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A MOBILE DECISION SUPPORT SYSTEM BASED ON DYNAMIC CHOICE OF ALTERNATIVES

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The aim of this paper is to present a new prototype of decision support system for group decision making problems based on dynamic sets of alternatives. The prototype incorporates a mechanism that allows to manage dynamic decision situations in which some information about the problem is not constant through the time. In order to get a general system, experts' preferences are assumed to be represented by different preference representations. Furthermore, the prototype is specifically designed to be used on mobile devices in order to make decisions anytime and anywhere.

Keywords: Group decision making, mobile internet, decision support systems.

1. Introduction

A decision making process, consisting in deriving the best option from a feasible set, is present in just about every conceivable human task. It is obvious that the comparison of different actions according to their desirability in decision problems, in many cases, cannot be done by using a single criterion or an unique person. Thus, we interpret the decision process in the framework of group decision making (GDM). This has led to numerous evaluation schemes.[1–4]

In some GDM situations, the application of the latest technologies extends opportunities and allows to carry out consensus processes where pre-

viously could not be correctly addressed. We assume that such adoption is based on the assumption that if the communications are improved the decisions will be upgraded, because the discussion could be focussed on the problem with less time wasted on unimportant issues.[5,6]

Usually, resolution methods for GDM problems are static, that is, it is assumed that the number of alternatives and experts acting in the GDM problem remains fixed throughout the decision making process. However, in real decision situations we find dynamic GDM problems in which the number of alternatives and/or experts could vary during the decision making process. In this paper, we assume dynamic GDM problems with possible changes on the set of alternatives.

The aim of this paper is to present a prototype of mobile DSS to deal automatically with GDM problems based on mobile technologies. Additionally, to better simulate real decision making processes usually carry out in these cases, the proposed tool incorporates both consensus and selection processes. Another innovation introduced in the prototype is a mechanism to manage dynamic GDM situations. In order to build a flexible framework and give a high degree of freedom to represent the preferences, experts are allowed to provide their preferences in any of the following four ways: i) as a preference ordering of the alternatives, ii) as an utility function, iii) as a fuzzy preference relation, or iv) as a multiplicative preference relation.

In order to do this, the paper is set out as follows. Some general considerations about GDM models and mobile technologies are presented in Section 2. Section 3 deals with the dynamic environment and the prototype of a mobile DSS. Finally, in Section 4 we point out some conclusions.

2. Related Works

In this section we present the classical GDM situation and the advantages of using mobile technology in GDM problems.

2.1. *Group decision making*

In a GDM problem we have a finite set of feasible alternatives. $X = \{x_1, x_2, \ldots, x_n\}$, $(n \geq 2)$ and the best alternative from X has to be identified according to the information given by a set of experts, $E = \{e_1, e_2, \ldots, e_m\}$, $(m \geq 2)$.

The main problem consists in how to obtain the solution ranking of alternatives from the opinions on the alternatives given by the experts.

Usual resolution methods for GDM problems include two different processes:[4] i) *A consensus process:* that refers to how to obtain the maximum degree of consensus or agreement among the set of experts on the solution alternatives and ii) *A selection process:* which consists in how to obtain the solution set of alternatives from the opinions on the alternatives given by the experts.

2.2. *Mobile technologies and GDM*

With the fast increase of the new technologies usage[5,6] and the new services that are offered, the impact in the society of the mobile communication devices is much bigger. Moreover, the growing penetration of mobile devices and the recent technological innovation in the wireless technology field have changed the old wired Internet world to the new wireless mobile Internet world, as known as M-Internet.[7]

Nowadays, organizations have moved from face-to-face group environments to virtual group environment using communication technologies and tools to coordinate and share information with other people. The main objective of these new approaches is that the members of the group could work in an ideal way no matter where they are, having all the necessary information to take the most guessed right decisions. To support the new generation of decision makers and to add real-time process in the GDM field, many authors have proposed to develop decision support systems based on mobile technologies.[8] Thus, we can say that has born a new decision environment where does not matter neither the group size nor the place where the members are. This model make disappear the need of a face-to-face or distantly meeting, being the own computer system who acts as moderator and every expert can communicate with the system directly using his mobile device from any place of the world and at any time of the day.

3. A New Model of GDM Based on Mobile Technologies and Dynamic Information

In this section, we present a new approach to deal with dynamic environments and a mobile prototype which implements the DSS.

3.1. *Group decision making problems in a dynamic context*

In order to make the decision making process more realistic, we provide a new mechanism to deal with dynamic environments in decision making. In

such a way, we can solve dynamic decision problems in which, at every stage of the process, the discussion could be centered on different alternatives. To do so, we define a method which allows us to remove and insert new alternatives into the discussion process. This method has two different phases: (i) *Remove old bad alternatives* and (ii) *Insert new good alternatives.*

(1) The first phase manages situations in which some alternatives of the discussion subset are not available at the moment due to some dynamic external factors or because the experts have evaluated them poorly. Therefore, if an alternative deserves to leave the process, the system looks for a new good alternative. Then, the system asks for the experts' opinions about the replacement (see Fig 1).

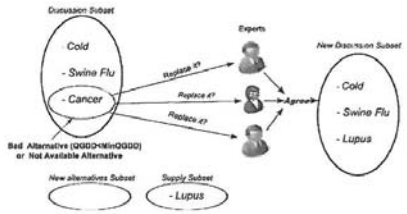

Fig. 1. *Dynamic choice process of alternatives: Case 1*

(2) The second case manages the opposite situation, that is, when some new alternatives have emerged. Now, the system has to identify the worst alternatives of the current discussion subset and asks for the experts' opinions about the replacement (see Fig 2).

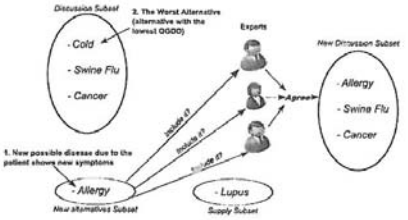

Fig. 2. *Dynamic choice process of alternatives: Case 2*

If the majority of experts think that the changes are appropriate, the system updates the discussion subset according to the above cases. The

possibility of these changes makes experts to be more involved in the process and improve their satisfaction with the final results.

3.2. *Prototype of the mobile DSS*

The chosen architecture for our prototype of Mobile DSS is a "Client/Server" architecture, where the client is a mobile device. The prototype lets the user send his/her preferences to the DSS by means of a mobile device, and the system returns to the expert the final solution or recommendations to increase the consensus level, depending on the stage of the decision process.

The **client** software has to show different interfaces to the experts on the mobile device in order to deal with the next services: *internet connection, authentication, problem description, selection of preference representations, insertion of preferences, change of alternatives request, feedback information and final solution.*

The **server** is the other fundamental part of the DSS. It is based on the next five main processes, which receive/send information from/to the experts through M-Internet technologies:

(1) *Uniform information process:* The server makes the information uniform using fuzzy preference relations as the base element of preferences representation.
(2) *Selection process:* Returns the solution set of alternatives.
(3) *Consensus process:* Determines if the required agreement degree has been reached.
(4) *Dynamic choice process of alternatives:* The system offers the possibility to update the discussion subset on time.
(5) *Feedback process:* The server generates and sends the recommendations.

In the diagram (see Figure 3) we can see all the functions of the system, the form in which they are connected together with the database, and the order in which each one of them is executed.

4. Conclusions

We have presented a prototype of Mobile DSS for dynamic GDM problems based on dynamic sets of alternatives and multiple elements of preference representation, which uses the advantages of M-Internet technologies to improve the user satisfaction with the decision process and to develop decision processes in anytime and anywhere.

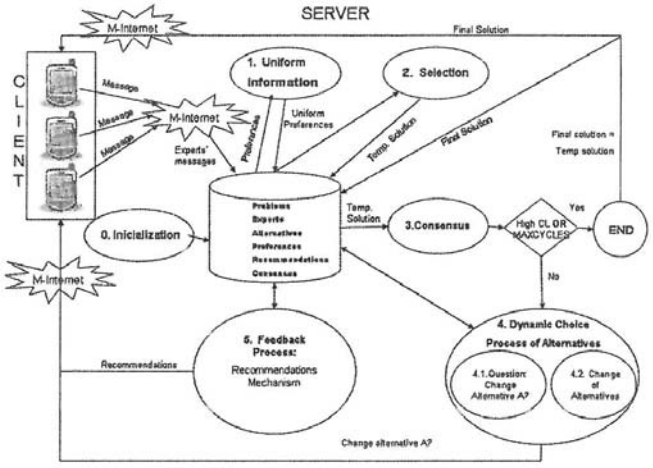

Fig. 3. *Functions Scheme of the System*

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