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A MOBILE DECISION SUPPORT SYSTEM IN MOBILE-COMMERCE ACTIVITIES

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Web 2.0 technologies provide rich and lightweight online tools that let users contribute with new data. They can associate in social networks, share ideas and information and collaborate together for many kind of reasons, obtaining a community's "collective intelligence". We propose to compute this collective intelligence with a Mobile Decision Support System (MDSS) to aggregate recommendations and use this collective advice to improve the customer satisfaction in decision making situations related with the m-commerce activities.

Keywords: Group decision making, mobile commerce, decision support system, linguistic approach, web 2.0, social network.

1. Introduction

In recent years, the World Wide Web has achieved a rapid development on a global scope. More and more people began to use the virtual borderless continent. Anyone in the world with a communication device and Internet access can now explore, join, build, or abandon any Web community at any time. This new freedom is often attributed to the "Web 2.0 era" of services and applications that let webizens easily share opinions and resources. Consequently, users can collectively contribute to a Web presence and generate massive content behind their virtual collaboration.[1]

Web 2.0 represents a paradigm shift in how people use the web. Nowa-

days, everyone can actively contribute content online. Thus, we can think about great potentials and challenges for the future of e-commerce (electronic commerce). E-commerce is the buying and selling of goods and services on the Internet, especially the World Wide Web. E-commerce is now spreading into all walks of life. Even, users can view, select and pay for online services in a mobile framework.[1,2]

M-commerce is the buying and selling through wireless communication devices such as cellular telephone and personal digital assistants (PDAs). Known as the next-generation e-commerce, m-commerce enables users to access the Internet without needing to find a place to plug in. M-commerce is about the explosion of applications and services that are becoming accessible from Internet-enabled mobile devices. It involves new technologies, services and business models. Social shopping sites emerged as the latest developments to leverage the power of social networking with online shopping. Users on social shopping sites can post product recommendations, create wish lists, post photos, make purchases, and form social shopping communities.[1]

The central goal of Decision Support Systems (DSSs) is to process and provide suitable information in order to support individuals or organizations in their decision making tasks like to decide where travel in holidays or shopping elections.[3] We propose to incorporate mobile technologies in a DSS for advising customers in their m-commerce experiences. Usually, people bring their mobile devices with them anywhere, making it possible to use some mobile services wherever they go.

In this paper, we present a mobile DSS as a new Web 2.0 service. It could be incorporated as a tool into a social network to aid customers in their m-commerce activities. To advice customers in their m-commerce elections, the MDSS shows to the customer the collective opinion extracted by aggregating the collective intelligence of the virtual community. In such a way, our system allows that the members connected with the customer help him/her to choose the best good or service of the stock, according to the customer's needs. To represent the preferences provided by the social network members we use a *fuzzy linguistic modelling*.[4] To compute the quality assessments we use computing with words tools based on linguistic aggregation operators.[5]

In order to do this, the paper is set out as follows. Some considerations about GDM problems and computing with words are presented in Section 2. Section 3 deals with the incorporation of the MDSS as a mobile web 2.0 service. Finally, Section 4 draws our conclusions.

2. Preliminaries

2.1. *Group Decision Making Models*

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, and has become a major concern of research in decision making.[6]

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.

2.2. *Use of Linguistic Information in GDM Problems*

There are situations in which the information cannot be assessed precisely and in a quantitative form but may be in a qualitative one. For example, when attempting to qualify phenomena related to human perception, we are often led to use words in natural language instead of numerical values, e.g. when evaluating quality of a football player, terms like *good*, *medium* or *bad* can be used.[7]

The use of Fuzzy Sets Theory has given very good results for modelling qualitative information.[4] The fuzzy linguistic modelling is a tool based on the concept of linguistic variable[4] to deal with qualitative assessments. It has proven its usefulness in many problems, e.g., in decision making,[8] quality evaluation, information retrieval models, and so on.

The ordinal fuzzy linguistic modelling[5] is a useful kind of fuzzy linguistic approach proposed as an alternative tool to the traditional fuzzy linguistic modelling.[4] This tool simplifies the computing with words process as well as some linguistic aspects of problems. It is defined by considering a finite and totally ordered label set $S = \{s_i\}, i \in \{0, ..., g\}$ in the usual sense, i.e., $s_i \geq s_j$ if $i \geq j$, and with odd cardinality (usually 7 or 9 labels).

We assume that each social network member e_h provides his/her preferences by means of a fuzzy linguistic preference relations (FLPR) P^h.[7,9]

On the other hand, an useful linguistic aggregation operator is the Lin-

guistic Ordered Weighted Averaging (LOWA) operator which has been extensively used in the literature by its good axiomatic properties.[5] We shall use it in our MDSS.

3. A Mobile Decision Support System to Advise Customers in their M-Commerce Experiences

The emerging mobile commerce services, such as mobile auctions, mobile financial services, mobile entertainment services, mobile advertising, and location-based services, are receiving considerable interest in the research and development community. Mobile technologies have changed the users' mode of operation as they have started to carry the devices in their pockets or handbags and to use them almost anywhere. Consequently, the use environment has become an issue.[2,10,11]

We propose the inclusion of a new mobile web 2.0 service to improve the customer satisfaction. This service is a MDSS to advise customers in their m-commerce experiences through "collective intelligence" of web 2.0 communities. The MDSS should provide a simple interface so that even the least sophisticated webizen can contribute input. In such a way, the customer can be advised by a set of members (other users of the social networking connected with him/her, with the same user profile and more experience) about some specific items provided by this customer.[10]

To do so, the system asks customer his/her current needs (the tool offers a personalized service). Taking into account these needs, together with the community's collective knowledge, the system shows to the customer the collective advice through his own mobile device. Therefore, the customer receives a social support to choose his/her preferred items. The advise is represented by means of linguistic rankings of shopping alternatives obtained from the individual preference relations provided by the social network members applying a selection process.

To clearly explain the way of use and the tool's features, we simulate a usage scenario that shows the mobile interfaces of the social network service, which are displayed in the customer's mobile device before buying an item using m-commerce as way of shopping.

The example deals with the purchase of a laptop. Firstly, suppose that the customer visits the laptops shop web site, selects a set of laptops as possible shopping alternatives, and has not a clear idea of which laptop is more adapted to his/her needs yet. Therefore, the customer needs some advice to choice the best option. To obtain this help, the customer uses our MDSS, which acts as an advices unifier and which is offered by the social

network of whom the customer is member. To complete the advice process, the customer has to follow three easy steps:

(1) The first step is to select the set of laptops that he considers that are the more adapted to his needs using his mobile device (see Figure 1a).
(2) Then, the customer sends his needs about the laptops environment to receive a personalized advice service. To do so, the customer has to answer some questions and submit the survey from his mobile device (see Figure 1b).

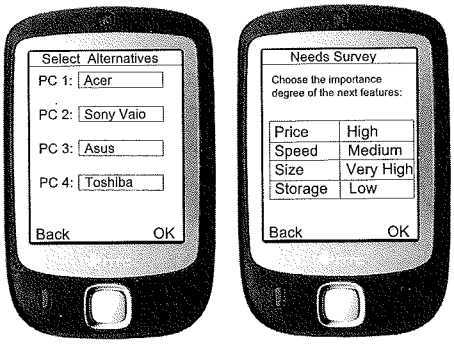

Fig. 1. a) Selection of alternatives. b) Needs survey

(3) Once the customer has submitted his preferred items and his current needs, the members connected with him have to give their opinions, taking into account the customer's needs, about the items that the customer selected. When all the members have given their opinions using fuzzy linguistic preference relations as element of preferences' representation (see Figure 2a), the system starts the selection process. The first phase of this process is called *the aggregation phase* and uses the LOWA operator to compute a collective preference relation. The second phase is called *the exploitation phase* and transforms the global information about the alternatives into a global linguistic ranking of them.[7]
When the system has computed the collective ranking, the customer receives the information in his mobile device (see Figure 2b):

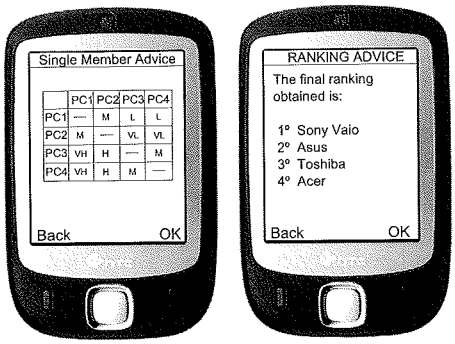

Fig. 2. a) Members' preferences (FLPRs) . b) Collective advice displayed

4. Concluding Remarks

We have presented a MDSS tool based on GDM models as a Web 2.0 service related with collective intelligence and m-commerce. This tool uses the advantages of M-Internet communication technologies to advise the customer in their m-commerce experiences and improve the customer satisfaction with the decision of purchase in anytime and anywhere.

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