A Communication Platform for Group Decision Support System: Based Web Services and Multicriteria Method

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ABSTRACT

In a group decision support system, the various decision-makers have their own information, constrains, decision strategies, preferences, and objectives which are generally not shared or communicated. This implies that the group decision process is distributed between the different entities implicated and impacted by various group members’ characteristics. Solution to this problem is to find a decision that would be acceptable to all the decision-makers, following the necessity of a negotiation process that allows the elaboration of a common agreement for a group that faces a conflict on the decision to take. In the current study, the authors propose to establish a communication platform for a group decision support system (GDSS) based on web services, incorporating a multicriteria analysis methods and a negotiation protocol.

KEYWORDS

Decision Support, Group Decision Support System (GDSS), Multicriteria Analysis, Negotiation Protocol, Promethee II, Web Services

1. INTRODUCTION

Decision-making refers to the selection of the best solution among several possibilities, which requires evaluating these possibilities regarding to several criteria. The case of the single criteria is not useful in real-world settings. Multicriteria Decision Support aims to handle this issue and allows decision-makers to create a hierarchical representation of a set of solutions based on their importance according to the different criteria. Due to their efficiency, multicriteria decision support methods are often integrated the current decision support systems. However, these systems must adapt to the reality of group decision making, and extending to what is called as Group Decision Support Systems (GDSS).

Collegiality in decision-making may be explicitly required by the type of problem being addressed or because of a structural choice. In both cases, the decisional process multi-makers have to result to a decision that has consensus within the group of decision-makers. Therefore, a GDSS has to provide mechanisms to facilitate the confrontation of views and allows guiding a group towards a solution

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that is mutually acceptable. Moreover, collaborative work in general has evolved considerably by exploiting all the advantages of new technologies. A group should no longer be gathered in one place to work. GDSS has to be aligned to this logic and allow geographically dispersed decision-makers to handle their tasks.

In order to respond to all these requirements, the authors propose a negotiation protocol to manage the conflicts between decision-makers which is integrated into with a multicriteria method. The authors’ contribution through this study consists of designing and implementing a communication platform that allow geographically disperse decision-makers to participate and resolve a decision problem. This platform provides also the interoperability required for future integration with other systems and applications, justifying the web services use. In order to achieve this goal, web-services technology is used to implement the proposed platform.

Section 2, present a brief description of the major work on group decision support and related issues. Section 3 focuses on the authors’ contribution. Section 4 is dedicated to provide a detailed description of the proposed system, which includes the negotiation protocol and the multicriteria method used (Promethee II in this case). Section 5 defines the web services. Section 6 is dedicated to a real case study. Finally, section 7 concludes the discussion by highlighting the limitations of the proposed system and some considerations for future research.

2. RELATED WORK

In the domain of decision support, there is a variety of systems designed to treat different types of decision-making. However, the decision support is grouped into two broad categories: (i) The single-actor decision support - A decision-maker forms an opinion based on the information available to him (not the expertise), as well as his personal orientations (values), and (ii) The multi-actor decision support - Several actors decide with together on an issue, with personal views often divergent compared to others, which often requires the negotiation process.

In the context of single-actor decision support, several decision support systems in TP (Territory Planning) have caught attention. Joering (1997) propose system MEDUSAT for locating the site of a waste treatment plant in Tunisia. MEDUSAT combines a GIS tool allowing the creation of homogenous areas determined from spatial data and common land (constituting a similarity index); these areas constitute a set of possible solutions. Bensaid et al. (2007) use Multicriteria analysis as a tool for decision making for spatial localization of areas under heavy human pressure. In the same area, Čančer (2012) introduces the use of the 5Ws & H technique, which is the creative problem-solving technique based on who, what, when, where, why and how questions, for the establishing of the criteria weights in multi-criteria decision-making. A case study was presented at the University of Naama, Algeria in the same work. Various decision support systems rich in spatial tools and multicriteria analysis methods have been developed for management and decision making in territorial problems Hamadouche (2011). All these systems integrate in various levels multicriteria analysis tools coupled with GIS, but they consider the criteria as independent and unable to model any interaction between them.

Therefore, traditional decisional models adapted to the single decision-maker case are not consistent with the organizational reality. Group decision support, or multi-participant decision, treats processes, in which multiple decision-makers are involved. According to Smoliar and Sprague (2002), decision processes in organizations usually involve several actors interacting with each other. Indeed, Group Decision Support has been the subject of several research works. The work presented by the Hemaissa (2008) has been conducted in order to provide a solution to group decision problems encountered in crisis management applications, especially the distributed allocation problems. In this optic, the authors have defined multidimensional and multilateral negotiation protocols based on cooperation. Morge & Mancarella (2014) proposed a multi-attribute qualitative decision support tool called MARGO; it is based on an abstract approach for cancellable argumentation of Dung
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