
Implementing Voting Tools in GRUS

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ABSTRACT

The aim of this work is to develop a recommendation system to help to choose a voting procedure. For this purpose, we have to implement these voting procedures in a GDSS (Group Decision Support Systems). Therefore, it involves to review the literature on voting procedures and voting tools in order to know their functionality. We will use a practical example to show the level of implementation of the platform in its current state. Finally, we will invoke the perspectives of future work to continue to improve the voting tools of GRUS (GRoUp Support).

Keywords: Decision making, voting procedures, voting tools, GDSS, GRUS.

INTRODUCTION AND BACKGROUND

Decision-making and its execution are the fundamental goals of any organization and their management. Indeed, any organization depends on the nature of the decisions that are made within it by decision-makers, whether individual or collective [1].

However, a collective decision often creates conflict situations due to differences in the views and interests of decision-makers about the same set of objects, hence using decision support systems is needed. Making a decision is choosing from a set of alternatives likely to solve a problem in a given context [2]. To achieve this, the problem of collective multicriteria decision-making often comes down to an aggregation problem that is characterized by the definition of a set of criteria to evaluate the performance of the alternatives according to each criterion considered as relevant by all decision makers.

Group Decision Support Systems (GDSS) are developed to help decision makers and are most often based on computer platforms that provide decision-makers with a formal framework for reflection, and investigative skills to express the preferences and parameters of each, to evaluate them, and to provide the relevant elements for the decision-making process.

This type of system consists in offering tools of software for group decision [3]. A particular actor stands out in the process of group decision making. This is the facilitator. This actor's role is to help the group making a decision. This assistance can be defined not only on the technical level, but also on the content or the decision-making process. Few software packages are currently being developed to assist the facilitator in assisting the decision-making process. A Group DSS has been developed at IRIT called GRUS (GRoUp Support) [4]. Indeed, the main

objective of this work is to develop a complementary tool implementing different voting procedures [5] but above all allowing the facilitator to choose the most appropriate procedure depending on the type of the working context of the group through a recommendation mechanism. The working context of the group is defined by the size of the group, the date of delivery of the decision, the working mode of the group (synchronous or asynchronous / distributed or not).

To achieve these objectives, we must make a state of the art on the different existing voting procedures, to understand their rules of operation. In addition, we also have to know what are the existing tools implementing the voting procedures.

RELATED WORK

Voting procedures

Voting is considered as an individual mode of expression allowing a group of people to make a decision. Therefore, a voting procedure consists of determining from one method the winner(s) of a vote. Thus, there are several voting procedures that have emerged depending on the specific situations. We can cite: the majority with its variants, the approval or assent, the weighted, elimination, Borda, Condorcet [6,7]. The two most common methods are Borda and Condorcet and the following points describe their basic principles or rules [8,9].

The Borda method

If we have n candidates or alternatives, Borda's method works as follows: Each voter classifies alternatives following his preference order. For each ballot cast, points are awarded to each alternative as follows: The first-place ranking is worth n points, the 2^{nd} place ranking is worth $n - 1$ points, and so on. The last place ranking is worth 1 point. The alternatives are then ranked in the preference order by how many points they have accumulated. And the alternative that gets the highest points is the winner. For example: seven (7) voters 1, 2, 3, 4, 5, 6, 7, ordering three (3) candidates, A, B, C, as follows

Voter→		1	2	3	4	5	6	7	Points
Ranking	1th	C	C	B	B	A	A	A	3
	2nd	B	B	C	C	B	C	C	2
	3th	A	A	A	A	C	B	B	1

$P(A) = (3*3) + (4*1) = 13$ points
 $P(B) = (2*3) + (3*2) + (2*1) = 14$ points
 $P(C) = (2*3) + (4*2) + 1 = 15$ points
 Hence C is the winner with 15 points

Table 1: Example of Borda

The Condorcet method

Each voter classifies alternatives following his preference order. To prevail, an alternative must undo the others in a "one by one" confrontation. One compares the alternatives by raising the number of votes obtained by duel. The winner is the one that has won its duels against the other alternatives. Let us use the same example and taking ">" as a representation of the preference relation of one candidate to the other one obtains

Duel→	A versus B	A versus C	B versus C
	A>B = 3	A>C = 3	B>C = 3
	B>A = 4	C>A = 4	C>B = 4
Winner→	B	C	C

C won all his duels, therefore he is the winner.

Table 2: Example of Condorcet

Existing voting tools

Several tools are developed, some of them are free and other are not. Among them we can refer to Condorcet Vote [10], Decision Maker [11,12], RoboVote [13], Tricider [14], Whale3 [15], Electionrunner [16], VoxVote [17], Doodle [18], etc. Two of them are largely used and the following section describes them.

RoboVote is a free service that helps users to combine their preferences or opinions into optimal decisions. To do so, RoboVote employs state-of-the-art voting methods developed in artificial intelligence research. This solution offers two types of polls (Objective Opinions and Subjective Preferences), which are tailored to different scenarios; it is up to users to indicate to RoboVote which scenario best fits the problem at hand. Its algorithms are based on the Condorcet's voting method [13].

Whale3 (WHich ALternative is Elected) It is a web application dedicated to collective decision-making and voting. You can create a poll (open or secret), invite people to participate, and view the results. Whale3 offers several modes of preference expression (ordinal, qualitative, binary, numerical), and relies on voting theory to illuminate the results [15].

VOTING TOOLS IN GRUS

GRUS is equipped with several collaborative tools and can be used in various decision-making situations: asynchronous or not and distributed or not. Depending on the contexts, GRUS allows to define the stages of the decision-making process of a group. Each stage may correspond to the use of a specific tool. For example, a decision-making process of a group can be composed of the following steps: - Brainstorming - Categorization of ideas - Establishment of consensus. In the case of a consensus, it will be easy to conclude. If not, a recourse to voting procedures is necessary.

A voting plugin tool for GRUS will have the following particularities in its use: a) ability to interact, in the processes of a meeting, with the other tools existing on GRUS; b) usable alone as a vote planner like the other solutions explained in the **section of Existing voting tools**. To achieve this, it follows the following logical architecture:

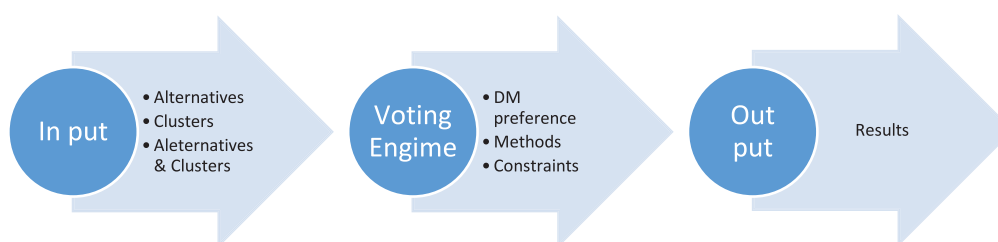


Figure 1: Logical architecture of GRUS's plugin voting tool

Inputs may vary from case to case. Alternatives, clusters of alternatives or a mixture of the two can be used as input for the vote during a meeting. The Voting Engine, receives these inputs, applies one or more methods according to the preferences of the voters for a proclamation of the result which leads to the outputs.

The current status of the implementation

Currently, we have developed the Borda method in the voting tool for GRUS. And we'll use a practical example to assess the current state of implementation.

Suppose that in a management meeting of a company, five (5) leaders must decide on the adoption of a new source of energy for the respect of the environment. The alternatives selected are: wind, solar or hydroelectric among several proposed. So we will have five (5) voters (V_1, \dots, V_5) who must choose between three (3) alternatives ($Alternative_1, Alternative_2, Alternative_3$) corresponding respectively to wind, solar and hydroelectric. The Table3 represents the actual preferences of voters.

Ranking	V_1	V_2	V_3	V_4	V_5
1th	Wind	Solar	Hydroelectric	Solar	Wind
2nd	Hydroelectric	Wind	Solar	Hydroelectric	Solar
3th	Solar	Hydroelectric	Wind	Wind	Hydroelectric

Table 3: Preference of five voters

With the GRUS voting tool, the facilitator must do the following:

- a) Create a vote that takes into account the data of the example as shown in Figure 2.

Figure 2: Voting creation Screen

- 1: descriptions of the vote to know: title, description, start and end dates, status
- 2: the alternatives proposed in the meeting. 2': the selected alternatives used for the vote
- 3: The participants of the meeting. 3': the selected participants who will vote.

- b) Let the participants vote: Expression of the preferences of each voter as shown in Figure 3.



Figure 3: Vote participation screen

4: the list of candidates for the vote (2 ')

4': the list of preference of the voter representing his choices on the alternatives.

c) Proclaim the result of voting (see Figure 4)

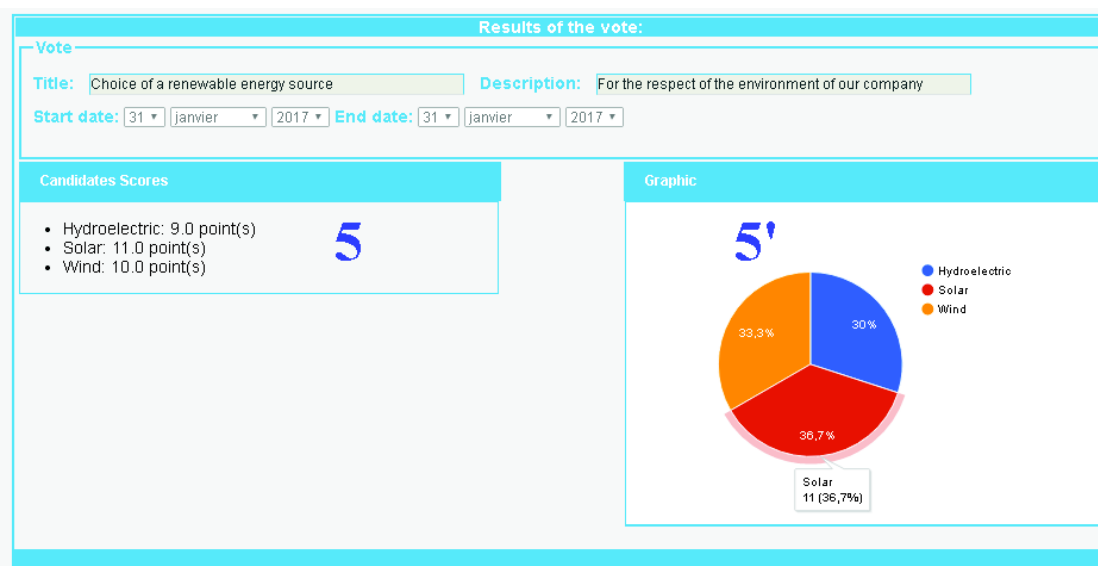


Figure 4: Voting results screen

5: numerical scores of the candidates.

5': graphical representation of the voting result

So the Solar with 36,7% is chosen by the management team.

This example shows that a first implementation has been done. Because it contains features such as management of vote (create, update, delete), participation in a vote and the announcement of the result of applying the method Borda.

CONCLUSIONS AND PERSPECTIVES

There are several voting procedures that are well documented in the literature because they have been the subject of a lot of researches. They are also present in many tools, some of which are free. A voting tool plugin for GRUS, gives it a considerable advantage to be a very complete GDSS.

In its state, this plugin is functional and uses the Borda method, for the calculation of the votes result. This method makes it possible to choose one or more alternatives generally benefiting a high degree of satisfaction of the voters.

As in perspectives of this work, we propose to:

- implement other voting procedures in the GRUS's plugin voting tool;
- conduct a detailed study of the impact of meeting contexts in order to implement the recommendation feature in this voting tool;
- integrate the plugin into the GRUS's toolbox.

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