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A REST Architecture for Social Disaster Management

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ABSTRACT

This article presents a social approach for disaster management, based on a public portal, so-called Disasters2.0, which provides facilities for integrating and sharing user generated information about disasters. The architecture of Disasters2.0 is designed following *REST* principles and integrates external mashups, such as Google Maps. This architecture has been integrated with different clients, including a mobile client, a multiagent system for assisting in the decentralized management of disasters, and an expert system for automatic assignment of resources to disasters. As a result, the platform allows seamless collaboration of humans and intelligent agents, and provides a novel web2.0 approach for multiagent and disaster management research and artificial intelligence teaching.

Categories and Subject Descriptors

H.3.5 [Online Information services]: Data sharing, web based services. I.2.11 [Distributed artificial Intelligence]: Intelligent Agents, multiagent systems.

General Terms

Experimentation.

Keywords

Disasters, social, Web2.0, Mobile, mashup, REST, Intelligent techniques.

1. INTRODUCTION

Natural disasters are associated to chaotic situations in which information is usually incomplete and imprecise, and this lack of information makes difficult the process of making decisions and managing effectively catastrophes. The secretariat of the International Strategy for Disaster reductions of the United Nations (UN/ISDR) proposes eleven lessons for disaster management; the first two are [1]:

Public awareness is an essential element of preparedness for saving lives and livelihoods.

Individuals and communities play important roles in managing risks from natural hazards.

This project proposes that Web2.0 technologies are a valuable tool to contribute to both lessons, enabling public knowledge and both individual and social participation in disaster management. Web2.0 [2] has proven the power of users' participation to create content, give opinions and organize themselves in social networks. Examples such as Wikipedia or del.icio.us show us the potential of this collective intelligence when it is used appropriately. This article proposes integrating different technologies usually grouped as Web2.0 technologies.

The management of natural disasters is a potential application of this collective intelligence. If everybody could report in real time the location and magnitude of a disaster, being even able to monitor it, then the response could be much more effective and immediate. In order to make this information available to anybody, our system has been designed to provide REST [3] services which can be combined using *mashups*.

2. DISASTERS2.0

The system presented in this article, Disasters2.0, is a complete platform for managing information about disasters. The core of this platform is user-generated data shared all around the world. Anybody can use the system to provide information about disasters using a computer, a mobile phone or any device with internet connection. This information can be instantly visualized in a map by anyone using simple symbols in a user-friendly interface. Moreover, resources (such as firemen or ambulances) and casualties can be displayed in the map and utilized to manage disaster situations.

In addition to the web and mobile clients, there are other elements interacting with the application: an expert system and a multiagent platform. The expert system has been designed to assign resources to disasters following rules which are based on the severity of the disasters. The multiagent platform models every resource as an intelligent agent and allows the user to see how these agents interact with the application by rescuing victims and fixing disasters.

3. ARCHITECTURE

Disasters 2.0 has been designed following REST principles. The main entities of a disaster have been modeled as resources. The system has considered the following entities: events such as fire or flood, allocated resources such as policemen or firemen, and damages such as victims. These resources are accessible from a REST interface using standard HTTP methods so that they can be obtained (GET), modified (PUT), created (POST) and deleted (DELETE).

In order to provide REST resources, the system Disasters 2.0 follows a client-server architecture, as shown in Figure 1.

The server is responsible for saving persistently all the information about disasters in a database, implementing the business logic to update and recover that information and serving it through REST services in JSON [4] format. This REST interface has been implemented using the open source framework Restlet [5].

The web client allows users to add information to the system very easily and to visualize all the activity of the world in a map. An AJAX Engine has been introduced to make this client more functional.

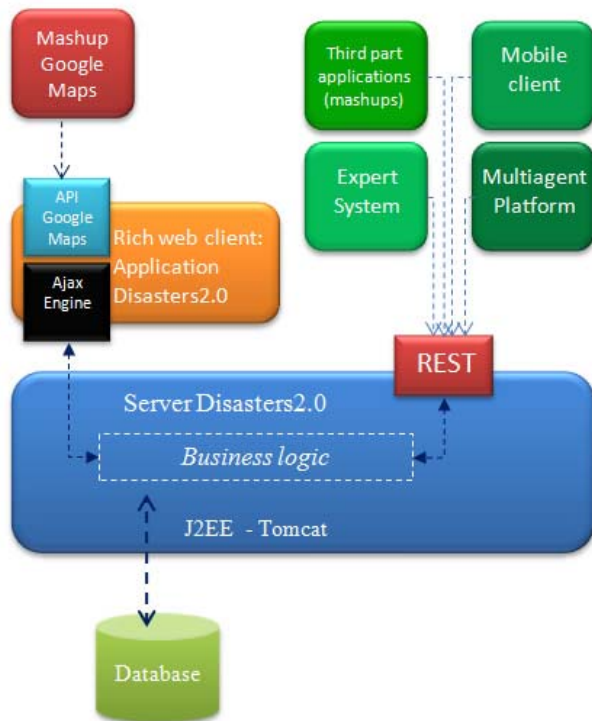


Figure 1. Architecture of Disasters2.0

The mobile client, developed with Mojax[6], has focused on the use of mobile web technologies (mCSS, mJavaScript...) for providing a web2.0 interface, and integrating 'mobile mashups' such as Yahoo Maps and Disasters2.0.

4. INTELLIGENT TECHNIQUES

This project has researched the application of intelligent techniques in the system Disasters2.0 aiming to improve the assignment and coordination of resources in disaster situations.

We have developed an expert system which assigns free resources (which are available in a database) such as policemen, firemen and ambulances to active events, such as fires, floods and collapses. This expert system has been developed using Jess [7], a rule engine for Java which allows the creation of highly complex rules by applying a pattern matching system.

A multiagent system has also been developed using Jadex [8]. In a first version, every resource (firemen, policemen and ambulances) can decide on its own how to act in an emergency situation. A second version of the system develops several levels of coordination and a hierarchical structure in which an emergency central service coordinates the resources in order to cover all the disasters while avoiding the blocking of roads or small areas.

This system communicates with the user interface of the web client and allows the user to see how the agents are moving to the assigned disasters, taking the victims to the closest hospital and resolving the disaster.

5. CONCLUSIONS

Internet has become an ubiquitous participation platform, which enables unprecedented applications. This brief article shows how the social approach can help in the management of disaster

situations. From a technical perspective, the system has researched on the usage of web2.0 interaction in both mobile and web browser clients. In order to fulfill this goal, a REST architecture which provides a resource-oriented interface for disasters has been defined. This interface has been validated with different clients, such as a social web application and a mobile client. In addition, this REST architecture has proven to be effective for integrating external systems, such as an expert and a multiagent system.

Disasters2.0 is available as an open source project and is currently being evaluated by local authorities in order to analyze its integration with a real system. In addition, the implementation of a disaster simulator is currently under progress. This simulator will provide researchers a benchmark for disaster management.

More information, demonstrations and videos about the project can be found at [9].

6. ACKNOWLEDGMENTS

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SCREEN-SHOTS

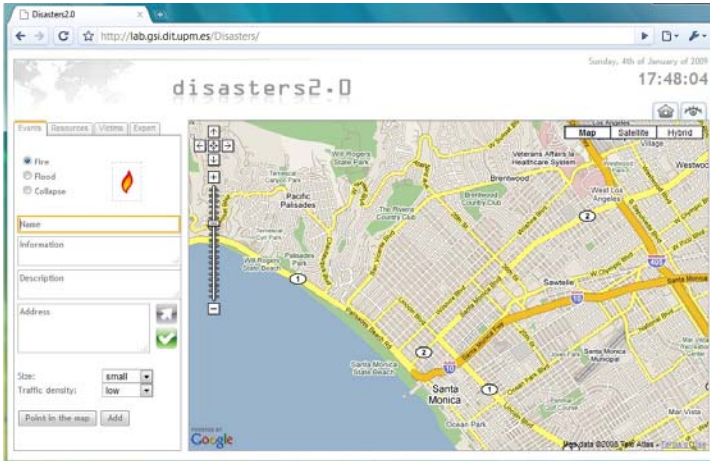


Figure 2. Web Client



Figure 3. Multiagent Intelligent Platform

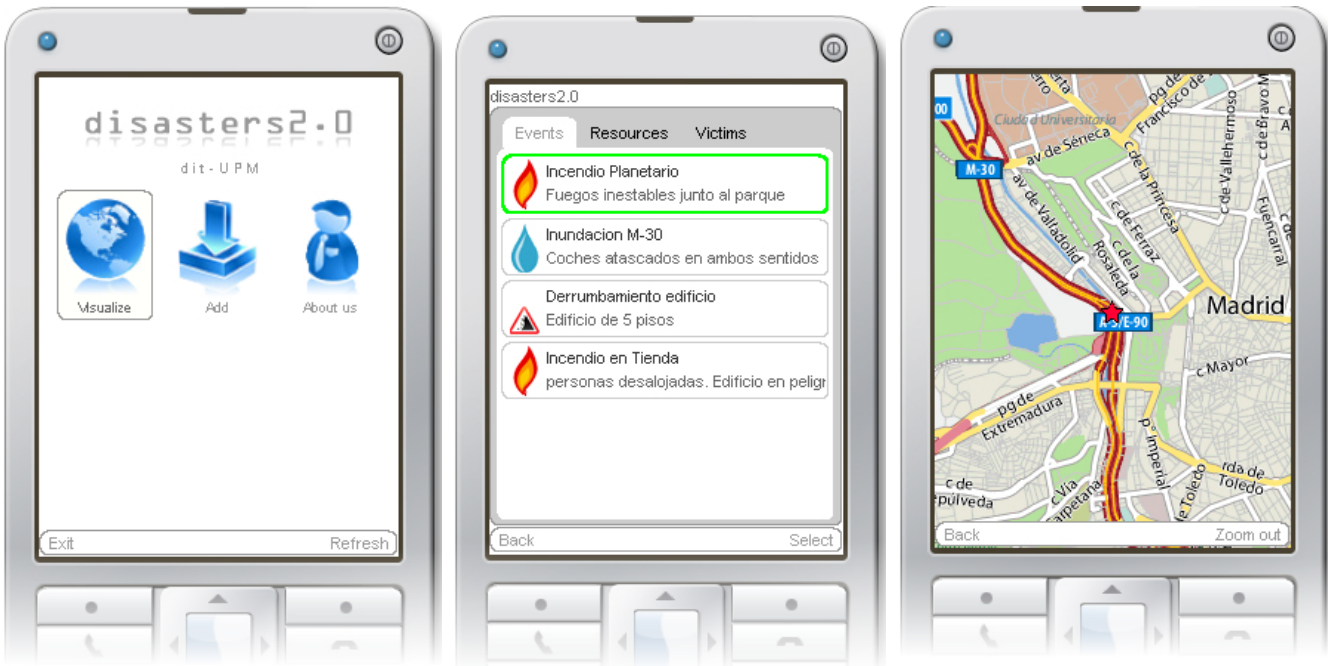


Figure 4. Mobile Client