SYSTEM DESIGN FOR THE NATURAL DISASTER MANAGEMENT IN ALBANIA

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Introduction

Nowadays, one of the goals of science is to prevent natural disasters, such as earthquakes, slopes or floods. But on the other hand, it is also important to manage these disasters in terms of reducing human damages and minimizing economic damages. In the last decade, international discussions related to the definition of natural disaster risks have included in the analysis many different factors that have characterized geological risk as a very important element. Albania is affected by at least one major natural disaster each year, where earthquakes, floods, landslides can be introduced. The data show that average annual losses amount to up to 2.5% of GDP, i.e. $ 68.7 million.

Based on the above we propose the design and development of an information and management system that will enable the collection of historical data of geological events occurring in Albanian territory and the processing of events that occur in real time. This system aims to integrate spatial data of natural disasters that have occurred in the past with the possibility of direct signaling for help from local residents in civil emergencies. This will make it possible to predict the spread of the phenomenon by the responsible authorities in real time, thus facilitating decision-making.

Samples and methods

The system is based on Server-Client infrastructure and is divided into three main modules (Fig. 1):

1. Server Module which collect all data coming from different sources that may be citizens or terrain (rescue) groups. This data is stored in a MySQL DBMS that puts it on the server while respecting the relational model. Also, the server performs the execution of neural algorithms, based on artificial intelligence, which can be used as a suggestion for emergency headquarters decision making. The suggestions are based on the weighing of each emergency situation by creating a rank based on the weights. In this way the system suggests which situation should be solved first and the way of solution.
2. Client Module that is a desktop computer program that is used by all Civil Emergency Staff Operators. This program provides information on the emergency situation to each operator in graphical form, through georeferenced maps, as well as in textual form, via interactive graphical interfaces. In this module, among other things, are displayed all the calculations performed by the server as well as the result of these calculations.
3. The mobile application module is simply installed on all mobile platforms (Android, IOS, Windows Mobile) and sends to the server all data from the field. This application will be divided into two sub modules:
    a. Field Workers' Module or volunteers who through the application provide data and receive information that comes in the form of a decision on where and how to act to resolve a specific situation. In this module, giving and receiving information is both graphic and textual. Citizens can also get suggestions through the application that may prove to be very useful in these cases.
    b. Citizen's module who provide data through graphical forms and very simple textual questions (e.g. what floor is on or on which floor has reached the water).

Results

To measure the functioning of the system, a general test was conducted in the city of Gjirokastra, south of Albania. During the testing, an earthquake was simulated for which 83 referrals were made by the citizen using the mobile application (Fig. 1.a). Citizens through mobile apps answered a few basic questions (Fig.

1.b). The system based on the artificial intelligence algorithms selected 7 of them who need the intervention of the aid teams and send the result to the nearest team (Fig. 1.c). This decision-making of the system is also based on the risk of other geological phenomena that the earthquake could have caused, for example, slides.

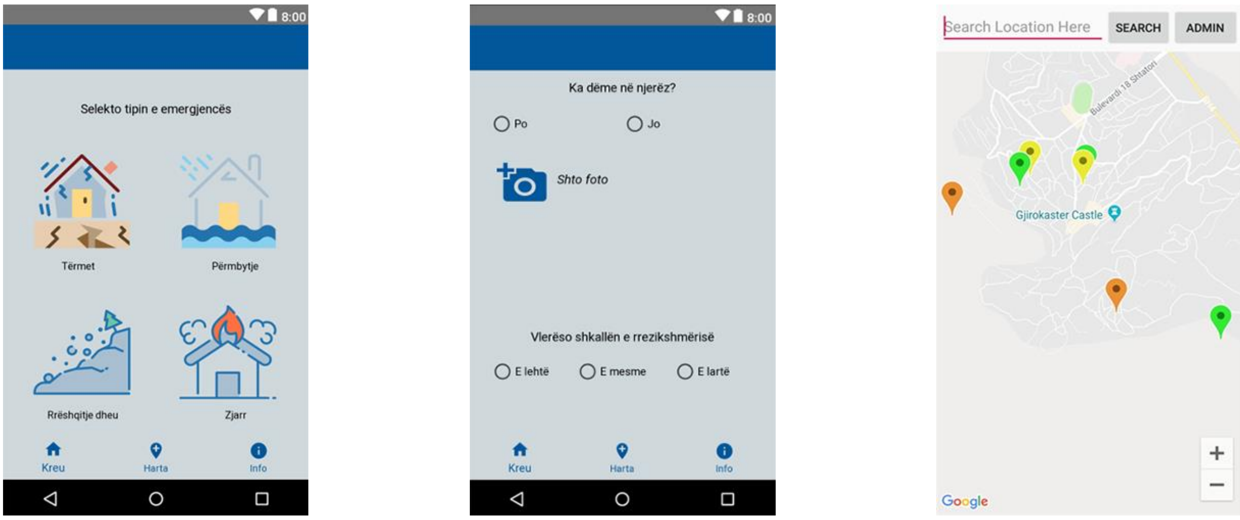

Figure 1. *a) Mobile apps interface for user to select the happened phenomenon. b) Some questions that user has to answer. c) The rescue team interface that indicate the hotspots with relative marker with three colors (high risk in red, medium risk in orange and low risk in green).*

The system also offers some hot spots that are sent to the operator at the civil emergency management centre. These data are based on the elaboration of the historical data of the area where the geological phenomenon occurred (Tab 1).

Zone name	**Latitude**	**Longitude**	**Risk level**	**Description**
Dunavat	40.07413	20.1280437	3	Area with high sensitivity to sliding.
Palorto	40.07591	20.1332181	1	Area with low sensitivity to sliding.
Pazari i Vjetër	40.076274	20.142239	2	Area with medium sensitivity to sliding.
Varosh	40.07659	20.134002	2	Area with medium sensitivity to sliding.

Conclusions

With the testing of this system there is an increase of performance as regards the resolution of complex situations in case of catastrophic geologic phenomena such as in the case of earthquakes. The system was able to collect data from a number of sources and link them to the historical data of geological phenomena in a given area.

This system helps reduce the loss of human lives and reduce the economic damage from a geological phenomenon, enabling it to provide real-time information both to citizens and state structures.

References

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