

# SIGAME: Web-based System for Resources Management on Emergencies

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## ABSTRACT

This paper describes SIGAME, a web-based application for national cooperation in case of disaster. The main motivation of SIGAME is to provide a quick, flexible, reliable, many-to-many, updated communication channel for improving and coordinating the response of assistance suppliers (located at several territories) when an emergency occurs. In order to make communication as efficient as possible and taking into account the organizational diversities of the suppliers, the political implication and the characteristics of the future users, a user centered design method for web-based interactive systems seems to be the best solution for attending the designer through the different phases and products of the design process. In particular, we will focus on the techniques used both to involve stakeholders in the design and to collect requirements.

## Keywords

Disaster mitigation, national cooperation, information management, requirements, design patterns.

## 1 INTRODUCTION

One of the goals of the Department of Civil Defence and Protection of Spain (DGPCE) described on the basic normative of Civil Protection (R.D. 407/92) [2] is the determination of the resources necessary to mitigate an emergency or crisis situation (i.e. city and forest fires, nuclear emergencies, warlike situations, floods, earthquakes, etc). The development of this goal requires the evaluation of those resources, identifying the proper mechanisms to provide them in all levels, as well as the private and public organisms and entities called to participate and the required information resources. It is important to define a procedure to evaluate damage produced by a disaster to specify the equipment and supplies that are necessary to help the victims or mitigate the crisis. In Spain, the responsibilities in case disaster are handed over each Autonomous Community (similar to a State in USA). When an emergency occurs, the affected territory, in case of Spain each Autonomous Community (AC), asks for help to other AC, to the State or to other country in an unilateral way, that is, using one to one communication channel (i.e. telephone or fax). In turn, the affected communities or organizations receive supply assistance in a way according to the capabilities of the cooperating ones, but without taking into account the possible collaborations that could have been made by others. This can be easily lead to the situation in which affected AC receives the resource too late or it never arrives, while the State and other Autonomous Communities did not know the situation and therefore they could not offer its aid. In this situation, the final responsibility is always of the State, although as mentioned before, it did not know that the necessities of aid of the affected community had not been covered or it did not even know that a crisis situation had taken place. Consequently, it is necessary to establish a ring of communications among all the communities and the DGPCE with the purpose of assuring that the communication flows between all the participants, but respecting the responsibilities of each one.

For this reason, the Spanish Civil Protection Department along the DEI research group at Carlos III University of Madrid started SIGAME, a web-based system designed to enhance the management of national cooperation in case of disaster by providing a platform for shared updated and reliable information among the communities and organisms centred on the resource's management.

The purpose of this paper is to describe SIGAME system and motivation, focusing on the technique used to involve stakeholders in the design process. More precisely, this paper explains the basic assumptions of the design of SIGAME in which design patterns play a prominent role.

## 2 SIGAME

SIGAME facilitates the contribution of resources located outside an AC to face a situation of emergency creating a communication ring where the entire involved agents are informed on the situation. This platform favors an inter-territorial and multidirectional communication to make the answer more effective and efficient. In addition it does not interfere with the protocols of management of existing emergencies in the different Autonomous Communities. The context that gives place to this system can be summed up in the following points:

- There are no agile and trustworthy channels of communication with automated protocols between the different Autonomous Communities and the Department of Civil Protection and Emergencies of Spain (DGPCE).
- The processes of request, contribution, monitoring, delivery and return of resources do not have the systematization and the automation necessary to obtain a greater efficiency and effectiveness.
- Currently, it is necessary to repeat the communications of request of aid by the competent organ of the affected AC in order to ask for help to many communities.
- It is necessary to develop agile mechanisms that facilitate the contribution and the monitoring of the given resources.
- It is necessary to go further in the integration with the Communitarian Mechanism of Civil defense of the European Union.

The solution proposed is the development of a web platform that eases the communication and management of resources. In order to obtain this it is necessary to facilitate the different flows of information that will depend on the different roles or responsibilities users can exercise in the system. In addition, SIGAME will make use of new and rigorous techniques that allow guaranteeing the good operation of the system as well as the security of the information held.

SIGAME will give support three scenarios:

- **Coordination between communities with bilateral agreements.** Some communities establish agreements with others by different reasons like for example: geographic proximity, good political relations, complementariness of resources, etc. In these cases it is necessary to establish a direct channel of communication between them.
- **Coordination of the supra-communitarian aids with the participation of the DGPCE.** When a community asks for aid to others without mediating bilateral agreements, it is necessary to coordinate and to guarantee that the aid arrives at the affected community. This is the responsibility of the DGPCE. Then, if some of the applied resources are not offered by any community, DGPCE will be responsible for obtaining it.
- **Monitoring of resources in the cooperation between communities.** It is necessary to develop mechanisms so that the communities can at any moment know and control the state or the situation of the own resources and the resources coming from other communities.

This platform is being developed using incremental life cycled model. The first version will include the necessary tools to give support the scenarios defined above. The implementation and design will be made in a modular and flexible form. This way, if new services and requirements are identified its extension could be raised (i.e. inclusion of techniques of mining of data to extract knowledge on the existing information of emergency situations already closed). In addition, it is important to study how to integrate this platform in each of the mechanisms of emergencies management of the different Communities with the purpose of developing specific interfaces.

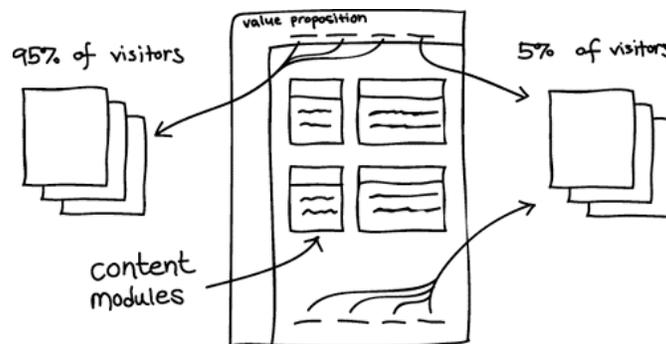
### 3 HOW TO INTEGRATE THE REQUIREMENTS AND THE DESIGN

One of the most common reasons of dissatisfaction with a newly developed system is the lack of success in meeting the user's needs, due to how requirements are collected, represented and reasoned during the conceptual modelling. During the analysis phase in the development process of a web application, the user's needs must be identified and documented as requirements.

To illustrate this process we will use as a supposed fire of high dimensions on one AC. What operatives take place on this situation? What is the procedure for solving this situation? What problems origin the current way of acting? With these kinds of questions, the user's needs are identified and documented as requirements making up the problem space. Later, in the design phase the solution space for those requirements is described. Therefore, the designer needs to be able to synthesize a problem to produce a complete and efficient solution. This difficulty in finding and mapping requirements to design entities often makes it more of an art than a science. The difficulty arises from the fact that the success of this task depends on the skills and knowledges of the requirement elicitor.

In order to collect functional, usability and other non functional requirements of the system, interviews, surveys and cases of are being used in the SIGAME project. These techniques are very useful for understanding the purpose and services the system must cover describing the space of the problem. To translate requirements into usable solutions we are using web design patterns according to [3]. A design pattern records the knowledge and the experience of domain experts on how to make a software system more reusable and flexible as a result of many efforts on the design and codification of systems. Patterns are presented as a rule that guides the transformation between a given problem and a solution. Thus, each problem described on the requirement can be connected with the solution proposed by the design pattern so that conceptual design can be automatically proposed. In addition, there are specific design patterns for special domains of application and particular problems of design. They not only can provide us a valid solution to a requirement already discovered, also they can originate more requirements. Therefore, as another extraction technique of requirements we are using web design patterns.

In order to develop SIGAME it is necessary to explore multiple domains. For example, one requirement of SIGAME related to the usability aspect of a web application is that *"users must be able to access any functionality of the system anywhere, access easily to contents and the appearance and interaction of the system must be easy to use for them"*. On [4] we have found the Homepage Portal pattern which proposes as solution that matches with this requirement. This pattern suggests dedicating 95 percent of the area and links above the fold to the users groups that comprise 95 percent of the total user population. It proposes to keep the remaining area and links for user groups that make up the remaining 5 percent. Then it uses additional links in the footer of the homepage to make explicit links for each group, including those in the 5 percent category. Finally, it says that is crucial to build a homepage layout that provides strong cues to define navigation and content, and that downloads quickly. On Figure 1 a draft of the solution proposed above is shown.



**Figure 1. Sketch out strong first impressions of your homepage with compelling titles and logos, and simple navigation.**

Applying this pattern to SIGAME we would obtain a result as shows figure 2. Links located on the top of the page represent each scenario that will be implemented on the application. Also a resume of the last applications, offers and resources, both sent and received, is accessible from this point so users have a global view of the whole application content.

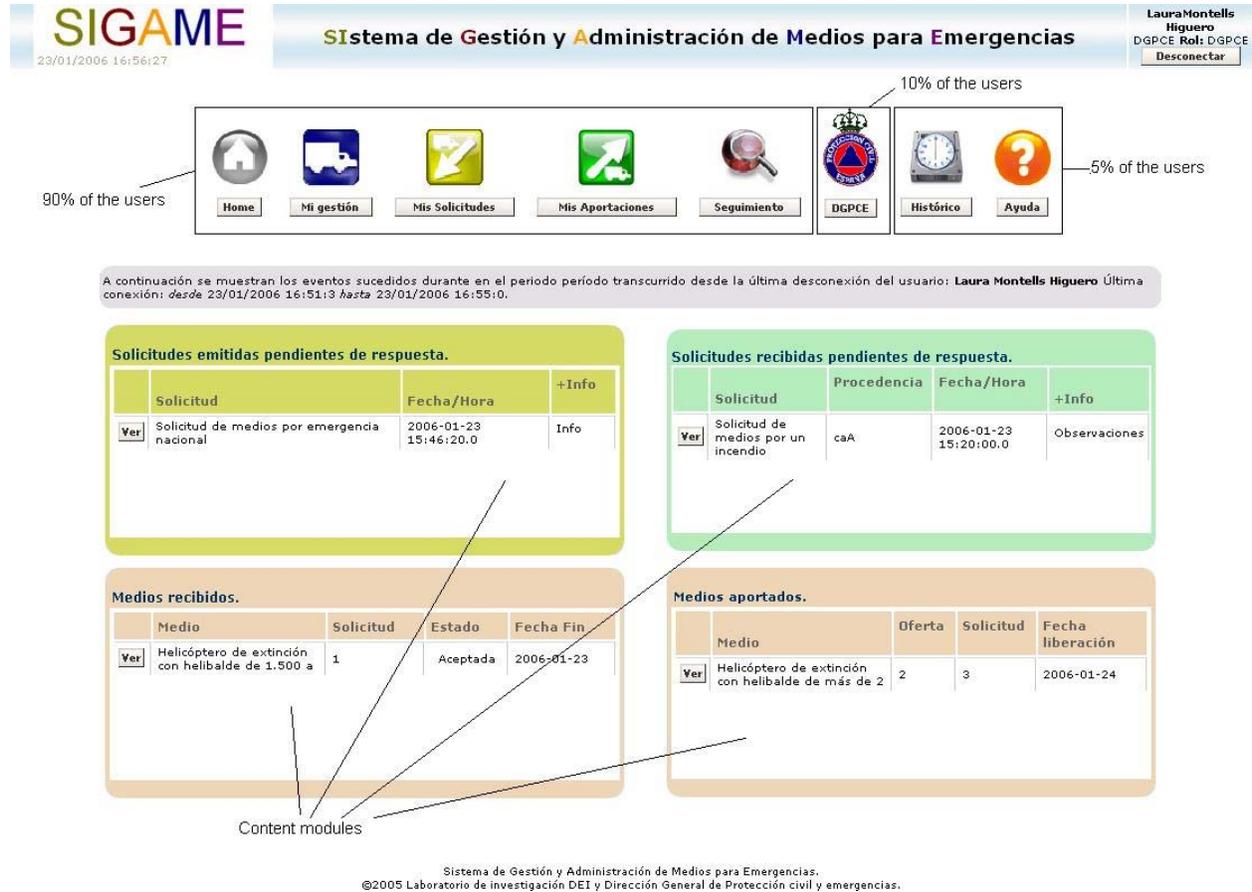


Figure 2. Homepage screenshot of SIGAME.

Evaluating this pattern, we have not only found a valid solution for our requirement but that also we have located new requirements applicable to our system like for example: ‘It is important to make the Homepage download quickly so that the user trusts the good operation of the system’

The same process is repeated with each requirement and available pattern to complete the requirements specification and to develop an early prototype that can be discussed with stakeholders. Moreover, errors (misunderstood requirements) as well as new requirements can be detected. If we define requirements in a formal and detailed way using, for example using soft-goal graphs as in [5], we can link the statements expressed on each requirement with a valid solution proposed in a design pattern and navigate through the requirements structure to detect new functionalities or new patterns to apply. This way we could assist the designer in the searching of the adequate solution for each problem offering him a set of proven solutions.

#### 4 CONCLUSIONS

SIGAME is an information system to helping in supplying resources located outside an AC facing a situation of emergency. It creates a communication ring where the entire involved agents are informed on the situation. The best solution for helping the designer through the different phases and products of the design process seems to be using a user centred design method for web-based interactive systems. This improves communication between stakeholders and designers considering the organizational diversities of the suppliers, political implication and the characteristics

of the potential users. Then, using cases of use, interviews and surveys with the final users, application-independent usability requirements and analysis of design patterns related to different dominions, can be used to gather requirements. But requirements have to be translated into design solutions for which we could reuse the design knowledge underlying accepted design patterns. This paper proposes to establish relationships amongst requirements and design patterns so that design solutions can be proposed automatically and new requirements can be found. In this point, it is necessary to make further research on how to represent functional and usability requirements not only for enable the automation of this process but for supporting automatic validation and verification of requirements. Finally, it will be important to promote specific design patterns to record the knowledge in the development of this kind of application.

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