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Requirements Specification 3

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<tr>
<td>PU</td>
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Executive Summary

Requirements Specification 3

This document presents the deliverable D1.1.3 (Requirements Specification 3) of project FP7-614154 | CNPq-490084/2013-3 (RESCUER), a Collaborative Project supported by the European Commission and the MCTI/CNPq (Brazil). Full information on this project is available online at http://www.rescuer-project.org.

This deliverable provides the results of Task 1.1 (Requirements Engineering) for the third iteration of RESCUER. This document is an evolution of the requirements specified for the RESCUER system, presented in document D1.1.2 [1]. Due to the research nature of this project, this document version has significant changes when compared to D1.1.2. Changes refer to document contents and structure. It updates the requirements and use cases specified in the second iteration as well as it presents new ones specified for the third project iteration.

This is a final document that will be extended to support the goals of the RESCUER third iteration and reflect acquired knowledge, as the project evolves and results are evaluated.

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1. Introduction

The main challenge for an Emergency Command and Control Centre is to obtain, quickly, contextual information about the emergency in order to take proper decisions. Late decisions or decisions based on inaccurate information may cause even more damages. Since mobile devices are widely used and, in many cases, connected to the Internet, crowdsourcing information and mobile technologies offer great potential for addressing this challenge [10].

Mobile applications in emergency situations are important tools to collect a considerable amount of data from the crowd. Such data can be sent in different formats: text, image and videos. It is difficult for humans to analyse texts, images, and videos, and simultaneously generate a reliable overview of the incident. The RESCUER aims to analyse the data automatically as soon as they are available, while ensuring reliability and displaying them for a comprehensive understanding of the incident. Thus, the project uses a combination of crowdsourcing approach, smart mobile applications and data analysis techniques to increase the emergency management effectiveness.

1.1. Project Topic

The RESCUER project aims to develop an interoperable computer-based solution to support Command and Control Centre during emergencies, and managing such situations in a fast way through reliable and intelligent analysis of crowdsourcing information mashed up with open data. The solution is designed to work specifically on Industrial Parks and Large-scale Events.

1.2. Project Goals

The RESCUER project intends to provide Command and Control Centre coordination with real-time contextual information related to the emergency situation through the collection, automatic analysis and aggregation of crowdsourcing information to support communication about the emergencies targeted to different audiences (e.g. authorities, affected community and general public) [10]. To achieve it, the solution performs the following steps:

- Gather emergency and crisis information from the crowd through a mobile application with a simple user interface;
- Provide an intelligent, integrated, and reliable multimedia data analysis of the information sent by the crowd;
- Provide effective visualisation and manipulation mechanisms to the Command and Control Centre, in order to improve decision making and coordination of the emergency and crisis situation.

To achieve this goals the RESCUER system, considers three iterations: 1) Crowdsourcing information gathering, 2) Group-target follow-up Interaction and coordination among operational forces, and 3) Public communication and Crowd steering. The first iteration deals with the spontaneous communication from the crowd to the Command and Control Centre, providing real-time contextual information regarding the incident. The second iteration covers group-target follow-up interaction and the coordination among Workforces.
Group-target follow-up interaction refers to communication between the Command and Control Centre and the crowd. This communication aims to clarify previous information and ask for further information about an incident, such as: missing information, clarifications on specific information, contradictory information, investigation of potential problems, and continuously evolving information. On the other hand, coordination refers to communication between the Command and Control Centre and Workforces directly or indirectly involved in the incident. In this case, the coordinators ask people to perform specific tasks or request information about resources tasks and additional resources.

The third iteration focuses on the interaction between the Command and Control Centre and the public. Such interaction with the public can be Public communication or Crowd steering. Public Communication intends to inform the public and authorities about the incident. Crowd Steering provides instructions to the public affected by an incident, keeping them safely. Beside this, the third iteration deals with the data integration between the Rescuer and legacy systems.

1.3. Purpose

The purpose of this document is to describe the RESCUER system requirements, considering the users’ perspective using general narrative. The requirements are result from the interactions with the project end-user partners, through the following methods:
- Workshops;
- Questionnaires;
- Interviews;
- Prototyping;
- Ethnographic Studies; and
- Literature and Documentation Reviews.

1.4. Change Log

This deliverable extends the content of the ones provided in the first iteration (D1.1.1) and the second iteration (D1.1.2). As such, it presents new contents and changes from the previous documents. The third deliverable updates information that was not available at the time of the first and second iteration. It was restructured and aligned with information described in the following documents: D1.4.2 [12] and D7.3 [20].

1.5. Partners’ Roles and Contributions

Vomatec’s role in this iteration was to elicit information concerning the particularities of the European side and review the specified requirements and concepts.

UFBA was responsible to write this document, with the following contributions:

- Review of the document D1.1.2 [1], consolidating its information with contents from others project documents;
- Elicit information regarding the RESCUER third iteration goals;
- Describe new requirements and use cases, and update the ones provided in previous iterations.
The remainder of this document is structured as follows:

- Chapter 2 briefly describes the RESCUER components;
- Chapter 3 describes the RESCUER stakeholders and how they interact with each other;
- Chapter 4 specifies the functional and non-functional requirements;
- Chapter 5 specifies the use cases;
- Chapter 6 presents the concluding remarks.
2. RESCUER Components

The RESCUER solution encompasses four main conceptual components (Figure 1):

- **Mobile Crowdsourcing Solution (MBL):** this component supports the communication between the crowd (e.g., eyewitnesses, employees), first responders (e.g., police, firefighter) and Command and Control Centre. The crowd can send information in text, image and video formats. It comprises a set of mobile applications tailored to different platforms and devices;

- **Data Analysis Solutions (DAS):** DAS is composed by algorithms to process and filter data aiming to extract relevant and consolidated information;

- **Communication Infrastructure (COM):** it offers the needed equipment to allow the information flowing between stakeholders; and

- **Emergency Response Toolkit (ERTK):** this component is a set of solutions to manage the analysed crowdsourcing information, presenting it to the Command and Control Centre using adequate visualization metaphors.

![Figure 1: Conceptual overview of RESCUER](image)

The functionalities of the Mobile Crowdsourcing Solution, Data Analysis Solution and the Emergency Response Toolkit are the main sources for the requirements and use cases specified in this deliverable. The Mobile Crowdsourcing Solution and the Emergency Response Toolkit are the components that have explicit interaction with the stakeholders.

The Mobile Crowdsourcing Solution gathers information from the crowd when an incident happens, supports the coordination activities and follow-up interactions between the Command and Control Centre and the workforces. Additionally, it supports sending public information and steering instructions to the public affected by an emergency.
The Data Analysis Solution automatically analyses the multimedia information received from the Mobile component. The DAS has three main modules: text analysis, image analysis and video analysis. All three modules analyse data establishing priorities and extracting relevant information to send it to the Emergency Response Toolkit. The DAS component also provides support to integration between Rescuer and Legacy Systems.

The main goal of the Emergency Response Toolkit is to support decision-making, coordination, and communication between the Command and Control Centre and involved users. The ERTK must provide an intuitive, concise, and resourceful information dashboard, with different metaphors for information visualisation, as well as modern solutions for emergency mapping. It will integrate and extend existing solutions and add support for coordination among workforces. Moreover, the ERTK has the ability to send information to internal and external stakeholders (public communication), send instruction (crowd steering) to the public with the goal of guiding people to safety, and provide the ability to receive information from Legacy Systems.

The Communication Infrastructure offers the required infrastructure (equipment and technology) in order to allow the information flowing among stakeholders. For detailed information see document D1.3.2 [16].

RESCUER components are designed for use in four scenarios: Industrial Parks in Brazil, Industrial Parks in Europe, Large-scale Events in Brazil and Large-scale Events in Europe. Details about each one of these scenarios are in document D1.1.2 [1].
3. Stakeholders

3.1. Users’ Profiles

This section describes the stakeholders that interact with the RESCUER system, and their profiles. The complete list of organisations, their members, roles, and detailed description are presented in the document D4.1.3 [11].

The users of the RESCUER system are divided into five main profile groups, as illustrated in Figure 2. Table 1 describes each profile with responsibilities and goals.

![Figure 2: User profiles and sub groups for the RESCUER system](image)

<table>
<thead>
<tr>
<th>Table 1: RESCUER Users’ Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Command and Control Centre</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>Represents stakeholders of the Command and Control Centre (C&amp;CC) organisation in Large-scale Events and European Industrial Parks. In case of Brazilian Industrial Parks, such a profile represents stakeholders that belong to Emergency Committee and Crisis Committee organization. The following roles are part of this profile: Emergency Coordinator, Evacuation Coordinator, Industrial Plant Manager, Operational Supervisor, Crisis Committee Coordinator, Crisis Committee Leader, Industrial Companies’ Representatives, and Public Communication Coordinator.</td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td>Make decisions to handle the emergency situation. The main tasks are: dispatch emergency calls, alert and send the Fire and Emergency Brigade to emergency site, monitor the emergency, and keep the public informed about the situation.</td>
</tr>
<tr>
<td><strong>Goals</strong></td>
</tr>
<tr>
<td>• Obtain reliable information about the emergency as soon as</td>
</tr>
</tbody>
</table>
possible in order to make proper decisions;
- Provide an efficient and reliable end-to-end response time within 3 minutes from the moment that the report is sent until the moment the system analyses it;
- Provide a fast, continuous and efficient channel of communication to give and receive feedback regarding the treatment of the emergency;
- Provide a communication channel operative even when the main network fails;
- Provide an overview of the emergency area;
- Monitoring the emergency evolution;
- Release in a fast, easy and reliable way the information about the emergency to the press and authorities;

<table>
<thead>
<tr>
<th>Workforces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
</tbody>
</table>
| **Goals** | - Obtain reliable information about the emergency situation;  
- Provide a common communication channel with Command and Control Centre;  
- Identify injured people;  
- Identify crowd disturbance;  
- Ask for resources support;  
- Guide people to a safety point. |

<table>
<thead>
<tr>
<th>Supporting Forces</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
<tr>
<td><strong>Goals</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Civilians</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Responsibilities</strong></td>
</tr>
</tbody>
</table>
| **Goals** | - Receive instructions to protect them from the danger;  
- Receive reliable information about evacuation routes; |
3.2. Interactions between Stakeholders

This section describes how the flow of information happens in RESCUER, its goals and involved stakeholders. The communication begins with the interaction between the crowd and the RESCUER system. The Crowdsourcing Information Gathering is a spontaneous event from the crowd to the Command and Control Centre to inform about an incident (Figure 3). The user provides reports about the incident, in an intuitive way, answering pre-defined and simple questions, writing free text, or sending photos or videos.

![Crowdsourcing Information Gathering](image)

After the information gathering, the Command and Control Centre can communicate with the crowd to obtain further information. This step is called Group-target Follow-up Interaction (Figure 4). After analysing and visualising the information, they support the coordination among Workforces, clarify received information, and investigate potential problems.

Group-target Follow-up Interaction is the communication between the Command and Control Centre and a specific group. The criteria that defines the specific group can be profile, role, position, movement, previous interaction and affiliation. The communication from the Command Centre to the group-target can occur in one of the following ways:

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Responsibilities</th>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Public</td>
<td>Publish information about the emergency.</td>
<td>• Receive reliable information about the emergency situation; • Publish emergency information;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>External public are people or organizations not directly involved in the incident. This profile comprises Press, Environmental Department, and Public Authorities.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibilities</td>
<td>Main task: publish information about the emergency.</td>
</tr>
<tr>
<td>Goals</td>
<td>• Receive reliable information about the emergency situation; • Publish emergency information;</td>
</tr>
</tbody>
</table>
- One-to-one: Command Centre → specific user (a visitor, an employee or a member of the Workforces);
- One-to-many: Command Centre → group-target (a specific group considering the Command Centre needs in that moment).

The third step is the Coordination Interaction, where the Command and Control Centre communicates the Workforces, Supporting Forces or external entities (e.g. Civil Defence) to request the execution of a specific task or ask for resources. The communication occurs between two people, or one person and a group-target (Figure 5).

The two last steps are Public Communication and Crowd Steering.

The goal of the Public Communication is to inform external and internal stakeholders about the emergency. The delivered information depends on the target stakeholder, the emergency’s phase and the scenario (Industrial Parks or Large-scale Events). Such information comes to the stakeholders through the public communication coordinator (Figure 6).
The document D4.3.1 [2] describes in details the process to perform Public Communication in this project.

Crowd steering is the action of “guide a group of people towards locations, along optimal paths and taking into account contextual information describing the presence of crowded areas which should be dynamically intercepted and circumvented” [3].

The focus of both Public Communication and Crowd Steering is communication. In Crowd steering the information content intends to guide the public to safety. Figure 7 shows the crowd steering communication flow.
The investigation of involved stakeholders in Industrial Parks scenario identified three target stakeholders: employees, visitors and neighbouring community. In Large-scale Events scenario, we identified two target stakeholders: civilians and employees.

Appendix I (Industrial Parks) and Appendix II (Large-scale Events) show which information should be available to each stakeholder in each emergency phase.
4. RESCUER System Requirements

This chapter describes functional and non-functional requirements of the RESCUER system. The evaluation plan for non-functional requirements and the related quantitative and qualitative metrics are detailed in the document D5.1 [17].

Several workshops, interviews, questionnaires and prototyping, with different stakeholders from Brazil and Europe supported the identification and description of requirements in this chapter. They are in accordance with the set of features identified as the scope of the RESCUER system in the document D1.4.2 [12].

The requirements were grouped and identified considering the main components of the RESCUER system. Functional and non-functional requirements are codified as FR (functional requirements) or NFR (non-functional requirements) respectively, where corresponds to the component acronym that implements the requirement (see Table 2) and corresponds to the number of the requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GNR</td>
<td>General (more than one component)</td>
</tr>
<tr>
<td>DAS</td>
<td>Data Analysis Solution</td>
</tr>
<tr>
<td>ETK</td>
<td>Emergency Response Toolkit</td>
</tr>
<tr>
<td>MBL</td>
<td>Mobile Crowdsourcing Solution</td>
</tr>
</tbody>
</table>

4.1. RESCUER System Key Concepts

This section presents three key concepts to clearly understand the requirements of this document. They are report, incident and emergency.

4.1.1. Report

The report corresponds to a spontaneous communication from the crowd to inform the occurrence of an incident. There are two types of report: simple and complete. In a simple report, also known as “Incident Notification”, the user of the mobile solution informs the type of incident and sends it with a single click. On the other hand, in a complete report, also known as “Incident Report”, the user provides a set of information about the incident, and the user can attach images, video and a free text.

The Incident Notification has the following information (document D2.1.2 [7]):

- Report identification;
- User profile;
- Timestamp;
- GPS notification position;
- Incident type.
The Incident Report has the following information:

- Report identification;
- User profile;
- Timestamp;
- GPS report position;
- Incident type;
- Question/answer about incident;
- Image(s);
- Video;
- Text.

When sending an image or video with the RESCUER app, the following sensor data will be recorded automatically (document D2.1.2 [7]):

- GPS position (image/video);
- Timestamp (image/video);
- Gyroscope (video);
- Accelerometer (video).

For reports, the following rules are considered:

- The incident types are: fire, explosion, gas leakage, environmental or help;
- The user profile is informed by the user when he installs the app in his mobile phone. This profile will be used by the app in every report sends by the user;
- The Meta Data - GPS position and timestamp - will be collect automatically and send in each report and notification;
- Report information should not be updated, it is historical data;
- Image, video and free text of reports will be analysed individually in order to find fire/crowd aspects;
- Result of individually analysis will be used to create an aggregated analysis.

4.1.2. Incident

Incident is a natural or man-made occurrence that interrupts the normal procedure or behavior of a certain situation. It may cause a critical or emergency situation that requires measures that immediately reduces adverse consequences to life and property, since it can affect the image of the business and/or of the country. The concept of incidents as defined here includes the concept of accident (document D2.1.2 [7]). In terms of Rescuer system, the incident has a group of reports related by incident type occurring at the same incident area.

An incident contains the following information:

- Incident identification;
- Incident type;
- Incident area;
- Start date and time;
- End date and time;
- Keywords;
• Phases.
For incidents, the following rules are considered:
• The incident starts when the system receives the first report;
• The keywords of the incident are a result from a combined analysis of the reports that belong to the incident;
• The incident area is a circle considering the position of the first report (P0) and a radium parameter set by the user;
• An incident is assigned taking into account the type of incident and position of report. The report that have the same incident type and position inside of the incident area are from the same incident. If have different incident type or is outside of the incident area are from a new incident;
  o The phases of an incident are: Informed, Confirmed, Under Combat, Under Control, and Finished;

4.1.3. Emergency

Emergency is a critical situation caused by an incident, natural or man-made that requires measures to immediately to reduce their adverse consequences to life and property [10]. Examples of natural incidents are floods, wildfires, and snow storms, whereas examples of man-made incidents are fires, explosions and/or substance spills from oil platforms, ships, and factories.

In the RESCUER project, an emergency situation is characterized by one or several incidents (similar or different types) reported in the same monitoring area that requires response from the Command and Control Centre (C&CC).

The emergency has the following information:
• Emergency type;
• Monitoring area;
• Monitoring start date and time;
• Monitoring end date and time;
• List of the incidents;
• Phases (Informed, Confirmed, Under Combat, Under Control, and Finished);

The C&CC is in charge of the definition of the area of the emergency and period to be monitored. During such period of time and defined area, the system will collect, receive, analyze and send information about the emergency.
4.2. Functional Requirements

This section is divided into three component requirements: Mobile, DAS and ERTK. For each component there is a requirements table list. After each table, the mentioned requirements are described in details. Some requirements were excluded by the developers for not having research interest; others were excluded by users for not having features of interest (Appendix II).

4.2.1. Mobile Crowdsourcing Solution

Table 3: Mobile Crowdsourcing Solution Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRMBL01</td>
<td>Making User Registration</td>
</tr>
<tr>
<td>FRMBL02</td>
<td>Sending Incident Notification</td>
</tr>
<tr>
<td>FRMBL03</td>
<td>Sending Incident Report</td>
</tr>
<tr>
<td>FRMBL04</td>
<td>Collecting Sensor Data</td>
</tr>
<tr>
<td>FRMBL05</td>
<td>Receiving Follow-up Structured Questions</td>
</tr>
<tr>
<td>FRMBL06</td>
<td>Answering Follow-up Structured Questions</td>
</tr>
<tr>
<td>FRMBL07</td>
<td>Receiving Follow-up Free Questions</td>
</tr>
<tr>
<td>FRMBL08</td>
<td>Answering Follow-up Free Questions</td>
</tr>
<tr>
<td>FRMBL09</td>
<td>Receiving Crowd Steering Instructions</td>
</tr>
<tr>
<td>FRMBL10</td>
<td>Receiving Incident Public Communication</td>
</tr>
<tr>
<td>FRMBL11</td>
<td>Connecting Ad-Hoc Communication</td>
</tr>
</tbody>
</table>

FRMBL01 – Making User Registration

**Description:** The Mobile Solution must provide user the ability to inform their profile and information to make their registration.

**Business Rules:**
- The profiles to consider are: Workforces, Supporting Forces and Civilians;
- If the profile is Workforces, it must be informed which workforces the user belongs to (Police, Fire-fighter, or Rescue Service), and the user role on the emergency management process;
- If the user profile is Supporting Forces, the user must inform the specific supporting forces (Volunteer, Security Staff, or Emergency Staff). Being a Volunteer, in industrial area, the user must inform the community;
- If the profile is Civilians, the user needs to inform whether he/she is visitor or employee. Being an employee, in industrial area, the user must inform the company.

FRMBL02 – Sending Incident Notification

**Description:** The Mobile Solution must support Civilians, Supporting Forces and Workforces to send the incident notification to Command and Control Centre.

**Business Rules:**
- The incident notification only inform the incident type;
- The incident types are fire, explosion, gas, environmental, or help.
FRMBL03 – Sending Incident Report

Description: The Mobile Solution must support Civilians, Supporting Forces and Workforces to send incident report with answer to pre-defined and structured questions, and optional free text or/and images or/and videos to Command and Control Centre.

Business Rules:
- The pre-defined and structured questions depend on the type of incident, detail in document D2.1.2 [7];
- A report may be partial: the system sends the incomplete report every 5 seconds. After the user finished the report, it will be sent again with the same report id. The system should consider the latest report as the final report;
- The uploaded videos should have at least 5s and maximum of 25s;
- The image sent must have this minimum resolution: VGA – 640x480, SD – 720x480 (depending on the mobile device specifications) and minimum frame rate of 15fps;
- Images and videos have to be compressed by the Mobile Crowdsourcing Solution to reduce data transmission via Internet;
- Text, image and video will must be available from DAS component.

FRMBL04 – Collecting Sensor Data

Description: The Mobile Solution must collect and record data available automatically by the mobile device of Civilians, Supporting Forces and Workforces.

Business Rules:
- The data to be collected are:
  - GPS position
  - Timestamp
- When making an image or video with the RESCUER App, the following sensor data are recorded automatically:
  - GPS position;
  - Timestamp;
  - Gyroscope
  - Accelerometer.
- Data collected has to be relevant and not excessive with respect to the processing purposes.
- The data collected by mobile sensor must be available from DAS and ERTK components;

FRMBL05 – Receiving Follow-up Structured Questions

Description: The Mobile Solution must support Civilians, Supporting Forces and Workforces to receive follow-up pre-defined and structured questions from the Command and Control Centre.

Business Rules: The structured questions depend on incident type and the user’s profile (detailed information in document D2.1.2 [7]).

FRMBL06 – Answering Follow-up Structured Questions

Description: The Mobile Crowdsourcing Solution must support Civilians, Supporting Forces and Workforces to answer follow-up pre-defined and structured questions to the Command and Control Centre.
- **Business Rules:** User can include images and video to structured answer and the images and video must be available for DAS component.

**FRMBL07 – Receiving Follow-up Free Questions**
*Description:* The Mobile Crowdsourcing Solution must support Civilians, Supporting Forces and Workforces to receive follow-up free questions from the Command and Control Centre.
*Business Rules:* Follow-up for free text interaction with the reporter will be in chat format.

**FRMBL08 – Answering Follow-up Free Questions**
*Description:* The Mobile Crowdsourcing Solution must support Civilians, Supporting Forces and Workforces to answer follow-up free questions to the Command and Control.
*Business Rules:* Images and/or videos can be included and must be available for DAS components.

**FRMBL09 – Receive Crowd Steering Instructions**
*Description:* The Mobile Crowdsourcing Solution must support Civilians (Employees, Visitors and Neighbouring Community) to receive crowd steering instructions from the Command and Control Centre.
*Business Rules:*
- The receiver stakeholder differs from Industrial Park and Large-scale Events scenario.
  - Stakeholders of Industrial Park are: Employees (affected unit and non-affected unit), Visitors (inside the plant and outside the plant) and Neighbouring Community.
  - Stakeholders of Large-scale Events are: Employees and Civilians.

**FRMBL10 – Receiving Incident Public Communication**
*Description:* The Mobile Crowdsourcing Solution must support Civilians, Environment department, Neighbour Community to receive public communication from the Command and Control Centre.
*Business Rules:*
- The receiver stakeholder differs from Industrial Park and Large-scale Events scenario.
  - Stakeholders of Industrial Park are: Environment department, Neighbouring Community and Employees.
  - Stakeholders of Large-scale Events are Civilians.

**FRMBL11 – Connecting Ad-Hoc Communication**
*Description:* The Mobile Crowdsourcing Solution must support Civilians, Supporting Forces and Workforces to communicate using the ad-hoc networking approach to enable message delivery during times of network outage.
*Business Rules:*
- The RESCUER ad-hoc network approach should be based on the capability of smart phones to act as mobile WiFi hotspots;
- Some of the smart phones in a crowd will turn into access points, while the smart phones in those devices’ vicinity could become clients connecting to those access points to exchange data;
- Once the connection is established, all phones that are connected to an access point will exchange their data (i.e. text messages) amongst each other – this does also include the phone that is currently acting as an access point;
- The Mobile Crowdsourcing Solution has to run on unmodified off-the-shelf smart phones;
- The Mobile Crowdsourcing Solution should support Android and iOS smart phones.

### 4.2.2. Data Analysis Solution

**Table 4: Data Analysis Solution Requirements**

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>FRDAS02</td>
<td>Prioritizing Image and Video Analysis</td>
</tr>
<tr>
<td>FRDAS03</td>
<td>Clustering Incident Reports</td>
</tr>
<tr>
<td>FRDAS04</td>
<td>Identifying Image and Video with Fire/Smoke</td>
</tr>
<tr>
<td>FRDAS05</td>
<td>Identifying Fire Relevant Regions in Image</td>
</tr>
<tr>
<td>FRDAS06</td>
<td>Identifying Smoke Colour in the Image</td>
</tr>
<tr>
<td>FRDAS07</td>
<td>Identifying Duplicated Images</td>
</tr>
<tr>
<td>FRDAS08</td>
<td>Identifying Video with Crowd Density</td>
</tr>
<tr>
<td>FRDAS09</td>
<td>Segmenting Videos</td>
</tr>
<tr>
<td>FRDAS10</td>
<td>Clustering Data Collected by Sensors</td>
</tr>
<tr>
<td>FRDAS11</td>
<td>Prioritizing Video Analysis for Crowd Aspects</td>
</tr>
<tr>
<td>FRDAS12</td>
<td>Prioritizing Video Analysis for Fire Aspects</td>
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<tr>
<td>FRDAS13</td>
<td>Prioritizing Image Analysis for Fire Aspects</td>
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<td>FRDAS14</td>
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<tr>
<td>FRDAS16</td>
<td>Identifying Reports with Fire in Density Areas</td>
</tr>
<tr>
<td>FRDAS17</td>
<td>Identifying Videos with Crowd Disturbance</td>
</tr>
<tr>
<td>FRDAS18</td>
<td>Giving Incident Confirmation Level</td>
</tr>
<tr>
<td>FRDAS19</td>
<td>Integrating Legacy System Database</td>
</tr>
</tbody>
</table>

**FRDAS01 – Identifying W-questions Answers in the Text**

**Description:** The DAS must identify the words or expressions in the report’s text related to the W-question.

**Business Rules:** The words or expressions W-questions to found are ‘what’, ‘when’, ‘where’ and ‘who’;

**FRDAS02 – Prioritizing Image and Video Analysis**

**Description:** The DAS must prioritize the report’s images and videos. This should be done to ensure that the most relevant images and videos will be analysed first.

**Business Rules:**
- To prioritize the images and videos the following criteria should be considered, from most important to least important:
  - Report’s category:
    - Profile;
    - Follow-up answer;
- Injured people.
- Context’s category:
  - Proximity to P0,
  - New incident (different incident type),
  - Different incident in the same area,
  - ERTK user marked incident as important.
- Interplay analysis’s category:
  - Indication of crowd aspects,
  - Indication of fire/smoke aspects.

The following information should be considered:
- The sorting algorithm should be flexible and allow easy change in the criteria and in the order of the criteria;
- Report structured data must be considered;
- Report from workforces and supporting forces profile are more relevant;
- The image has more priority if it is near P0 and inside the incident area;
- Knowing the incident that the report belongs to is required;
- Indication of crowd aspects is result of video analysis (FRDAS11);
- Indication of fire aspects is result on image and video analysis (FRDAS12 and FRDAS13).

FRDAS03 – Clustering Incident Reports

**Description:** The DAS must provide a clustering of reports in incidents, according to the incident type and area, to avoid incident duplication.

**Business Rules:**
- The incident will be created when the first report is received;
- The incident type must be considered, taking into consideration the incident type or compatible incident types (e.g. fire and explosion, or help and any other incident type are compatible incident types);
- The incident area must be calculated considering the position of the first report (P0) and a radium parameter set by the user (defined in UCETK02);
- T0 is the time of the first report of an incident, each incident has a T0;
- All report received after T0, with the same or compatible incident type and that the position is inside the incident area will be considered report from the same incident, except in case of the incident finished.

FRDAS04 – Identifying Image and Video with Fire/Smoke

**Description:** The DAS must identify the presence of fire and/or smoke in the report’s image and video.

**Business Rules:**
- The DAS must identify if there is fire/smoke with:
  - Flames and smoke;
  - Just flames;
  - Just smoke.
FRDAS05 – Identifying Fire Relevant Regions in Image  
**Description:** The DAS Solution must identify regions in images where fire and smoke are more evident.

FRDAS06 – Identifying Smoke Colour in the Image  
**Description:** The DAS must identify the colour of the smoke in the report’s image.  
**Business Rules:**  
- The DAS must identify smoke colour with:  
  - Light grey;  
  - Dark grey;  
  - Other.  
- The configuration parameters (light grey, dark grey, other) are defined in UCETK02.

FRDAS07 – Identifying Duplicated Images  
**Description:** The DAS must identify duplicate images in the report and in the incident.  
**Business Rules:** Duplicated images do not add value to user analysis.

FRDAS08 – Identifying Video with Crowd Density  
**Description:** The DAS must investigate crowd density in the report’s video.  
**Business Rules:**  
- The system must identify if there is crowd density (low-density, middle-density or high-density) in videos and give estimation of this measure (people/m2);  
- The configuration parameters (low-density, middle-density or high-density) are defined in UCETK02;

FRDAS09 – Segmenting Video  
**Description:** The DAS must identify relevant parts of the video producing a segmented video.  
**Business Rules:** The segmented video must consider frames of video that show fire/smoke and crowd aspects.

FRDAS10 – Clustering Data Collected by Sensors  
**Description:** The DAS must cluster the data collected from mobile device sensors to build the crowd density heat map.  
**Business Rules:**  
- Data sensor cluster must result in crowd density and movement speed information in heat map;  
- Information coming from the clustering sensor data will identify areas of crowd density.

FRDAS11 - Prioritizing Video Analysis for Crowd Aspects  
**Description:** The DAS must prioritize the report’s videos sent from density areas to analyse crowd aspects.  
**Business Rules:**  
- The identification crowd density comes from regions of density pointed by sensor analysis (FRDAS10);
**FRDAS12 – Prioritizing Video Analysis for Fire Aspects**

**Description:** The DAS must prioritize the report’s videos with indications of fire to analyse fire aspects.

**Business Rules:**
- The indication of a fire incident can be obtained from the following sources:
  - Incident type of the report and/or;
  - Result of the ‘what question’ of text analysis and/or;
  - Result of the analysis of images associated to the same report.

**FRDAS13 – Prioritizing Image Analysis for Fire Aspects**

**Description:** The DAS must prioritize the report’s images with indications of fire to analyse fire aspects.

**Business Rules:**
- The indication of a fire incident in this case comes from the following sources:
  - Incident type of the report and/or
  - Result of the ‘what question’ of text analysis.

**FRDAS14 – Indicating Report Confirmed Information**

**Description:** The DAS must indicate report’s information confirmed by the result of analysis to highlight them in the ERTK visualization.

**Business Rules:**
- The following report’s information must be confirmed:
  - Incident type will be confirmed by result of Image and Video analysis;
  - Smoke colour will be confirmed by result of Image analysis.

**FRDAS15 – Giving Report Reliability Level**

**Description:** The DAS must indicate the reliability level of each report.

**Business Rules:**
- The DAS must provide reliability level to each report, considering:
  - Reports coming from Workforces or Supporting forces have 100% of reliability level;
  - Reports coming from Civilians have the initial reliability level parameter 70% configured by the ERTK user;
  - The level of reliable can grow up using adding percent configuration parameter 30% depending on the confirmation of incident type (FRDAS14);
  - Incident type will be confirmed by result of Image and Video analysis;
  - Civilians initial and adding reliability level parameter are defined in UCETK02.

**FRDAS16 – Identifying Reports with Fire in Density Areas**

**Description:** The DAS must identify reports with ‘fire’ (in any source of information) from density areas to prioritise them in the ERTK visualization.

**Business Rules:**
- Information coming from the sensor cluster will identify density areas (FRDAS10);
- The source of fire information are:
  o Incident type;
  o Report structured answers;
  o W-question Text analysis;
  o Result of image analysis;
  o Result of video analysis.

FRDAS17 – Identifying Videos with Crowd Disturbance
Description: The DAS must identify videos with crowd disturbance
Business Rule:
- The DAS must identify if there is crowd disturbance “yes/no” in video;
- This videos will be highlighted in the ERTK visualization.

FRDAS18 – Giving Incident Confirmation Level
Description: The DAS must indicate the confirmation level of each incident.
Business Rules:
- To determine the incident’s confirmation level the following topic should be considered:
  o Number of reports;
  o Reliability of each report.
- Incident confirmation level is 100%, if an incident has at least one workforce or supporting force report or at least one civilian report with reliable level 100%;
- Incident confirmation level must consider number of reports if don’t have at least one workforce, supporting force or civilian report with reliable level 100%. In this case, the number of reports has positive impact in reliable level.

FRDAS19 – Integrating Legacy System Data
Description: The DAS shall provide an interoperable communication to legacy systems.
Business Rules:
- DAS will support retrieve information from legacy systems and send information to legacy systems;
- The retrieve and send information must be in Rescuer context;
- This is done in parameterized time intervals, depending on the scenario. The options are: automatic by time interval or periodic by initial and final data (UCETK02);
- Rescuer system or a Legacy one makes a query using vocabulary of an ontology;
- This query is translated through mappings to a form that the system’s database can understand and retrieve information;
- This information will be send back to the system that made the request also in the form of ontology vocabulary.
4.2.3. Emergency Response Toolkit

Table 5: Emergency Response Toolkit Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
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<tr>
<td>FRETK01</td>
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<tr>
<td>FRETK02</td>
<td>Informing Monitoring Area and Time</td>
</tr>
<tr>
<td>FRETK03</td>
<td>Showing List of Incident Report</td>
</tr>
<tr>
<td>FRETK04</td>
<td>Showing Detailed Information of a Report</td>
</tr>
<tr>
<td>FRETK05</td>
<td>Providing Follow-up Report</td>
</tr>
<tr>
<td>FRETK06</td>
<td>Showing Detailed Information of an Incident</td>
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<td>FRETK08</td>
<td>Showing Incident Map</td>
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<td>Drawing in the Incident Map</td>
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<tr>
<td>FRETK10</td>
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</tr>
<tr>
<td>FRETK11</td>
<td>Providing Incident Summary Graphics</td>
</tr>
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<td>FRETK12</td>
<td>Showing Emergency Map</td>
</tr>
<tr>
<td>FRETK13</td>
<td>Providing Emergency Summary Graphics</td>
</tr>
<tr>
<td>FRETK14</td>
<td>Maintaining Public Communication Target-group List</td>
</tr>
<tr>
<td>FRETK15</td>
<td>Maintaining Public Communication Templates</td>
</tr>
<tr>
<td>FRETK16</td>
<td>Sending Emergency Public Communication</td>
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<tr>
<td>FRETK17</td>
<td>Maintaining Crowd Instruction List</td>
</tr>
<tr>
<td>FRETK18</td>
<td>Sending Crowd Steering Instructions</td>
</tr>
</tbody>
</table>

**FRETK01 – Making User Registration**

**Description:** The ERTK must provide for the user the ability to inform his/her profile and information during the registration process.

**Business Rules:**
- C&CC is responsible to make decisions to handle the emergency situation and represents the stakeholders that belong to Command and Control Centre organization in Large-scale Events and European Industrial Parks;
- In case of Brazilian Industrial Parks, this profile represents the stakeholders that belong to Emergency Committee and Crisis Committee organization.

**FRETK02 – Informing Monitoring Area and Time**

**Description:** The ERTK must provide to the C&CC the ability to inform the monitoring area and the time configuration parameter.

**Business Rules:** The following criteria should be considered:
- The monitoring area represents the area that must be monitored by Rescuer sensor mobile;
- The configured monitoring time is the following:
  - Continuous;
  - Started or finished by user;
  - The user informs start and end time.
FRETK03 – Showing List of Incident Report

**Description:** The ERTK must provide a list of reports per incident ordered by classification criteria to improve the user’s critical appraisal.

**Business Rules:**
- The priority criteria should be considered, following the order:
  - The most update information in injured people (first report with this information or last report from a workforce with this information);
  - The proximity to P0 (the three zones can be used: hot, warm and cold);
  - The longer time span since T0 (updated information);
  - Whether the report has a follow-up answer;
  - Report user profile;
  - Incident type confirmed by DAS (FRDAS16);
  - Has detailed informed (not only notification).
- The user can assign importance of incident and this is considered in multimedia analysis of the report;
- If a new report was received and old report was changed, the current list of reports of the incident shall be updated and/or reordered by priority dynamically;
- Reports with fire in middle/high-density areas must be highlighted (FRDAS17);
- The system must indicate reports updated in the current list of incident reports.

FRETK04 – Showing Detail Information of a Report

**Description:** The ERTK must provide detailed information of a report, if requested by the user, to improve the incident understanding.

**Business Rules:**
- Detail information of report are:
  - Report identification;
  - Incident type;
  - Report structured questions and answered;
  - Identification of the source of report (profile of the sender);
  - Analysed free text with the most relevant words highlighted;
  - Highlight the incident type, if it was confirmed by image/video analysis for fire aspects;
  - Indication of the status of the data analysis: not analysed, partially analysed and, analysed;
  - Track user trajectory in case of user can send parts of the report from different positions;
  - Free text and/or structured follow-up report (FRETK05);
  - List of images and videos included in the report with function of hide and show.
- For images and videos list included in the report:
  - Show duplicated images at the end of the list as not relevant data;
  - The video should show only the relevant segment (video with fire/smoke and crowd);
  - The user can see the complete video upon request;
  - Video with crowd disturbance shall be highlighted.
- The following priority criteria should be considered to order the list images and videos:
  - Compatibility to the incident type;
RESCUER

- Longer time span since T0 (T0 is the time of the first report of the incident);
- Image with fire aspects;
- Video with fire aspects or crowd aspects.

**FRETK05 – Providing Follow-up Report**

**Description:** The ERTK must provide to the C&CC the ability to make follow-up reporting with structured or free questions. This follow-up reporting requests additional information to one person or a group-target in the crowd about an incident.

**Business Rule:** The following criteria should consider:
- This information is related to missing information, clarifying contradictory information, investigating potential problems and continuously evolving information;
- The system should provide the ability to keep the list of pre-defined and structured questions to be chosen dynamically. The detail about follow-up catalogue is described in document D2.3.1, Table 1;
- The pre-defined structured follow-up questions depend on the incident type and user profile;
- The questions could be selected by the user;
- Follow-up report can attach images and videos.

**FRETK06 – Showing Detail Information of an Incident**

**Description:** The ERTK must provide relevant information about the incident to improve the C&CC analysis.

**Business Rule:**
- The following information should be considered:
  - Location information;
  - Timeline of the incident phases;
  - List of incidents nearby;
  - Incident map;
  - Short incident description (group of keywords);
  - The list of incident media;
  - The free text and/or structured follow-up from the incident reports.
- The following criteria should be considered:
  - The location information will be obtained by the GPS position (position P0) of the incident;
  - The system automatic updates the first incident phase, “Detected”, when the first report arrives;
  - The user updates the others incident phases;
  - The list incidents nearby assists users in the task of reorganize incidents (FRETK07); 
  - The incident map is shown according with FRETK08;
  - The short incident description is composed by structured data common values extracted from reports coming from workforces, and major values extracted from reports coming from civilians;
  - The list of incident media is composed by the fifteen most important images and videos, considering the importance and priority of all incident reports. The user is able to hide images or videos;
Video with crowd disturbance shall be highlighted.

FRETK07 – Reorganizing Incident Allocation

**Description:** The ERTK must provide to the C&CC the ability to reorganising preliminary incident reports assignments by merging or splitting them.

**Business Rules:**
- Both the incident position and assignment of reports to an incident can be refined by the ERTK user, if necessary or desired;
- After merge two incidents the following criteria should be consider:
  - Only one remains and the incidents information must be combined and updated;
  - The short incident description must be updated joining all words;
  - Short textual description is provided by the user;
  - User has the possibility of modifying the short textual description.

FRETK08 – Showing Incident Map

**Description:** The ERTK must provide to the C&CC the ability to show the incident map.

**Business Rule:** The following criteria should consider:
- Incident map has to show:
  - Heat map;
  - Five most priority report in the list of incident reports;
  - Special areas;
  - Temperature, wind speed and direction.
- ERTK shows the crowd density (based on the number of people carrying smart mobile devices) in a heat map;
- ERTK shows the crowd movement in terms of arrows that capture the average direction of people and arrow size indicates the movement velocity (the bigger the faster);
- ERTK places images/videos with fire and/or smoke in the heat map;
- ERTK places video with crowd density and/or flow issues in the heat map;
- To display temperature, wind speed and direction the internet service must be available;
- Special areas are “hot”, “cold” and “warm” zones that user can draw (FRETK09);
- The system automatically draw in the map two layers:
  - The ‘Basic incident area’ extracted from indication of incident area, provided by DAS (FRDAS03);
  - The ‘Fire incident area’ extracted from grouped reports of the incident with image and videos analysis with “fire” (FRDAS04);
  - The user can resize and change the label in this area.

FRETK09 – Drawing in the Incident Map

**Description:** The ERTK must provide to the C&CC the ability of drawing in the incident map.

**Business Rule:** The following criteria should consider:
- The user can draw: points, lines and polygons, this draw will be identified by labels;
- The user can draw zones in the map and give labels to them. For the “hot”, “cold” and “warm” labels, the system will recognize them and use this information.
FRETK10 – Modifying Incident Information
Description: The ERTK must provide to the C&CC the ability to modify incident information.
Business Rule: The following criteria should consider:
- The user can change the name of the incident to a name desired by the user (kind of short name);
- The user can mark an incident as important to improve the system analysis;
- The user updates the incident phase;
- The ERTK suggests correction of the incident time (T0) based on the “when” text analysis report received from the Workforces;
- The ERTK suggests correction of the incident place (P0) based on the “where” text analysis report received from the Workforces and vector map of the area.

FRETK11 – Providing Incident Summary Graphics
Description: The ERTK must provide graphics about the incident for further analysis.
Business Rule:
- This following graphics are provided:
  - Number of reports by type of incident/keywords;
  - Number of reports by profile per time;
  - Number of reports by profile per zone and time;
  - Number of reports by fire dimension;
  - Number of injured people per time;
  - Number of people in the area per time.
- Reports by type of incident/keywords:
  - Keywords are taken from the structured data of the report;
  - The number of reports is result of the aggregation of each keyword taking into account the weight according to the reliability;
  - Provide dynamic update of aggregated information as new reports or part of report arrives;
  - Provide selection of seeing aggregated information only from Workforces or from Workforces and crowd;
  - Provide graphical information for the most frequent keyword as default.
- Reports of injured people per time:
  - This graphic will provide only if Workforces informed the number of injured people.
- Reports by fire dimension:
  - This fire dimension information comes from the report structured information.
- Report by number of people:
  - The sensor mobile data should use to estimate the total number of people.

FRETK12 – Showing Emergency Map
Description: The ERTK must provide a map of the emergency with different layers to improve the C&CC analysis.
Business Rule:
- The following map layers are provide:
FRETK13 – Providing Emergency Summary Graphics

**Description:** The ERTK must provide graphics about the emergency to improve the C&CC analysis.

**Business Rule:**
- This following graphics are provided:
  - Emergency phases per time;
  - Number of reports by keywords;
  - Number of reports of injured people per time;
  - Only If there is more than one incident:
    - Number of incidents per time;
    - Number of incidents per phases;
- The following criteria should be considered:
  - The emergency phases are: Informed, Confirmed, Under Combat, Under Control, and Finished;
  - The system automatically updates the first emergency phase, “Informed”, when the first report arrives;
  - The user updates the others emergency phase (Confirmed, Under Combat, Under Control, Finished).

FRETK14 – Maintaining Public Communication Target-group List

**Description:** The ERTK must provide to the C&CC the ability to add, remove or edit the list of public communication target-group.

**Business Rule:**
- The following information list must be available as target-group:
  - Email or SMS list: Each email or SMS has to be associated to a profile or to a specific stakeholder;
  - RESCUER Web site address;
  - RESCUER Social network address.

FRETK15 – Maintaining Public Communication Templates

**Description:** The ERTK must provide message templates for public communication.

**Business Rule:**
- Template is a structured text that has a set of sentences;
- Each sentence has relationship with emergency phase and target stakeholder;
- Target stakeholder determine the content of the sentences;
- The detail definition of templates and sentences is at document D4.3.1 [2].
FRETK16 – Sending Emergency Public Communication

**Description:** The ERTK must provide to the C&CC the ability to send custom public communication messages according to emergency phases and stakeholders criteria.

**Business Rule:**
- The message can be sent by email, SMS, Mobile App, Web site or Social Networks;
- Messages depend on the type of emergency (fire, explosion, gas leak or environment);
- The communication will be done through a pre-defined template list, based on emergency phase and the target-stakeholders, as described in the use case UCETK12;
- Target stakeholder differ from Industrial Park and Large-scale Events scenario:
  - Industrial Park: Press, Politicians, Environment department, Neighbour community and Employee;
  - Large-scale Events: Press, Politicians and Civilians.

FRETK17 – Maintaining Crowd Instruction List

**Description:** The ERTK must provide to the C&CC the ability to add, remove or edit procedures for assuring public safety.

**Business Rule:** Each instruction has to be associated to a profile or to a specific stakeholder, beside this, has to be associated to an incident phase.

FRETK18 – Sending Crowd Steering Instruction

**Description:** The ERTK must provide to the C&CC the ability to send instructions based on incident phases and stakeholders.

**Business Rule:** The following criteria should consider:
- The message will be sent to the Mobile app;
- The communication will be done through a pre-defined crowd instructions list based on incident phases and the target-stakeholders as described at requirement FRETK18.
- The C&CC has to have the ability to choose one or more stakeholders.
- The target-stakeholders differ from Industrial Park and Large-scale Events scenario. Table 6 below shows the differences.

<table>
<thead>
<tr>
<th>Industrial Park</th>
<th>Large-scale Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee (affected unit)</td>
<td>Employee</td>
</tr>
<tr>
<td>Employee (non-affected unit)</td>
<td></td>
</tr>
<tr>
<td>Visitor (inside the plant)</td>
<td>Civilians</td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td></td>
</tr>
<tr>
<td>Neighbour community</td>
<td></td>
</tr>
</tbody>
</table>
4.3. Non-Functional Requirements

This section describes the non-functional requirements identified for the RESCUER system.

Table 7: Non-Functional Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFRGNR01</td>
<td>Performance</td>
</tr>
<tr>
<td>NFRGNR02</td>
<td>Availability</td>
</tr>
<tr>
<td>NFRGNR03</td>
<td>Security</td>
</tr>
<tr>
<td>NFRGNR04</td>
<td>Usability</td>
</tr>
<tr>
<td>NFRGNR05</td>
<td>Scalability</td>
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<tr>
<td>NFRGNR06</td>
<td>Extensibility</td>
</tr>
<tr>
<td>NFRGNR07</td>
<td>Portability</td>
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<tr>
<td>NFRGNR08</td>
<td>Adaptability</td>
</tr>
<tr>
<td>NFRGNR09</td>
<td>Privacy and Data Usage Control</td>
</tr>
</tbody>
</table>

**NFRGNR01 – Performance**

*Description*: to ensure performance, the RESCUER must consider the following criteria:
- The latency between sending reports from the mobile device and visualizing results in the ERTK should be less than one minute;
- The result of text, image and video analyses should be presented in ERTK at less than three minutes (since the moment that the user sends the information from the mobile);
- The time to connect to an Ad-Hoc network should be quick enough not to interfere with the system communication (between 5 and 10s).

**NFRGNR02 – Availability**

*Description*: to ensure availability, the RESCUER must consider the following criteria:
- In case of network unavailability, the system has to provide a way to transmit at least text. RESCUER will use an Ad-Hoc like approach for this goal;
- The Mobile Crowdsourcing Solution has to be designed in such a way that the battery consumption is considered to ensure that the service will be available.

**NFRGNR03 – Security**

*Description*: The RESCUER system should exchange encrypted messages.

**NFRGNR04 – Usability**

*Description*: to ensure usability, the RESCUER must consider the following criteria:
- The RESCUER system should have an easy-to-use user interface requiring minimal interactions;
- The use of the application should not disturb with unnecessary information or an overload;
- Users should receive minimal information, being the instructions informative, imperative and without filler words. The guideline for user interaction is detailed in document D2.1.2 [7]. It explains the general recommendations for mobile users regarding simplicity, accuracy, instant usage, error tolerance and flexibility;
- The Mobile Crowdsourcing Solution has to be designed flexibly and has to allow that people in emergencies provide any input information with no restriction. Measures for achieving flexibility are described in document D2.1.2 [7];
- The system should be responsive: run in any screen size, with any hardware features, including mobile (e.g., notebook, tablet, smart phone) and desktop;
- The Emergency Response Toolkit Solution must run in any Internet browser.

NFRGNR05 – Scalability
Description: The system needs to be scalable regarding the number of devices using the application. In both scenarios of Large-scale Events and larger Industrial areas, several thousand people may run the Mobile Crowdsourcing Solution of RESCUER. The communication network as well as the server system should be able to handle the arising amount of data.

NFRGNR06 – Extensibility
Description: In order to be prepared for a changing environment and extension of its scope, the RESCUER system should be designed as an extensible system following the principle: “close for modifications open for extension” [9]. This holds for software extensibility as well as for hardware extensibility.

NFRGNR07 – Portability
Description: The Mobile Crowdsourcing Solution should be able to run in all devices without knowing previously, which platform or operating system they are using.

NFRGNR08 – Adaptability
Description: The user interface in the Mobile Crowdsourcing Solution and in the Emergency Response Toolkit has to be optimized regarding users’ personal data. This means the application’s interface and available functions adapt to the user preferences and/or current situation. For example, Civilians may have different functionalities than Workforces. The user interface has to show the information in the specified user language (using the device’s operational system information). The adaptation may be applied to user interfaces, device’s characteristics, available functionalities and provided information.

NFRGNR09 – Privacy and Data Usage Control
Description: The Mobile Crowdsourcing Solution shall provide the protection of the privacy of its users. To satisfy this requirement, the following items should be considered:
- The identified concrete requirements should be translated, whenever possible, into technical measures, which shall be implemented by the components in Rescuer;
- To ensure data usage control, the Mobile Crowdsourcing Solution shall provide Civilians, Supporting Forces and Workforces with the ability to inform the user about the start and end time of sensor data recording;
- The Rescuer platform shall protect users’ data and users’ privacy. More precisely, the Rescuer platform shall be compliant, or shall provide means that enable compliance.
5. Use cases

This chapter describes the RESCUER system use cases. Figure 8 shows the use-case diagram and the interaction between the actors of the Mobile Crowdsourcing Solution.

Figure 8: Mobile Crowdsourcing Solution use-case diagram
**UCMBL01 – Make User Registration**

| Actor | - Workforces;
|       | - Supporting Forces;
|       | - Civilians. |

**Goal**
Provide to the user the ability to inform his/her profile and personal information for registration.

**Input Data**
- User profile;
- Depending on user profile:
  - Role;
  - Community;
  - Company.

**Main Flow**
1. The system allows the user to inform his/her profile and personal information;
2. The user informs their profile and personal information for registration;
3. The system asks the user to allow that the system record their data and permits the user to read the “terms to use the system”;
4. The user accepts the request;
5. The system persist user profile and information and finishes the user registration.

**Alternative Flow**
Reject recording data:
1. If in the step 3 of the main flow, the user does not allow the system to record their data;
2. The system cancels the registration.
Updating user profile:
1. If after step 5 of the main flow, the user wants to update the profile;
2. The system allows the user to update the profile;
3. The user updates the profile;
4. The system updates the user profile.
Deleting user profile:
1. If after step 5 of the main flow, the user wants to delete the profile;
2. The system allows the user to delete the profile;
3. The user requests that the system deletes the profile;
4. The system deletes the user profile.

**Functional Requirements**
FRMBL01 – Making User Registration

**Non Functional Requirements**
NFRGNR03 – Security;
NFRGNR04 – Usability;
NFRGNR07 – Portability;
NFRGNR08 – Adaptability;
NFRGNR09 – Privacy, Data Usage Control;

**Results & Output Data**
Persistent user profile and information.
### UCMBL02 – Send Incident Notification

| Actor            | - Workforces;  
|                  | - Supporting Forces;  
|                  | - Civilians. |

| Goal                                      | Allow the user directly involved in the incident sends to the Command and Control Centre, with only one click, a notification identifying the type of incident. |

| Input Data                                      | - User profile;  
|                                                | - Incident Type. |

| Main Flow                                      | 1. The user informs the profile (only in the first access to RESCUER app);  
|                                                | 2. The system shows a list of incident type;  
|                                                | 3. The user chooses one incident type;  
|                                                | 4. The system creates a unique report id, adds the metadata (GPS position and timestamp), and sends the incident notification to DAS and ERTK components; |

| Alternative Flow                                | Cancel Report:  
|                                                | 1. In the step 2 of the main flow, the user cancels the submission of the notification;  
|                                                | 2. The system shows a message to confirm the cancelled submission;  
|                                                | 3. The user confirms the cancelled submission. |

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>FRMBL02 – Sending Incident Notification</th>
</tr>
</thead>
</table>

| Non Functional Requirements | NFRGNR03 – Security;  
|                            | NFRGNR04 – Usability;  
|                            | NFRGNR05 – Scalability;  
|                            | NFRGNR07 – Portability;  
|                            | NFRGNR08 – Adaptability. |

| Results & Output Data | - Report id;  
|                       | - User profile;  
|                       | - GPS position;  
|                       | - Timestamp;  
|                       | - Incident type. |

### UCMBL03 – Send Incident Report

| Actor            | - Workforces;  
|                  | - Supporting Forces;  
|                  | - Civilians. |

| Goal                                      | Allow the users directly involved in the incident to send specific and structured information about the incident to the Command and Control Centre. |

| Input Data                                      | - User profile;  
|                                                | - Incident Type (fire, explosion, gas, environmental, or help);  
|                                                | - Pre-defined and structured questions;  
|                                                | - Structured answers;  
|                                                | - Free text;  
|                                                | - Images; |
### Main Flow

1. The user informs the profile (only in the first access to RESCUER app);
2. The system shows a list of incident type;
3. The user chooses one incident type;
4. The system shows the pre-defined and structured questions according to the incident type chosen;
5. The user answers pre-defined and structured questions, and can include free text, images and/or video;
6. The system creates a unique report id, adds the metadata (GPS position and timestamp), and sends the incident report including text, images and video to DAS and ERTK components.

### Alternative Flow

**Cancel Report:**
1. From step 5 of the main flow the user cancels the submission of the report;
2. The system shows a message to confirm the cancelled submission;
3. The user confirms the cancelled submission.

### Functional Requirements

**FRMBL03 – Sending Incident Report**

### Non Functional Requirements

- NFRGMR03 – Security;
- NFRGMR04 – Usability;
- NFRGMR05 – Scalability;
- NFRGMR07 – Portability;
- NFRGMR08 – Adaptability.

### Results & Output Data

- Report id;
- User profile;
- GPS position;
- Timestamp;
- Incident type;
- Pre-defined and structured answers;
- Image(s);
- Video;
- Free text;
- GPS position of the photo/video;
- Timestamp of the photo/video;
- Gyroscope of the video;
- Accelerometer of the video.

### UCMBL04 – Collect Sensor Data

<table>
<thead>
<tr>
<th>Actor</th>
<th>Sensor data collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Collect sensor data automatically.</td>
</tr>
</tbody>
</table>

### Main Flow

1. The user enters in the monitoring area and time;
2. The sensor data collector informs the user the start of recording;
3. The user approves the recording;
4. The system collect and record data available automatically and sends to DAS.
5. When the user is out of monitoring area or time of monitoring is over the sensor data recording is finish.

### Alternative Flow

**Position Data Tracking**

1. If in the step 3 of the main flow, the position sensor is available in the device of the user, the system collects and records their position and transfers it to the Sensor Analysis.

### Functional Requirements

FRMBL04 – Collecting Sensor Data

### Non Functional Requirements

NFRGNR03 – Security.

### Results & Output Data

- GPS position;
- Timestamp.

---

### UCMBL05 – Receive Follow-up Structured Questions

<table>
<thead>
<tr>
<th>Actor</th>
<th>Workforces;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Supporting Forces;</td>
</tr>
<tr>
<td></td>
<td>Civilians.</td>
</tr>
</tbody>
</table>

| Goal            | Allow the users directly involved in the incident to receive and answer follow-up structured questions about the incident from the Command and Control Centre. |

<table>
<thead>
<tr>
<th>Input Data</th>
<th>Report ID;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User profile;</td>
</tr>
<tr>
<td></td>
<td>Incident type;</td>
</tr>
<tr>
<td></td>
<td>Pre-defined and structured questions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main Flow</th>
<th>The user receive follow-up structured questions from ERTK;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The user answers the structured questions, attach text, images and video and send to DAS and ERTK;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternative Flow</th>
<th>Cancel Report:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. If in the step 2 of the main flow the user cancels the submission of the structured or free answers;</td>
</tr>
<tr>
<td></td>
<td>2. The system shows a message to confirm the cancelled submission;</td>
</tr>
<tr>
<td></td>
<td>3. The user confirms the cancelled submission.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>FRMBL05 – Receiving Follow-up Structured Questions;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRMBL06 – Answering Follow-up Structured Questions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non Functional Requirements</th>
<th>NFRGNR03 – Security;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NFRGNR07 – Portability.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Results &amp; Output Data</th>
<th>Answers:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Report ID;</td>
</tr>
<tr>
<td></td>
<td>User profile;</td>
</tr>
<tr>
<td></td>
<td>GPS position;</td>
</tr>
<tr>
<td></td>
<td>Timestamp;</td>
</tr>
<tr>
<td></td>
<td>Incident type;</td>
</tr>
<tr>
<td></td>
<td>Structured answers;</td>
</tr>
<tr>
<td></td>
<td>Image;</td>
</tr>
<tr>
<td></td>
<td>Video(s);</td>
</tr>
<tr>
<td></td>
<td>Free text.</td>
</tr>
</tbody>
</table>
### UCMBL06 – Receive Follow-up Free Questions

| Actor | - Workforces;  
|       | - Supporting Forces;  
|       | - Civilians. |

| Goal | Allow the users directly involved in the incident to receive and answer follow-up free questions about the incident from the Command and Control Centre. |

| Input Data | - Report ID;  
|            | - User profile;  
|            | - Incident type;  
|            | - Free questions. |

| Main Flow | 1. The user receive follow-up free questions from ERTK;  
|           | 2. The user answers the free questions, attach images and video and send to DAS and ERTK. |

| Alternative Flow | Cancel Report:  
|                  | 3. If in the step 2 of the main flow the user cancels the submission of the answers;  
|                  | 4. The system shows a message to confirm the cancelled submission;  
|                  | 5. The user confirms the cancelled submission. |

| Functional Requirements | FRMBL07 – Receiving Follow-up Free Questions;  
|                         | FRMBL08 – Answering Follow-up Free Questions. |

| Non Functional Requirements | NFRGNNR03 – Security;  
|                             | NFRGNNR04 – Usability;  
|                             | NFRGNNR05 – Scalability;  
|                             | NFRGNNR07 – Portability;  
|                             | NFRGNNR08 – Adaptability. |

| Results & Output Data | Answers:  
|                      | - Report Id;  
|                      | - User profile;  
|                      | - GPS position;  
|                      | - Timestamp;  
|                      | - Incident type;  
|                      | - Answer to free questions;  
|                      | - Image(s);  
|                      | - Video(s);  
|                      | - GPS position of the photo/video;  
|                      | - Timestamp of the photo/video;  
|                      | - Gyroscope of the video;  
|                      | - Accelerometer of the video. |
### UCMBL07 – Receive Crowd Steering Instructions

| Actor            | - Workforces;  
|                  | - Supporting Forces;  
|                  | - Civilians.  
| Goal             | Allow the users directly involved in the incident to receive crowd steering instructions from the Command and Control Centre.  
| Input Data       | Instruction.  
| Main Flow        | The user receives crowd steering instructions.  
| Functional Req   | FRMBL09 – Receiving Crowd Steering Instructions.  
| Non Functional Requirements | NFRGNR03 – Security;  
|                  | NFRGNR04 – Usability;  
|                  | NFRGNR05 – Scalability;  
|                  | NFRGNR07 – Portability;  
|                  | NFRGNR08 – Adaptability.  

### UCMBL08 – Receive Incident Public Communication

| Actor            | Civilians  
| Goal             | Allow the users directly involved in the incident to receive public communication from the Command and Control Centre.  
| Input Data       | Public Communication.  
| Main Flow        | The user receives public communication.  
| Functional Req   | FRMBL10 – Receiving Incident Public Communication.  
| Non Functional Requirements | NFRGNR03 – Security;  
|                  | NFRGNR04 – Usability;  
|                  | NFRGNR05 – Scalability;  
|                  | NFRGNR07 – Portability;  
|                  | NFRGNR08 – Adaptability.  

### UCMBL09 - Connect Ad-hoc Communication

| Actor            | - Civilians;  
|                  | - Supporting Forces;  
|                  | - Workforces.  
| Goal             | Allow the users directly involved in the incident the ability to communicate with ad-hoc networking approach to enable message (only text) delivery during times of network outage.  
| Main Flow        | 1. The system recognizes there is no connectivity and it switches into ad-hoc mode;  
|                  | 2. User exchanges data (text) through the ad-hoc network.  
| Alternative Flow | Internet access was re-established;  
|                  | 1. If in the step 2 of the main flow, the system identifies that the Internet access was re-established, the system sends images and videos that were not sent through the ad-hoc network;  

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2. User exchanges data through Internet connection.

<table>
<thead>
<tr>
<th>Functional Requirements</th>
<th>FRMML11 – Connecting Ad-hoc Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Functional Requirements</td>
<td>NFRGNR01 – Performance;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR03 – Security;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR02 – Availability.</td>
</tr>
</tbody>
</table>

Figure 9 shows the use-case diagram of the Data Analysis Solution. DAS is an internal component that has no interaction with the user, so the user of the following use-case diagram has no name.

**Figure 9: Data Analysis Solution use-cases diagram**

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Analyse the text of the reports to find the W-questions.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Report with text.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>The DAS receives report with text from the Mobile, identify the words or expressions in the report’s text and sends the result found to the ERTK.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRDAS01 – Identifying W-questions Answers in the Text.</td>
</tr>
<tr>
<td>Non Functional Requirements</td>
<td>NFRGNR03 – Security;</td>
</tr>
</tbody>
</table>
UCDAS02 – Prioritize Image and Video Analysis

Actor
- 

Goal
Prioritize the report’s image and video to ensure that the most relevant images and videos will be analysed first.

Input Data
Report with image and/or video.

Main Flow
The DAS receives image and/or video from UCDAS05, analyses the criteria for ordering, assigns a priority and goes to the respective use case: UCDAS03 – Analyse Image or UCDAS04 – Analyse Video.

Functional Requirements
FRDAS02 – Prioritizing Image and Video Analysis;
FRDAS11 - Prioritizing Video Analysis for Crowd Aspects;
FRDAS12 – Prioritizing Video Analysis for Fire Aspects;
FRDAS13 – Prioritizing Analysis for Fire Aspects.

Non Functional Requirements
NFRGGR03 – Security;
NFRGGR01 – Performance.

Results & Output Data
- Report Id;
- Image Id or Video id;
- Prioritization for analysis.

UCDAS03 – Analyse Image

Actor
- 

Goal
Analyse fire aspects of image.

Input Data
- Report id;
- Image Id;
- Prioritization.

Main Flow
The DAS receives the prioritize image, identifies the fire and/or smoke in image, the colour of smoke in image, regions where fire and smoke are more evident, duplicated images and sends the information found to the ERTK.

Functional Requirements
FRDAS04 – Identifying Image and Video with Fire/Smoke;
FRDAS05 – Identifying Fire Relevant Regions in Image;
FRDAS06 - Identifying Smoke Colour in the Image;
FRDAS07 – Identifying Duplicated Images.

Non Functional Requirements
NFRGGR03 – Security.

Results & Output Data
- Report Id;
- Image Id;
- Prioritization;
- Fire/Smoke (flames and smoke, just flame, just smoke);
- Smoke Colour (light grey, dark grey, other);
- Fire/smoke evident regions;
- Indication of duplicate image.

### UCDAS04 – Analyse Video

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Analyse fire and crowd aspects of video.</td>
</tr>
</tbody>
</table>
| Input Data | - Report Id;  
- Video Id;  
- Prioritization. |
| Main Flow | The DAS receives the prioritize video, identifies crowd density and disturbance, produces segmented video, extracts frames from video and sends them to image analysis to identify fire/smoke, and sends the video analysis information to the ERTK. |
| Functional Requirements | FRDAS04 – Identifying Image and Video with Fire/Smoke;  
FRDAS08 – Identifying Video with Crowd Density;  
FRDAS09 – Segmenting Videos;  
FRDAS17 – Identifying Videos with Crowd Disturbance. |
| Non Functional Requirements | NFRGNR03 – Security;  
NFRGNR01 – Performance. |
| Results & Output Data | - Report Id;  
- Image Id;  
- Prioritization;  
- Crowd density (low-density, middle-density or high-density);  
- Crowd disturbance (yes/no);  
- Segmented video;  
- Video Frames. |

### UCDAS05 – Cluster Incident Reports

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Provide a grouping of reports per incidents, according to the incident type and area, to avoid incident duplication.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Report information.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>The DAS receives the report from the Mobile, analyses the report information and identifies the incident it belongs to, then associates the existed incident to the report or created a new incident and goes to UCDAS02.</td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRDAS03 – Clustering Incident Reports.</td>
</tr>
</tbody>
</table>
| Non Functional Requirements | NFRGNR03 – Security;  
NFRGNR01 – Performance. |
| Results & Output Data | New Incident information (case of first incident report);  
Report related with incident. |
**UCDAS06 – Cluster Data Collected by the Sensor**

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Cluster the data collected by the Mobile sensor to identify dense area and crowd flow.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Set of GPS positions and Timestamps.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>The DAS receives a set of data collected by Mobile sensor, clusters them to process the heat map, identifies areas with crowd density, flow and sends the information to ERTK.</td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRDAS10 – Clustering the Data Collected by the Sensor</td>
</tr>
<tr>
<td>Non Functional Requirements</td>
<td>NFRGNR03 – Security; NFRGNR01 – Performance.</td>
</tr>
<tr>
<td>Results &amp; Output Data</td>
<td>Heat map with indication of dense area and flow.</td>
</tr>
</tbody>
</table>

**UCDAS07 – Identify Report with Fire in Density Area**

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Identify reports with fire information in crowd density area.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Report information.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>The DAS identifies reports with fire in any source of information (incident type, structured answers, W-question text analysis, result of image analysis and result of video analysis) that are in crowd density area and sends this identification to ERTK component.</td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRDAS16 – Identifying Report with Fire in Density Area</td>
</tr>
<tr>
<td>Non Functional Requirements</td>
<td>NFRGNR03 – Security; NFRGNR01 – Performance.</td>
</tr>
<tr>
<td>Results &amp; Output Data</td>
<td>Indication of reports in density area with ‘fire’ information.</td>
</tr>
</tbody>
</table>

**UCDAS08 – Analyse Report Reliability Level**

<table>
<thead>
<tr>
<th>Actor</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Analyse the report to provide reliability level.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Report information.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>The DAS receives report from Mobile, analyses profile information according business rules of FRDAS15 and FRDAS16, assign the reliability level to report and sends result to ERTK.</td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRDAS14 – Indicating Report Confirmed Information FRDAS15 – Giving Report Reliability Level</td>
</tr>
<tr>
<td>Non Functional Requirements</td>
<td>NFRGNR03 – Security; NFRGNR01 – Performance.</td>
</tr>
<tr>
<td>Results &amp; Output Data</td>
<td>Reports with level of reliability.</td>
</tr>
</tbody>
</table>
Figure 10 shows the use-cases diagram and the interaction between the actors of the component Emergence Response Toolkit. The actor represents the Command and Control Centre.
**Figure 10: Emergency Response Toolkit use-cases diagram**

<table>
<thead>
<tr>
<th>UCETK01 – Make User Registration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor</strong></td>
</tr>
<tr>
<td><strong>Goal</strong></td>
</tr>
</tbody>
</table>
| **Main Flow** | 1. The system allows the user to inform his/her profile and personal information;  
2. The user informs their profile and personal information for registration;  
3. The system persists user profile and information and finishes the user registration. |
| **Functional Requirements** | FRETK01 – Making User Registration. |
| **Non Functional Requirements** | NFRGNR03 – Security;  
NFRGNR04 – Usability. |
| **Results & Output Data** | - User Id;  
- Password;  
- Profile;  
- Personal information. |
## UCETK02 – Define Configuration Parameters

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Allow the user to define RESCUER configuration parameters.</td>
</tr>
</tbody>
</table>

### Input data

- The configuration parameters are:
  - Monitoring area and time;
  - Radium of incident area (default value 100 meters);
  - Initial percent of reliable civilian level (default value 70%);
  - Adding percent of reliable civilian level (default value 30%);
  - People density level (default low-density: 0-4 people/m², middle-density: 5-6 people/m², and high-density: up to 6 people/m²) [21];
  - Smoke colours (if HSV colour pattern was considered defaults are: Dark Smoke Grey 31% brightness up to 58% brightness Light and Smoke Grey 59% brightness up to 86% brightness) [22].
  - Legacy data retrieval.

- The configured options of monitoring time is the following:
  - Continuous;
  - Started or finished by user;
  - The user informs start and end time.

- Legacy data retrieval determines when RESCUER system sends queries. The options are:
  - Automatic;
  - Time interval.

### Main Flow

1. System show for update the configuration parameter;
2. The C&CC select the parameter and informs the new value;
3. The system updates the system parameter and sends the information to DAS and Mobile.

### Functional Requirements

- FRETK02 – Informing Monitoring Area and Time

### Non Functional Requirements

- NFRGNR01 – Performance;
- NFRGNR03 – Security;
- NFRGNR04 – Usability.

### Results & Output Data

- Assigned values of configuration parameters.

## UCETK03 – Visualize Report

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Allow the user to visualize all information about reports of an incident.</td>
</tr>
</tbody>
</table>

### Main Flow

1. The ERTK receives incident reports from Mobile;
2. The ERTK shows list of incidents;
3. The C&CC selects the incident;
4. The ERTK orders the reports of the incident select, highlights the reports updated, shows the ordered
report list and shows detail of the first report in the list;
5. The C&CC selects other report to visualize the detail;
6. The ERTK shows the detail of the report.

Functional Requirements  FRET04 – Showing Detailed Information of a Report.
Non Functional Requirements  NFRGNR03 – Security;
  NFRGNR04 – Usability.
Results & Output Data  Show all details of the report selected.

<table>
<thead>
<tr>
<th>UCET04 – Follow-up Report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor</strong></td>
</tr>
<tr>
<td><strong>Goal</strong></td>
</tr>
</tbody>
</table>
| **Input Data** | - Report id;
  - Incident type;
  - Structured/free question (to send follow-up);
  - Structured/free answer (to receive follow-up). |
| **Main Flow** | 1. C&CC selects report from the list of incident reports;
  2. System show follow up option structured;
  3. The C&CC fills structured questions;
  4. The ERTK sends the structured questions to Mobile;
  5. The Mobile component process them with the use cases UCMBL05 – Receiving Follow-up Structured Question;
  6. The ERTK receives the structured answer follow-up and shows the results to the C&CC. |
| **Alternative Flow** | Option free follow-up
  1. C&CC selects report from the list of incident reports;
  2. ERTK show follow up option free;
  3. The C&CC fills free questions;
  4. The ERTK sends the free questions to Mobile;
  5. The Mobile component process them with the use cases UCMBO6 – Receiving Follow-up Free Question;
  6. The ERTK receives the free answer follow-up and shows the results to the C&CC. |
| **Functional Requirements** | FRET05 – Providing Follow-up Report |
| **Non Functional Requirements** | NFRGNR01 – Performance;
  NFRGNR03 – Security;
  NFRGNR04 – Usability. |
| **Results & Output Data** | - Report Id;
  - User profile;
  - GPS position;
  - Timestamp;
  - Incident type;
  - Structured/free questions (to send follow-up) and structured/free answer (to receive follow-up);
  - Images and videos (only to receive follow-up). |
### UCETK05 – Visualize Incident

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Allow the user to visualize an incident and modify it.</td>
</tr>
<tr>
<td><strong>Main Flow</strong></td>
<td></td>
</tr>
<tr>
<td>1. The ERTK shows the list of incidents;</td>
<td></td>
</tr>
<tr>
<td>2. The C&amp;CC selects the incident;</td>
<td></td>
</tr>
<tr>
<td>3. The ERTK shows the details of the incident.</td>
<td></td>
</tr>
<tr>
<td><strong>Alternative Flow</strong></td>
<td>Modify Incident Information</td>
</tr>
<tr>
<td>1. If in the step 2 of the main flow, the user wants to modify the incident;</td>
<td></td>
</tr>
<tr>
<td>2. The ERTK allows the user to modify the incident name, mark an incident as important, update incident phase, modify T0 and P0;</td>
<td></td>
</tr>
<tr>
<td>3. The user modifies the incident and confirms;</td>
<td></td>
</tr>
<tr>
<td>4. The ERTK save the incident modifications.</td>
<td></td>
</tr>
<tr>
<td><strong>Functional Requirements</strong></td>
<td>FRETK03 – Showing List of Incident Report;</td>
</tr>
<tr>
<td></td>
<td>FRETK06 – Showing Detail Information of an Incident;</td>
</tr>
<tr>
<td></td>
<td>FRETK10 – Modifying Incident Information.</td>
</tr>
<tr>
<td><strong>Non Functional Requirements</strong></td>
<td>NFRGNR01 – Performance;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR03 – Security;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR04 – Usability.</td>
</tr>
<tr>
<td><strong>Results &amp; Output Data</strong></td>
<td>Show all details of the incident.</td>
</tr>
</tbody>
</table>

### UCETK06 – Show Incident Map

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Allow the user to visualize an incident Map, draw on it and show weather information.</td>
</tr>
<tr>
<td><strong>Pre-Conditions</strong></td>
<td>Execute the use case UCETK05 – Visualize Incident.</td>
</tr>
<tr>
<td><strong>Input Data</strong></td>
<td>Incident id</td>
</tr>
<tr>
<td><strong>Main Flow</strong></td>
<td></td>
</tr>
<tr>
<td>1. The C&amp;CC selects the option to show the incident map;</td>
<td></td>
</tr>
<tr>
<td>2. The ERTK shows the incident map;</td>
<td></td>
</tr>
<tr>
<td>3. The C&amp;CC visualizes the incident map.</td>
<td></td>
</tr>
<tr>
<td><strong>Alternative Flow</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Drawing on the map:</strong></td>
<td></td>
</tr>
<tr>
<td>1. If in the step 3 of the main flow, the user wants to draw on the incident map;</td>
<td></td>
</tr>
<tr>
<td>2. The system allows the user to draw in the incident map;</td>
<td></td>
</tr>
<tr>
<td>3. The user draws in the incident map.</td>
<td></td>
</tr>
<tr>
<td><strong>Showing weather information on the map:</strong></td>
<td></td>
</tr>
<tr>
<td>1. If in the step 3 of the main flow the Internet service is available, the system displays temperature, wind speed and direction;</td>
<td></td>
</tr>
<tr>
<td>2. The user visualizes the temperature, wind speed and direction.</td>
<td></td>
</tr>
<tr>
<td><strong>Functional Requirements</strong></td>
<td>FRETK08 – Showing Incident Map;</td>
</tr>
<tr>
<td></td>
<td>FRETK09 – Drawing in the Incident Map.</td>
</tr>
<tr>
<td><strong>Non Functional Requirements</strong></td>
<td>NFRGNR01 – Performance;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR03 – Security;</td>
</tr>
<tr>
<td></td>
<td>NFRGNR04 – Usability.</td>
</tr>
</tbody>
</table>
UCETK07 – Reorganize Incidents

**Actor**
Command and Control Centre

**Goal**
Allow the user to reorganize incidents by merging or splitting them.

**Input Data**
- Source incident id;
- Target incident id.

**Main Flow**
1. The C&CC selects the incident;
2. The ERTK shows the details of the incident selected and the incidents nearby;
3. The C&CC selects the incident(s) to be merged or split;
4. The ERTK merge or split the incident(s) selected.

**Functional Requirements**
FRETK07 – Reorganizing Incident Allocation

**Non Functional Requirements**
NFRGNR01 – Performance;
NFRGNR03 – Security;
NFRGNR04 – Usability.

**Results & Output Data**
Incident source and target reorganized.

---

UCETK08 – Show Incident Summary Graphics

**Actor**
Command and Control Centre

**Goal**
Provide to the user the ability to view incident summary charts.

**Input Data**
Incident id.

**Main Flow**
1. The C&CC request the system to show the incident summary charts;
2. The ERTK shows the summary charts;
3. The C&CC views the summary charts.

**Functional Requirements**
FRETK11 – Providing Incident Summary Graphics

**Non Functional Requirements**
NFRGNR01 – Performance;
NFRGNR03 – Security;
NFRGNR04 – Usability.

**Results & Output Data**
Incident summary graphics.

---

UCETK09 – Show Emergency Map

**Actor**
Command and Control Centre

**Role**
- Emergency Coordinator;
- Medical Support;
- Evasion Coordinators.

**Goal**
Provide to the user a map with different layers for analysis.

**Main Flow**
1. The ERTK shows to the user the option to view the emergency map;
2. The C&CC selects the option of the emergency map;
3. The ERTK shows the emergency map layers according to FRETK12.

**Functional Requirements**
FRETK12 – Showing Emergency Map.
Non Functional Requirements

NFRGNR03 – Security;
NFRGNR04 – Usability.

Results & Output Data

Emergency map layers.

<table>
<thead>
<tr>
<th>UCETK10 – Provide Emergency Summary Graphics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor</strong></td>
</tr>
<tr>
<td><strong>Goal</strong></td>
</tr>
</tbody>
</table>
| **Main Flow** | 1. The ERTK shows to the user the option to view the emergency summary charts; 
2. The C&CC selects the option of the emergency summary charts; 
3. The ERTK shows the emergency summary charts according FRETK13. |
| **Functional Requirements** | FRETK13 – Providing Emergency Summary Graphics |
| **Non Functional Requirements** | NFRGRN01 – Performance; 
NFRGRN03 – Security; 
NFRGRN04 – Usability. |
| **Results & Output Data** | Emergency summary charts. |

<table>
<thead>
<tr>
<th>UCETK11 – Maintain Public Communication Target-group List</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actor</strong></td>
</tr>
<tr>
<td><strong>Goal</strong></td>
</tr>
</tbody>
</table>
| **Input Data** | Items of public communication target-group: 
- Profile with E-mails; 
- Profile with SMS; 
- Web site; 
- Social Network Address. |
| **Main Flow** | 1. The ERTK shows to the user the option to register one item or to search the public communication target-group list; 
2. The C&CC select the option of register one item of the public communication target-group list; 
3. The ERTK shows the window to the user register the item; 
4. The C&CC registers the item; 
5. The ERTK persists the item informs the user. |
| **Alternative Flow** | Searching list: 
1. If in the step 1 of the main flow, the user selects the option to search the public communication target-group list; 
2. The system show the options to filter the search; 
3. The user informs the filter and request the search; 
4. The system shows the result of the search. |
| Updating list: | |

54
1. If in the step 4 of the alternative flow “searching list” the user wants to update the public communication target-group;
2. The system shows the edit window of the public communication target-group list;
3. The user updates the public communication target-group list and requests update;
4. The system updates the public communication target-group list and informs the user.

Deleting item of the public communication target-group:
1. If in the step 4 of the alternative flow “searching list” the user wants to delete item(s) of the public communication target-group list;
2. The system allows the option to select items to delete;
3. The user selects the item(s) that he wants to delete and request the exclusion;
4. The system deletes the selected item(s) of the public communication target-group list and informs the user.

### Functional Requirements
- **FRETK14** – Maintaining Public Communication Target-group List.

### Non Functional Requirements
- **NFRGNR01** – Performance;
- **NFRGNR03** – Security;
- **NFRGNR04** – Usability.

### Results & Output Data
- Public communication target-group list updated.

---

**UCETK12 – Maintain Public Communication Templates**

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre (Public Communication Coordinator)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Provide to the user the ability to add, remove or edit public communication information templates list.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Template structured text.</td>
</tr>
</tbody>
</table>

**Main Flow**
1. The ERTK shows to the user the option to register one template or to search the template list;
2. The C&CC select the option of register one template in template list;
3. The ERTK shows the window to the user register the template;
4. The C&CC registers the template;
5. The ERTK persists the template informs the user.

**Alternative Flow**
- **Searching template:**
1. If in the step 1 of the main flow, the user selects the option to search a public communication template list;
2. The system show the options to filter the search;
3. The user informs the filter and request the search;
4. The system shows the result of the search.

**Updating template:**
1. If in the step 4 of the alternative flow “Searching Template” the user wants to update a public communication template list;
2. The system shows the edit window of the public communication template;
3. The user updates the public communication template and requests update;
4. The system updates the public communication template and informs the user.

**Deleting a Public Communication Template:**
1. If in the step 4 of the alternative flow “Searching Template” the user wants to delete a public communication template;
2. The system allows the option to select a public communication templates to delete;
3. The user selects the public communication template(s) that he wants to delete and request the exclusion;
4. The system deletes the selected public communication template(s) and informs the user.

**Functional Requirements**
- FRETK15 – Maintaining Public Communication Templates.

**Non Functional Requirements**
- NFRG02 – Performance;
- NFRG03 – Security;
- NFRG04 – Usability.

**Results & Output Data**
- Template updated.

---

**UCETK13 – Send Emergency Public Communication**

**Actor**
- Command and Control Centre

**Goal**
- Provide to the user the ability to send public communication based on emergency phases and the target-stakeholders criteria.

**Main Flow**
1. The ERTK prompts the user enters the type and phase of emergency, the stakeholder destination and the environment in which communication will be published;
2. The C&CC fill the information;
3. The ERTK using the information filled by C&CC, searches the template, associate sentences and generates the message automatically;
4. The C&CC can edit message to customize it and send the message to stakeholder destination.

**Functional Requirements**
- FRETK16 – Sending Emergency Public Communication

**Non Functional Requirements**
- NFRG02 – Performance;
- NFRG03 – Security;
- NFRG04 – Usability.
### Results & Output Data

| Public Communication |

### UCETK14 – Maintain Crowd Instruction List

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Provide to the user the ability to add, remove or edit the list of instruction for assuring public safety.</td>
</tr>
<tr>
<td>Input Data</td>
<td>Item of Crowd Instruction List:</td>
</tr>
<tr>
<td></td>
<td>- Target-group;</td>
</tr>
<tr>
<td></td>
<td>- Phase;</td>
</tr>
<tr>
<td></td>
<td>- Crowd Instruction.</td>
</tr>
<tr>
<td>Main Flow</td>
<td>1. The ERTK shows to the user the option to register one instruction or to search the Crowd Instruction list;</td>
</tr>
<tr>
<td></td>
<td>2. The C&amp;CC select the option of register instruction;</td>
</tr>
<tr>
<td></td>
<td>3. The ERTK shows the window to the user register the instruction;</td>
</tr>
<tr>
<td></td>
<td>4. The C&amp;CC registers the instruction;</td>
</tr>
<tr>
<td></td>
<td>5. The ERTK records the crowd instruction and informs the user.</td>
</tr>
<tr>
<td>Alternative Flow</td>
<td>Searching list:</td>
</tr>
<tr>
<td></td>
<td>1. If in the step 1 of the main flow, the user selects the option to search item(s) of the crowd instruction list;</td>
</tr>
<tr>
<td></td>
<td>2. The system show the options to filter the search;</td>
</tr>
<tr>
<td></td>
<td>3. The user informs the filter and request the search;</td>
</tr>
<tr>
<td></td>
<td>4. The system shows the result of the search.</td>
</tr>
<tr>
<td></td>
<td>Updating list:</td>
</tr>
<tr>
<td></td>
<td>1. If in the step 4 of the alternative flow “Searching List” the user wants to update item of the crowd instruction list;</td>
</tr>
<tr>
<td></td>
<td>2. The system shows the edit window of the item of the crowd instruction list;</td>
</tr>
<tr>
<td></td>
<td>3. The user updates the item of the crowd instruction list and requests update;</td>
</tr>
<tr>
<td></td>
<td>4. The system updates the item of the crowd instruction list and informs the user.</td>
</tr>
<tr>
<td></td>
<td>Deleting item of crowd instruction list:</td>
</tr>
<tr>
<td></td>
<td>1. If in the step 4 of the alternative flow “Searching List” the user wants to delete item(s) of the crowd instruction list;</td>
</tr>
<tr>
<td></td>
<td>2. The system allows the option to select items to delete</td>
</tr>
<tr>
<td></td>
<td>3. The user selects the item(s) that he wants to delete and request the exclusion;</td>
</tr>
<tr>
<td></td>
<td>4. The system deletes the selected item(s) of the crowd instruction list and informs the user.</td>
</tr>
<tr>
<td>Functional Requirements</td>
<td>FRETK17 – Maintaining Crowd Instruction List</td>
</tr>
</tbody>
</table>
### Non Functional Requirements

- NFRGNR01 – Performance;
- NFRGNR03 – Security;
- NFRGNR04 – Usability.

### Results & Output Data

Crowd Instruction List updated.

---

### UCETK15 – Send Crowd Steering Instruction

<table>
<thead>
<tr>
<th>Actor</th>
<th>Command and Control Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal</td>
<td>Provide to the user the ability to send crowd steering instructions based on incident phases and the target-group.</td>
</tr>
</tbody>
</table>
| Input Data | **Item of Crowd Instruction:**  
- Target-group;  
- Phase;  
- Crowd Instruction. |
| Main Flow | 1. The ERTK shows to the C&CC the option to send crowd steering instructions;  
2. The C&CC selects the target-group, phase and the instruction(s) and requests the system to send;  
3. The ERTK sends the crowd steering instruction requested by C&CC to Mobile. |
| Functional Requirements | FRETK18 – Sending Crowd Steering Instruction |
| Non Functional Requirements | NFRGNR01 – Performance;  
NFRGNR03 – Security;  
NFRGNR04 – Usability. |
| Results & Output Data | Crowd Instruction. |
6. Conclusion

This deliverable specifies the requirements and uses cases of the RESCUER system considering three iterations: 1) Crowdsourcing information gathering, 2) Group-target follow-up Interaction and coordination among operational forces, and 3) Public communication and Crowd steering. This specification process was executed in an incremental way.

The requirements were described considering the users’ perspective using general narrative.

The requirements and business rules were obtained during interactions with end-users and project partners by applying the following methods:

- Workshops;
- Questionnaires;
- Interviews;
- Prototyping;
- Ethnographic Studies; and
- Literature and Documentation Reviews.

The approach of Rescuer’s process development involves many results of academic research, thus the technical limits and barriers found in these research impacts the degree of precision in the specification of requirements, and increases the risk and uncertainty in the implementation of system functions.
Bibliography

Glossary

Terms

**Affected Community:** People within the affected area of an incident that will most likely suffer from its impact.

**Command and Control Centre:** Group of people assigned to evaluate risks and make decisions in an emergency and/or crisis in an Industrial area or at a Large-scale Event.

**Crisis:** The adverse and therefore undesired consequences of an emergency give rise to a crisis.

**Crowdsourcing:** In RESCUER, crowdsourcing is described as the information gathering from a large number of people involved in an emergency situation, either explicitly (e.g., through form filling or video/photos sending) or implicitly (by recording sensor data).

**Dispatcher:** Person working in a command and control centre organising the operation (but not necessarily making decisions).

**Emergency Situation:** Several (similar or different types of) incidents, reported in different positions and time, may occur in an industrial area or large-scale event requiring the reaction of the command centre. In terms of the Emergency Response Toolkit, they belong to the same emergency situation.

**Emergencies:** Critical situations caused by incidents, natural or man-made that require measures to be taken immediately to reduce their adverse consequences to life and property [10]. Examples of natural incidents are floods, wildfires, and snow storms, whereas examples of man-made incidents are fires, explosions and/or substance spills from oil platforms, ships, and factories. These and other man-made incidents can also occur during large-scale events, either by negligence or on purpose, as for instance in the case of a terrorist attack. In large-scale events, the risk of crowd-inherent incidents, like conflicts between opposing crowds in football matches or mass panic, is of particular concern.

**Event:** Occurrence happening at a determined time and place, with or without the participation of human agents. It may be a part of a chain of occurrences, as an effect of a preceding occurrence and as the cause of a succeeding occurrence.

**Eyewitnesses:** People in the place of the incident.

**First Responders:** Members of the Workforces or volunteers that are sent to the place of the incident to control the emergency and restore safety conditions.

**Group-target:** Can be dynamically composed by people belonging to any of the RESCUER profiles, in any combination as indicated by the Command and Control Centre. Below we list some examples:

- Group A: visitors that are 1 km away from the incident;
- Group B: people working on the incident area (Workforces + volunteers);
- Group C: people working on the incident area (Workforces only);
- Group D: visitors and employees leaving to exit A;
- Group E: All firelighters allocated to the incident (specific Workforces);
- Group F: Police working on the incident.
Incident: Natural or man-made occurrence that interrupts the normal procedure or behaviour in a certain situation. It may cause a critical or emergency situation that requires measures to be taken immediately to reduce adverse consequences to life and property. In terms of the Emergency Response Toolkit, a collection of reports that are closely related in terms of type of incident, position of incident and approximate time of occurrence will be considered as reports of the same incident.

Production Plant: Building where products are created or processed.

Timestamp: Information that includes current date and time.

Workforces: Organisational units in charge of security and safety in the area where the incident occurred, e.g. police, fire fighters, and rescue forces.
Abbreviations

CETREL - Industrial Maintenance and Environmental Protection
C&CC - Command and Control Centre
CIP - Camaçari Industrial Park
COM – Communication Infrastructure
CPL- Chemical Park of Linz
DAS – Data Analysis Solution
DoW - Description of Work
EC - European Commission
ERTK- Emergency Response Toolkit
MBL- Mobile Crowdsourcing Solution
PAM- Mutual Aid Plan
RESCUER - Reliable and Smart Crowdsourcing Solution for Emergency and Crisis Management
SESGE- Special Department for Large-scale Events Security
ASCOM – Communication Department
### Appendix I – Crowd Steering – Industrial Parks

**A – DETECTED   B – UNDER COMBAT   C – UNDER CONTROL   D – FINISHED**  
*(A – DETECTED corresponds to INFORMED and CONFIRMED)*

<table>
<thead>
<tr>
<th>GROUP-TARGET</th>
<th>INFORMATION</th>
<th>Emergency phases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Industrial Parks</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Industrial (Brazil)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Industrial (Europe)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Parks</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>A</strong></td>
</tr>
<tr>
<td>Employee - affected unit</td>
<td>Keep calm, don’t run, walk / Keep calm</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Follow the emergency coordinator orientations / Follow the brigade’s orientation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is under control, remain calm and stay where you are.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is finished, wait for further orientation.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Return to your unit / Return to your place</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Unit in emergency</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>In case of breathing discomfort, use the scape mask.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Wait for further instructions at the safe meeting point</td>
<td>X</td>
</tr>
<tr>
<td>Visitor (inside the plant)</td>
<td>Keep calm, don’t run, walk / Keep calm</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Company &quot;X&quot; in emergency</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X X X X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is under control, remain calm and stay where you are.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is over, wait for further orientation.</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Return to your unit</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Total evacuation</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Follow the instructions of the evacuation coordinator of your company</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X X X X</td>
<td>X</td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>The incident is under control</td>
<td>X</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------</td>
<td>----</td>
</tr>
<tr>
<td>The incident is finished.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Return to your unit</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>If necessary, use the scape mask</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>If you are driving, stop the car</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Go to the meeting point</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visitor (outside the plant)</th>
<th>Follow the instructions of the evacuation coordinator or patrimonial security</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visitor (outside the plant)</td>
<td>Company &quot;X&quot; in emergency</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>The incident is under control.</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>The incident is over.</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>Return to your unit</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>If you are driving, park the car in the roadside</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>Go to the safe meeting point</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>Follow the others</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>Wait for guidance at the safe meeting point until the emergency is over.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>Keep calm don't run, walk.</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Visitor (outside the plant)</td>
<td>The roads are unblocked</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neighbour Community</th>
<th>Emergency level 4 in the Industrial Parks</th>
<th>X</th>
<th>X</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighbour Community</td>
<td>Follow the Civil Defence instructions</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>Keep calm</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>If you are at home, turn off electronic equipment and the stove, and go walking to the safe meeting point “X”</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>Close the doors and windows and leave the house</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>If you are driving, stop the car and go walking to the safe meeting point “X”</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>If you are unable to move, inform the Civil Defence and ask for guidance</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>If you are walking down the street, go to the safe meeting point “X”</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Neighbour Community</td>
<td>The situation is under control</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>The emergency is over</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Return to your home and/or normal activities</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix II – Crowd Steering – Large-scale Events

A – DETECTED  B – UNDER COMBAT  C – UNDER CONTROL  D - FINISHED  
(A – DETECTED corresponds to INFORMED and CONFIRMED)

<table>
<thead>
<tr>
<th>GROUP-TARGET</th>
<th>INFORMATION</th>
<th>Large-scale events (Brazil)</th>
<th>Large-scale events (Europe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civilians</td>
<td>Please, go to the gate &quot;X&quot;</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>Keep calm</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>In case you have limited mobility, follow the brigade’s orientation</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>Do not use the elevator, instead use the stairs</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>Follow the brigade’s orientation</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>The incident is under control, remain calm and stay where you are.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is finished, wait for further orientation.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Return to your place</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Employee</td>
<td>Please, go to the gate &quot;X&quot;</td>
<td>X  X</td>
<td>X  X X</td>
</tr>
<tr>
<td></td>
<td>Keep calm, don’t run, walk / Keep calm</td>
<td>X  X</td>
<td>X  X X</td>
</tr>
<tr>
<td></td>
<td>In case you have limited mobility, follow the brigade’s orientation</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>Do not use the elevator, instead use the stairs</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>Follow the emergency coordinator orientations / Follow the brigade’s orientation</td>
<td>X  X</td>
<td>X  X</td>
</tr>
<tr>
<td></td>
<td>The incident is under control, remain calm and stay where you are.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>The incident is finished, wait for further orientation.</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Return to your unit / Return to your place</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Turn off the equipment and get out</td>
<td>X  X</td>
<td>X  X</td>
</tr>
</tbody>
</table>
# Appendix III – Requirements Removed

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SMS Support</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
<tr>
<td><strong>Send Resource Request</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
<tr>
<td><strong>Receive Task Request</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
<tr>
<td><strong>Identifying Fire Dimension in the Image</strong></td>
<td>What the Image Analysis can provide is the percent of image pixels that was classified as fire. This information is highly dependent of many variables: the distance from the fire focus, the point of view and another parameter. The real dimension of the fire based on images and videos should not be considered since the image and video do not have enough information of the environment.</td>
</tr>
<tr>
<td><strong>Creating Panoramic View</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
<tr>
<td><strong>Identifying Fire Expansion in the Video</strong></td>
<td>Obstructions in the video scene can cause erroneous classification. This information is highly dependent of many variables: the distance from the fire focus, the point of view and another parameter. The real dimension of the fire based on images and videos should not be considered since the image and video do not have enough information of the environment.</td>
</tr>
<tr>
<td><strong>Showing Incident Map (Incident Map of Civilians not Moving)</strong></td>
<td>This layer will not be developed because the information collected can provide false positive and has no credibility.</td>
</tr>
<tr>
<td><strong>Receiving Resource Request</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
<tr>
<td><strong>Sending Task Request</strong></td>
<td>This requirement was removed after feedback from end users about its functionality and from developers about their research interests.</td>
</tr>
</tbody>
</table>