

FUZZY BASED SPATIAL QUERY AND ANALYSIS IN AN URBAN INFORMATION SYSTEM

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Commission IV, WG IV/1

KEY WORDS: Spatial Query, Information System, Fuzzy logic, Uncertainty, Linguistic variables, Decision Making

ABSTRACT:

With respect to the fact that nearly 60% of the world's population live in the cities and regarding the inevitable structural complexities as well as the cultural and economical complications in the cities, the intervention of a sophisticated information management systems has become a real necessity. This means that powerful city planning and management tools based on spatial information are a real need of the present situation of the world. Decision making from land administration and property valuation to simple house transactions as well as transportation decisions in a city needs spatial information management tools such as GIS and UIS (Urban Information System). An Urban information system is now internationally acknowledged to be a suitable tool for improving the management and planning potentials for the people who live in urban areas. In spite of the level of the sophistication and the services which are provided by GIS and UIS for many users in the cities, one of the main problems associated with them are the fact that these systems can answer only limited number of questions and hence a partial solution to the problem may be obtained. For example decision for purchasing a house may need to be made based on the following queries:

To be close to the shopping centers and schools,

To be far from the main roads,

To be far from the military camps,

To have a medium area size,

To have an affordable price.

With regard to the fact that there are certain level of uncertainties in these queries, incorporating them in a

conventional UIS is not possible. In order to increase the potentials of a UIS system to deal with these queries, it is necessary to incorporate the following concepts into the UIS system: (a) descriptive parameters should be expressed based on linguistic variables and (b) uncertainty levels of the queries should be modeled. The method that is proposed in this paper takes advantage of the concept of the fuzzy logic to solve the above mentioned complications. To verify the proposed idea, the problem of selecting and purchasing an appropriate house is considered as a case study. To model this problem based on the fuzzy reasoning approach, in the first stage linguistic variables for decision making to buy a house is defined. In the next step the membership functions with respect to the linguistic rules for describing an ideal house is determined. These are then embedded into a fuzzy reasoning structure. The fuzzy reasoning structure is Mamdani type in which the position, dimensions, cost, and other properties of a house are defined as the input variables and the user's definition for an appropriate house is defined as the output variables. The required information layers are extracted from 1:2000 scale digital map of the city of Tehran. These information include: educational centers, entertainment areas, medical centers, etc. The descriptive information such as the property valuation, position etc. are also extracted from existing data. The preliminary tests on the implemented fuzzy data management system indicate the superiority of our proposed method over the conventional systems.