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A GIS-based FOSS decision support system for the management of SAR operations in mountain areas

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Information plays a basic role in decision making processes. In particular in the emergency management and SAR (Search and Rescue) operations, it is extremely important to take into account and use correctly as much information as possible to maximize the possibility of making the right decisions. Quite often decision makers do not consider all the available information. Moreover, cognitive biases cause several errors in the decision making process. These are some of the reasons that justify the effort for trying to build a decision support system, based on a normative approach to the decision-making, to manage mountain missing person search. Since cognitive biases influence the way the rescue squads act, and the environment affects the way a lost person thinks and moves, it is possible to start the design of a decision support system by trying to evaluate in a combined way both environmental and individual variables. The more natural and logical way to manage environmental information, i.e. geographical data, is to use GIS (Geographic Information Systems), while the best way to model the behavior of lost people is to study the way they think and act. The implementation in a GIS allows the integration and the management of different kind of information.
The maximum speed of a missing subject is evaluated on the base of physiological variables and terrain features and it is used to evaluate the maximum reachable extent, thus defining the area the missing person can be found in. A map is built where isochronous lines are drawn around the last known position, defining the maximal search area for a given time. The model takes into account the morphological features of the searching area, the presence of physical obstructions to the lost person walk as well as preferential paths and some simple physiological parameters. The morphological parameters used are: height, terrain slope, vegetation density and the ground unevenness. Age, sex and training level of the subject are considered as physiological parameters. Visibility is another relevant parameter, accounting for the influence of light and darkness on the subject motion. Another important parameter that can strongly influence the lost person path is the presence of preferential paths or obstacles. It is possible to consider rivers as well as

bridges, roads and mountain paths as elements influencing the velocity the lost person can or can not achieve.
The available power is evaluated from the physiological parameters and matched against the energy cost required from the terrain features. In this way it will be possible to separate the effects of terrain features from missing person's parameters, making this approach more effective, since a map of the energy required to travel in an area can be evaluated in advance.
The model has been tuned on the few data available in literature and on walk speed estimates provided by professional mountain guides and by the ?Aiut Alpin Dolomites? rescue corp. A GPS campaign has been carried out to collect data to verify the results and the reliability of the model. A sensibility analysis has also been performed to evaluate the role and the relative influence of the different parameters of the model.
A GRASS module implementing the model has been built and will be released soon. Current developments include the development of a full DBMS approach, where all data, both semantic and cartographic, are stored in a spatial database. A web interface will be used both to feed the DBMS and run the model and to browse the model output and the database.

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