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Development of a communication system for humanitarian emergencies

Desenvolvimento de um sistema de comunicação para emergências humanitárias

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Resumo
Uma das principais tarefas das ONGs são os países em que atuam, alertar para possíveis emergências humanitárias que podem ocorrer devido a diversos eventos, como epidemias causadas por doenças, fome, conflitos armados e outros eventos que possam ocorrer. Um elemento chave para que a emergência seja controlada e não tenha consequências trágicas é a rapidez na gestão da informação: comunicação rápida da emergência, onde está ocorrendo, necessidades imediatas… Essas informações permitirão aos gestores da ONG agir e tomar decisões sobre como agir. Essas informações são normalmente coletadas no local onde são produzidas pelos doadores. Para tanto, é necessário contar com ferramentas informáticas especializadas que facilitem ao colaborador a transmissão das informações e o posterior processamento e exibição das informações coletadas. Este artigo descreve uma ferramenta destinada a cooperadores de ONGs que visa facilitar a coleta, transmissão e processamento de dados.
Palavras-chave: ONGs. Software de comunicação. Gestão de dados.

Abstract
One of the main tasks of NGOs is the countries in which they operate is to alert to possible humanitarian emergencies that may occur due to different events such as epidemics caused by illness, famine, armed conflict, and other events that may occur. A key element for the emergency to be controlled and not have tragic consequences is the speed of information management: rapid communication of the emergency, where it is occurring, immediate needs…This information will allow the NGO managers to take action and decisions about how to act. This information is normally collected at the place where it is produced by the donors. So it is necessary to have specialized computer tools that facilitate the cooperator the transmission of information and the subsequent processing and display of the information collected. This article describes a tool aimed at NGO cooperators that aims to facilitate data collection, transmission and processing.
Keywords: NGOs. Communication software. Data management.

1. Introduction

NGOs usually have a dense network of aid workers who act in the countries in which these organizations carry out actions. In this sense, the figure of the aid worker is key given that it is the primary and most immediate source of information on a humanitarian crisis. Thus, the mission of the aid worker is to collect data (Baamonde-Silva et al., 2017) in the NGO's areas of action and transmit it to the headquarters on which the aid worker depends so that they can analyze the information and take the most appropriate decisions and actions in response to alarms reported. In this process, a key element that will influence the extent and control of a crisis is the speed at which

information is transmitted and processed, so that action can be taken. That is why having a rapid communication system and information processing and visualization mechanisms are key in this process.

Before the introduction of information technologies, this process of data capture and communication to the NGO was carried out manually and usually by telephone, telegram, and other analog means. However, today the possibility of making use of a communications network is practically extended throughout the world. The only thing that will change in each case will be the quality and volume of data that it is capable of sending. For this reason, it is feasible to propose an alternative based on the use of digital communication networks to the use of analog means for the communication of alerts.

On the other hand, another requirement to take into account in a digital alert communication system is the conditions in which the cooperator works. In general, and taking into account that cooperators work in countries whose level of development and economic level are not very high, it can be assumed that the quality of the communications network will not be very high and that therefore the speed and amount of data that can be transmitted will be low. Likewise, in most cases, access to the areas where the humanitarian crisis is taking place may not offer such basic comforts as having a table or place to work, or there may even be scenarios with violent meteorological events that would make using a laptop inadvisable. It is for these reasons that the instrument that offers more autonomy and is better adapted to working conditions is a mobile phone or a Tablet, as it is small, easily transportable and offers the minimum necessary benefits. In this sense, for tasks similar to those described in this article, different mobile applications have emerged that have in common the possibility of generating alerts of various types (Betancur et al.,2016) such as alerts for medical epidemics (Toro et al., 2017) , police alerts, homicide alerts of gender violence, fire alerts (Sarasa, 2020), and other types of alerts. Some examples are FrontlineSMS (Jayathilake, et al., 2018), a communication system based on sending SMS that reaches a data center that is responsible for spreading the message among groups of health experts and responding with an SMS, Ushahidi (Njeru, et al., 2018) is a open source project that emerged during the earthquake in Haiti in 2007 (Bernard, et al., 2018) provides a system to collect information through SMS (Bengtsson, et al., 2011) , Web, voice messages and email (LoGerfo, et al., 2019) and has translation, classification and georeferencing tools (Hameed, et al., 2019) presenting the information on maps accessible through the web or mobile phones (Bamashmoos, et al., 2018), Asthmapolis (Ginsberg, et al., 2009) is a project focused on asthma patients to track asthma attacks using an inhaler that has GPS and a mobile application that performs monitoring the frequency of attacks so that using these data and the analysis of environmental causes generate outbreak risk maps (Millard, et al., 2018), the Outbreaks Near Me application (Freifeld, et al., 2008) that uses unofficial information sources (Freifeld, et al., 2010) on the web to track disease outbreaks (Fast, et al., 2018) and perform real-time monitoring of possible epidemics (Brownstein, et al., 2008), Flu Near You (Baltrusaitis, et al., 2018), a website that allows people to submit information on potential illnesses and reports on health status, Medic Mobile (Bhatt, et al., 2018) offers various applications to record and track disease outbreaks and maintain essential drug stocks and communicate on emergencies (Christakis, et al., 2010), Alert Cops (Alert Cops,2020) allows citizens to send notices and incidents (attacks, robberies ...) to the national police, for which it offers GPS location of the user, chat and sending messages, Disaster Alert (Disaster Alert, 2020) is a disaster risk detection system that informs users about disasters that have occurred or are active in different parts of the world, being able to delimit the information by location and view it on average nte interactive maps, and Spotlight - Incident Reporting (Spotlight, 2020) is a system that allows sending all kinds of incident alerts in real time (missing persons, medical attention for a serious accident that occurred) and also offers the possibility of subscribing to instant notifications about certain types of alerts, generation and visualization of incident reports or the use of a chat to share a location, documents or images of incidents.

This article describes a development of an alert management system for an NGO that aims to provide cooperators with a quick way to report information on humanitarian crises and carry out its

processing and visualization. To do this, a combined system of a mobile application and a web application is proposed that communicate through a common shared database that ensures the consistency of the information and that it is kept updated at all times. Likewise, the decision has been made that the information that contains an alert is light in order to adapt to the limitations that the communications network to be used may present. On the other hand, it was also decided to use a documental NoSQL database that offers flexibility about the data that can be stored since it is possible that the alerts generated in each place could contain different types of information according to the conditions of the place where they are produced. The decision was made to carry out their own development and not to use or adapt an existing application, since the NGO wanted an application design that was adapted to the way of working of the NGO, that was implemented in a way that was scalable with the time and offer support both to the cooperator and to the organization itself.

The structure of the paper is as follows. In section 2 the architecture of the application will be briefly explained, in section 3 the functionality of both the web application and the mobile application is described in detail, emphasizing all the services they offer to manage alerts. And then in section 4 the conclusions and a set of lines of future work are proposed.

2. Architecture and data model

The developed system is made up of two applications, an Android app and a web application, which communicate and share information through a common database of the Firebase type. In this way, it is possible to ensure that the information that manages the system remains constant and updated at all times, given that any change is reflected in the data base. Likewise, this allows the access to information retrieved by the cooperators to be accessed and processed in an immediate way through the system's web page. In figure 1 the application architecture is shown as well as the technology that has been used to develop it. In particular, it is observer that the applications mobile and web use Firebase database as a persistence mechanism and thus it is achieved the desired effect.

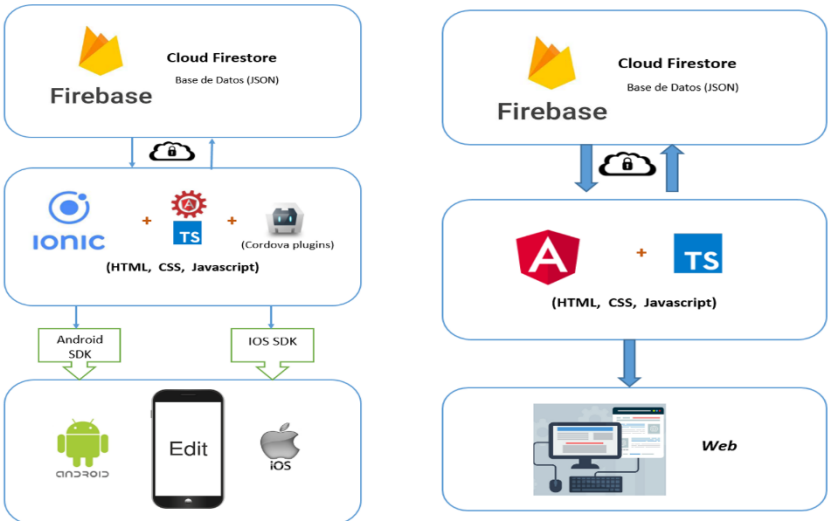

Figure 1 - Applications of the humanitarian emergency management system.

3. Functionality

Next, it will be presented the main functions of the implemented system, for which it will be described the functions of the Android app on the one hand and on the other hand the functions of the web application.

1.1 App Android

The main functionality of the application is the registration of alerts and the management of personal alerts that each cooperator registers. To register an alert, there is an icon in the application that allows access to the registration process, which consists of filling in data in a set of forms. In the first form shown in figure 2, the cooperator has to indicate the country of the NGO headquarters to which the cooperator belongs. To do this, a drop-down is displayed in which a set of countries where the NGO has headquarters are listed.

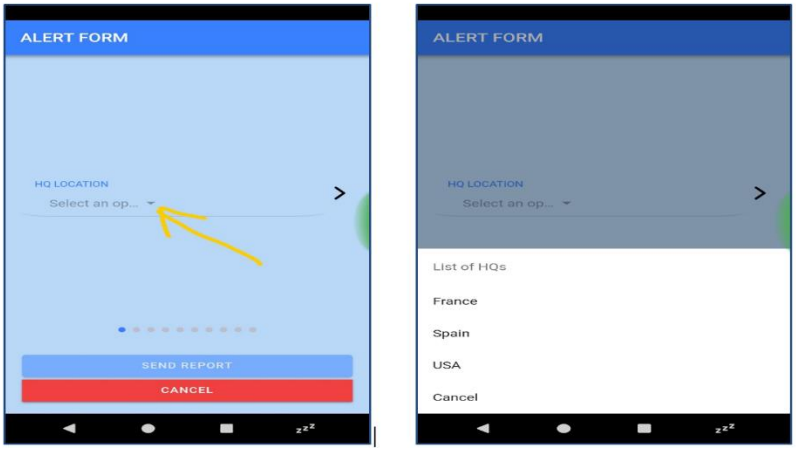

Figure 2 - Introduction of the location of the cooperator's headquarters.

Next, in the following form (Figure 3), the cooperator must associate a type to the alert that he is going to register. In the same way as in the previous case, it is shown a list with a type of alerts that can be associated, having to select only one type.

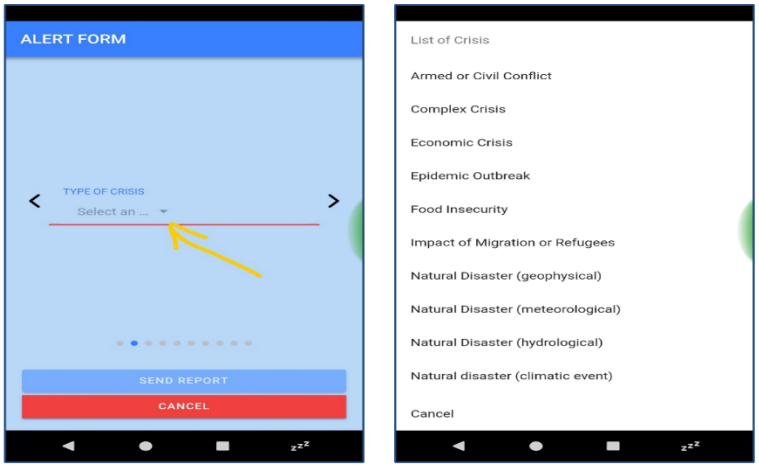

Figure 3 - Enter the type of the alert.

Next, in the following form (Figure 4), the cooperator gives an illustrative name to the alert that it is going to be registered.

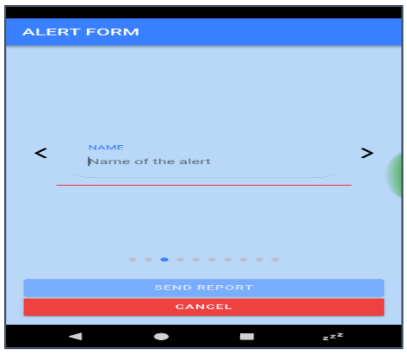

Figure 4 - Enter the name of the alert.

In the next step, the cooperator through 3 different forms (Figure 5) will select several aspects about the alert: the scale level that can vary between 1 and 5 from the least severe to the most severe, the level of complexity that can vary between 1 and 5 from least critical to most critical, and the level of urgency that can vary between 1 and 5 from least critical to most critical. To do this, in all cases the values of the level scale have been represented by graphic icons in order to facilitate the classification of the alert.

Figure 5 - Enter of the levels of scale, complexity and urgency of the alert.

In the following forms, the cooperator must enter information about the population affected by the alert. Specifically, the approximate number of families or people affected and, if possible, a percentage of the affected population must be indicated. Likewise, the location of the area affected by the alert must be entered. For this, a map is available that, using the mobile's geolocation, shows the place from where the alert is being registered. The cooperator can leave the location obtained by this mechanism as the location, or he can use the search bar to refine the place he wants to associate as the location of the alert. Once she has selected the location, it is marked on the map and a message appears indicating that the location has been stored. Both forms can be seen in figure 6.

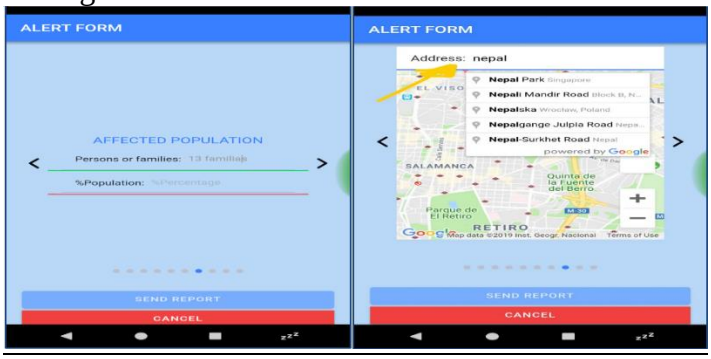

Figure 6 - Information on the affected population and location of the alert.

In the following form, the cooperator can upload a set of files that he wants to associate with the alert. For this, there is the option of browsing the mobile file system to choose them. The most common is to add photos, so in addition to being able to select photos that are stored on the mobile, there is also the possibility of taking a photo from the application so that it is directly associated with the alarm that is being given high. More than one file can be added to the alarm. Before registering an alarm, files can be deleted or new ones added. Figure 7 shows the process of adding new files.

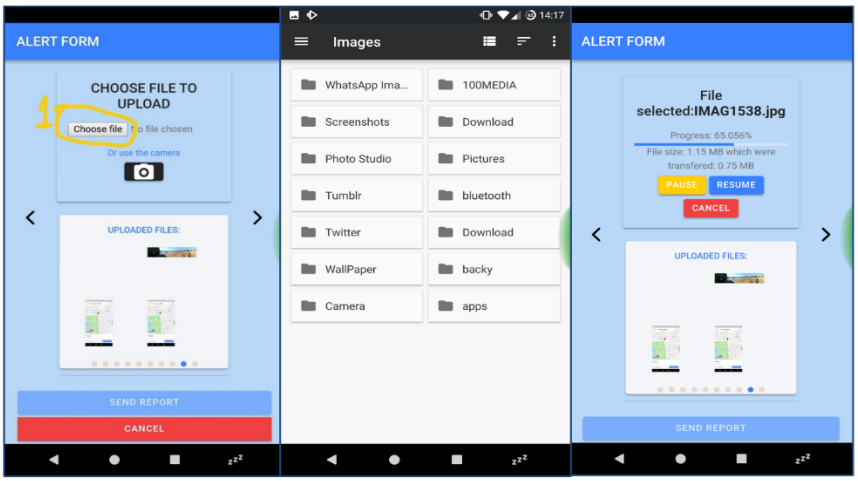

Figure 7 - Associating files to the alarm

The last step before registering the alert is to enter a short description that explains the most important details about the alert to be logged. Figure 8 shows the form for entering this information. Once this form has been filled in, it must be clicked on the "Send Report" button so that all the stored information is transferred to a document from a collection in Firebase. Note that the application allows to send the alert from any of the mentioned forms, leaving the information on the rest of the forms empty. The reason for allowing this is because on some occasions the information may not be available or the urgency of the situation makes it necessary to send the alert as soon as possible, leaving some information fields empty. Also note that thanks to the flexibility offered by Firebase as it is a document NoSQL database, different types of documents can be kept with more or less information.

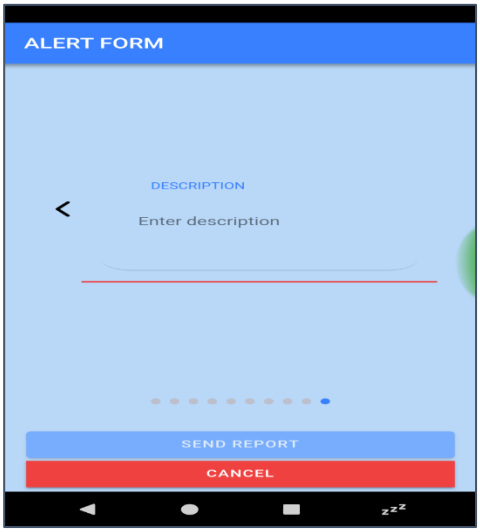

Figure 8 - Information about the alarm

The mobile application also offers another series of options to the user such as access to a visual guide for the use of the application, registration in the application, management of personal profile, and management of alarms registered by the cooperator. All these options are reached from the menu on the main screen of the application that can be seen in figure 9.

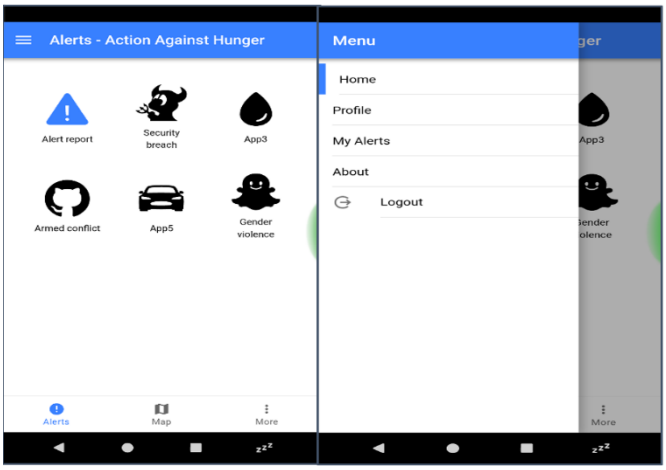

Figure 9 - Main menu and access to the functions of the app.

Regarding the management of the registered alerts, when you click on the "My Alerts" option, then a list of all the alerts that are registered by the cooperator will be shown. Furthermore, for each alert displayed, two actions can be carried out: they can be deleted by clicking on the trash can icon or they can be edited to change any of the data by clicking on the pencil icon. The fact of sharing the database with the web application facilitates that the information that is displayed will always be updated because whether an alert is deleted or updated, the change will immediately be reflected in the database shared by both applications. Figure 10 shows a list of alerts as well as the edit form for one of the alerts where you can see the option to update or cancel the edit.

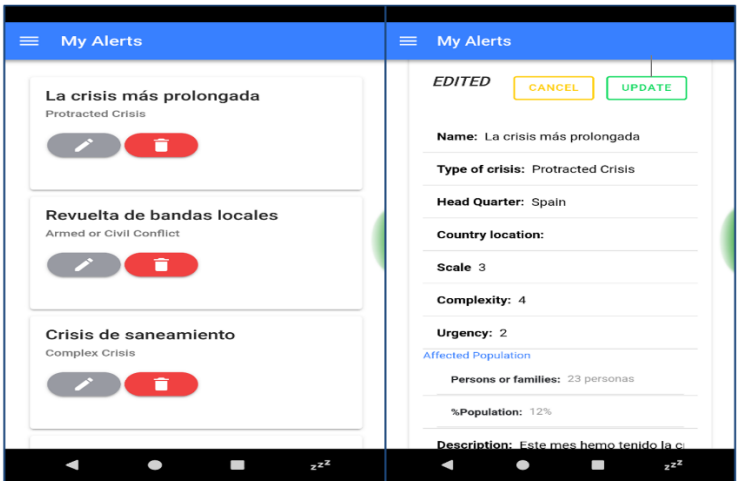

Figure 10 - List of alarms

1.2 Web Application

The web application has 2 types of main functionalities. On the one hand, it is possible to manage the alarms reported by the cooperators and on the other hand, the users of the tool can be managed. Regarding the management of alarms, the application allows them to be viewed in different ways: recent alerts, alerts by date, alerts by type, alerts by location, all alerts of one type, or all alerts by location. An alert is characterized by a type of crisis, the date on which it was

discharged, and the place to which the alert is associated. Based on these fields, it is possible to retrieve the information to view it, and that corresponds to the options mentioned. Depending on the way the alerts are retrieved, different graphs and information are displayed. When it is clicked on the "Recent Alerts" option (Figure 11), a list of the latest alerts that have been reported by the cooperators appears. In the list shown you can view the information about the name of the alert, the type of crisis, the country in which the alert is occurring, the level of complexity of the crisis, a value that represents the level of impact that can have the crisis, its level of urgency and the name of the aid worker who has registered the alert. When you click on any of the alerts, a pop-up window appears where all the information that constitutes the alert appears. Likewise, from this screen, it is possible to refine the searches by entering keywords in a search bar that makes queries against the information fields of the collections found in Firebase.

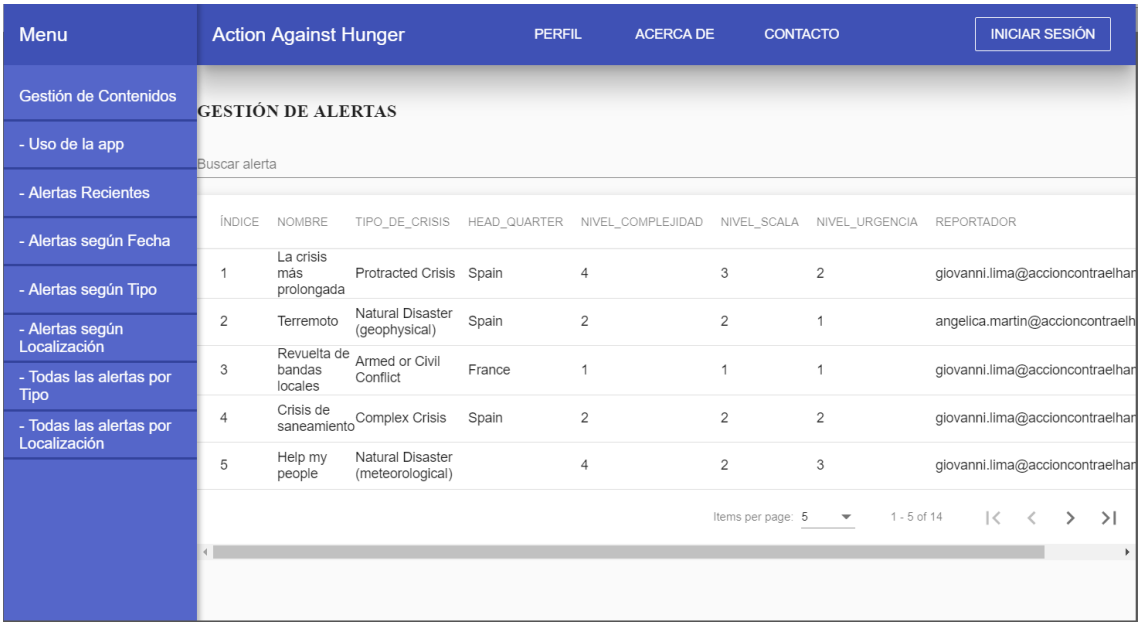

Figure 11 - Recent alerts page

In figure 12, the "Alerts according to location" recovery option has been selected. In this option, the way to navigate through the information is through a drop-down menu that allows you to select the country or place from which you want to view the data. In the example of the capture, the Philippines has been chosen. As a result, a pie chart is displayed that shows the percentages of alerts that have been registered based on the type of alert. Specifically, it can be observed in the catch that 33.3% correspond to alerts caused by a natural disaster. Likewise, when you click on an area of the pie chart, a pop-up window like the one shown in the previous figure appears where you can see all the alerts that have been registered by cooperators in the selected country and of the chosen type, showing the same information previous.

Figure 12 - Alerts according to location page

The other functionality offered by the web application is user management when the authenticated user has the administrator role. From this page it is possible to register or cancel users, modify data of registered users as well as carry out searches for specific users. Figure 13 shows the user search page, where by default all registered users are listed. Each user shows his personal data (name, telephone, email and occupation) as well as information about the headquarters of the NGO to which he belongs and the number of alerts he has reported. Likewise, from this page you can carry out specific searches for cooperators using keywords. These searches are launched on the data collections that are stored in Firebase, so that any of the information fields that appear are searched for.

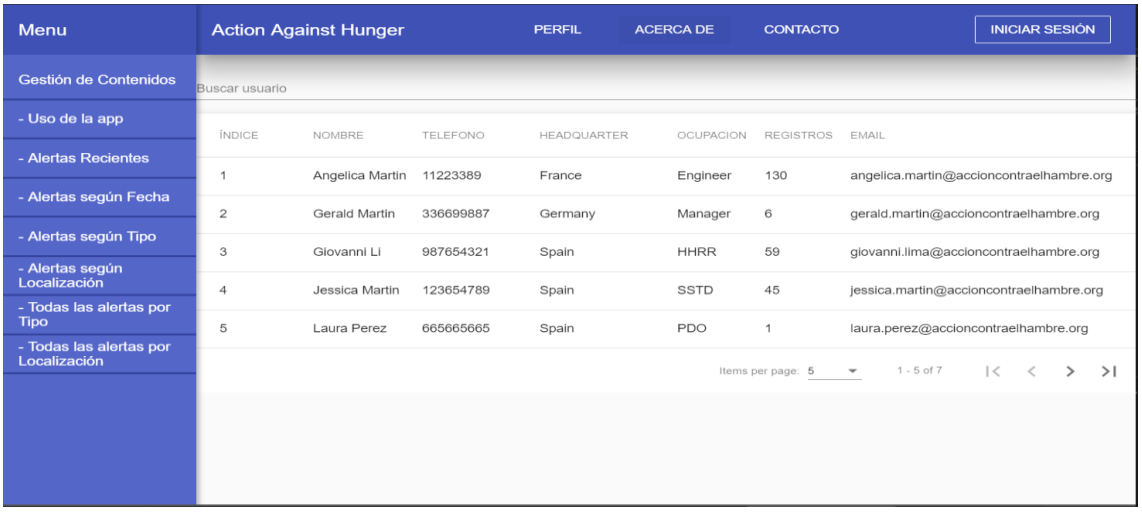

Figure 13 - User search page

When a specific record of a cooperator is selected, then a pop-up window appears in which the cooperator's data is displayed (Figure 14), which can be edited or the cooperator can be removed from the database. For this, the window has two buttons, one to save and the other to delete profile respectively. When a cooperator is eliminated, all the personal information of the same is permanently eliminated from the database, but not the information about the alerts that have been registered by that cooperator, given that they are found in different Firebase collections. Thus, when the alert made by a cooperator who is no longer in the database is retrieved, the cooperator's name will continue to be seen, with the exception that it will not be possible to search for information about it as it has been eliminated from the database.

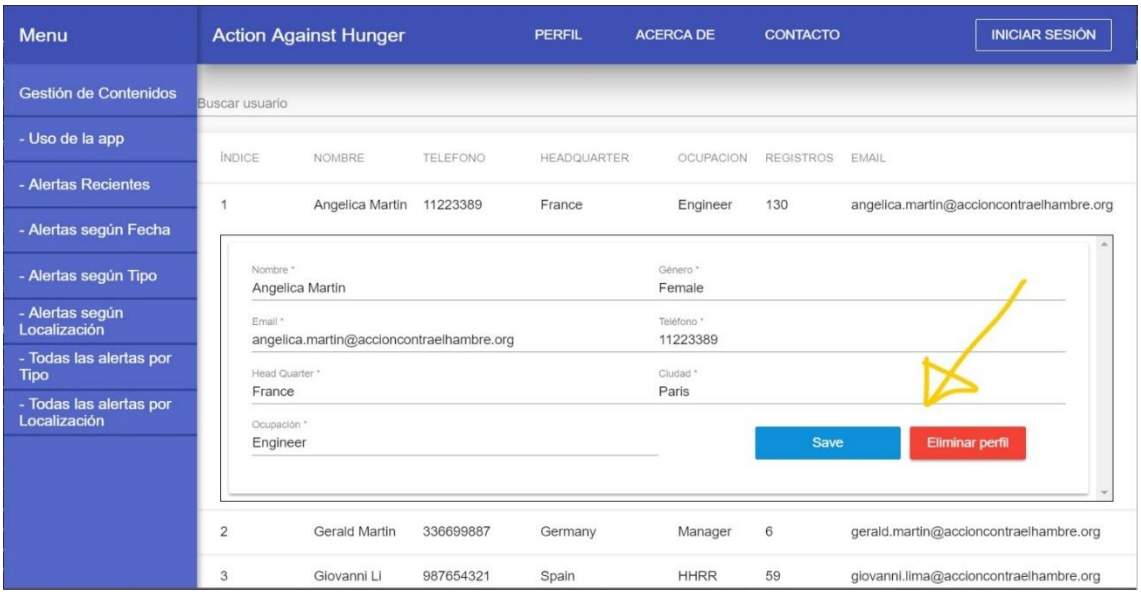

Figure 14 - Worker's data page

Finally, to mention that the web application also allows the management of the personal profile for any user regardless of the role they have within the system: administrator or cooperator. From this option, the user can change her personal data.

5. Conclusions and future work

In this work, an alert management system was presented for an NGO that is formed by a web application and a mobile application. The mobile application is designed to be used by NGO workers for the purpose of facilitating the rapid reporting of information when humanitarian crises occur. The data that is recovered from an alert are basic because of the limitations of the communication network used with the alert. On the other hand, the web application performs user management, allows access to all information about alerts that cooperators have reported, and offers search services on information from different perspectives (by location or cooperator) for the purpose to make it easier for the NGO to make decisions about the actions it needs to take to control and limit the effects of a humanitarian crisis.

With respect to the possible future lines of work:

- Incorporation of additional information retrieved from official and non-official sources such as open data repositories or linked data, social networks such as Twitter or digital journals.
- Automation of alert processing by performing natural language analysis on the texts of the descriptions of the alerts given.
- Adding communication tools such as chat or participation forums.
- Implement a notification system so that users can subscribe and receive information about alerts that are being produced.
- Implement a delayed communication system so that in those places where there is no good access coverage, the system collects the alerts that have been generated and when there is good coverage, proceed to send the information of the alerts collected.
- Implement a global management system so that it allows management of employees, co-workers and NGO leaders.
- Translate the entire system into several languages so that its use is not limited to certain places in the world.

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