose Multiple Representation Database (MRDB). This information is organized according to two multiplicity factors (see Figure 1); Level of Detail (LoD) and Point of View (PoV) (Vangenot, 2004) which respectively correspond to the concept of map scale (the level of granularity of GI) and the way of perceiving a real entity located on the surface of the earth (map objective) (Parent et al., 2002; Sarjakoski, 2007; Derbal et al., 2009). However, the satisfaction of the great diversity of web users requires the personalization of requested map. This is where an alternative ambitious approach appears called the generalisation; it allows generating as much representations as expressed needs from a very detailed GDB (high LoD). But, because of its complexity, the automation of generalisation process doesn’t achieve, it keeps improving since its inception thirty years ago, even more in the context of the web (Ruas et al., 2007; Park et al., 2011; Smirnoff et al., 2012; Brassel et al., 1988; McMaster, 1992).

Figure 1. Overall tasks of proposed approach
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