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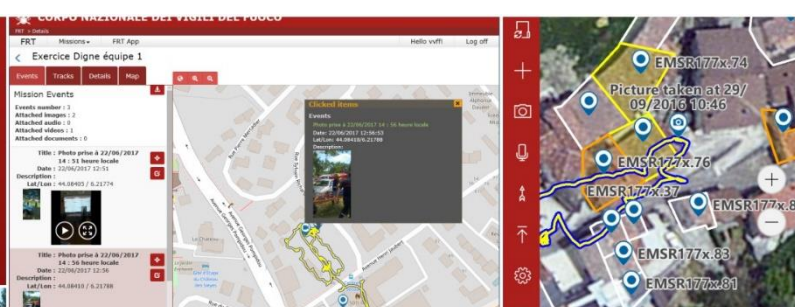
Field Reporting Tool

*Experience in Digne
with SDIS 04*

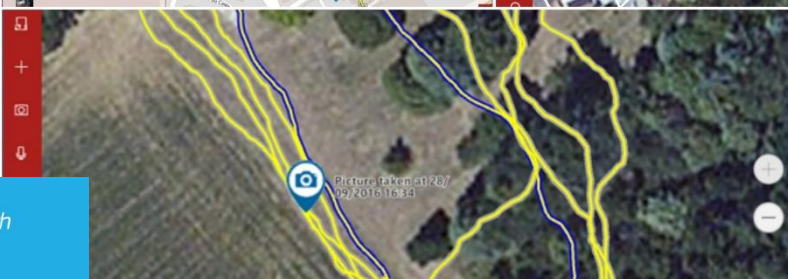
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Foreword

This document aims at reporting the experience with the Field Reporting Tool during a technological demonstration held in Digne by the Service départemental d'incendie et de secours des Alpes de Haute-Provence (SDIS 04).

Abstract

This document will describe the use of the Field Reporting Tool platform during a demonstration of technologies applied to the crisis management held in Digne by SDIS 04 on June, 22nd 2017.

The tool was applied to a search and rescue simulation and integrated with the other technologies demonstrated in Digne by SDIS 04.

1 Introduction

In June 2016, the JRC and the Italian Fire Brigade (IFB) signed a collaboration agreement, its main objectives being:

- To obtain the **scientific data** needed to understand better the process involving the management of the crisis information from the first notification to the first-hand observation and then to the resolution.
- To improve the **co-ordination and effectiveness** of co-operation efforts between operational bodies in the field of the **Civil Protection** and the JRC in the field of Crisis Management.
- To promote mutual interest and **co-operation** in understanding and resolving issues about the user experience and the effectiveness of User-Machine Interfaces.

In order to achieve such objectives the following actions were decided:

- Joint **development of innovative and cost-effective approaches** to improve the activity dispatching and management of a Control Room. The Italian Fire Brigade will make this development **available to** the JRC to promote its adoption by the **Member States**.
- **Exchange appropriate scientific and technological information**, throughout the on-the-field testing of developed software solutions, at least three exercise to evaluate the software provided by JRC. This activity includes the study of the Mobile Crisis Room paradigm (present and future implementations)
- **Harmonise information representation and exchange** and promote related methods to end-users internationally.

The Field Reporting Tool, hence forward FRT, was developed in order to provide the first responders with the capability to share information from the field easily and promptly with two major key points:

- The information must be georeferenced. Not only has this allowed a more effective visualization: it also improves the management of the resources deployed on the field, without requiring a specific activity by the operators, but naturally included in the operations they perform.
- The information must carry a valuable payload in terms of multimedia contents, which provides remotely a better understanding of the situation.

Based on previous experiences, the reference implementation includes additional functionality such as:

- Tracking: using GPS information, all user's activities are tracked, allowing to follow the operations of the field. This provided the means to improve the quality of search and rescue activities.
- Automatic report generation: all information gathered are applied to a template and used to provide a draft of a report on the activities performed.
- The interoperability with other system is achieved by the capability to import and export data in many of the most used data formats.

2 User requirements

In August 2016, an earthquake struck Italy during the night. Managing the first responders was even more difficult, because there was no mean to have a precise location for the teams deployed. The lack of electrical power allowed no recognition of the urban whereabouts and the Crisis Rooms had little knowledge of the involved villages; this made clear that the teams needed a way to provide easily this information while operating and providing the first support to the population.

At that time, FRT developments were already very advanced, based on clearly identified requirements:

- Geolocation: all activities performed by the operator, therefore all data shared with the Crisis Managers, needed to be provided with a geographic reference
- Multimedia: in order to help the Crisis Managers creating a Common Operational Picture, pictures, video and audio are needed to get a better understanding of the situation
- Ease of use: the application must provide a fast and easy approach to the main functionality. Advanced and more complex features will then be available by navigation, menus and other common means
- Low profile: the application must not require specific, expensive or fragile devices to be operated
- Interoperability: the platform must adhere at commonly adopted protocols and formats to improve the capability to share information with other systems
- Identity: the application needed to be recognizable by the user as owned; therefore, the visual identity of the users should be easy to implement and the platform must be translated in many EU languages

The section will describe how the application has to satisfy these needs.

2.1 Geolocation and data structures

Using the location services provided by the device, the mobile application must be able to tag all data with geographical information. The location will use the best precision provided by the system, thus allowing to use the tool also in closed environments, where other location means are available, like Wi-Fi access points or GSM network information.

Providing the information with geolocalization, will then allow organizing the data on a map: the application and the web site will use a map to present the data.

The map must be customizable in terms of background layer, including aerial images and schematic data with road and topographic references.

Geolocalized data will be of three types:

- Points
- Lines
- Polygons

All these data will be arranged in a container, a file that will group all the information related to the activities of the operator and called **mission**.

2.1.1 Container

In order to start a new activity, the user is required to create a mission, an object that will contain all the information gathered on the ground and used to spot more easily the data when browsing the repositories.

The mission has a title and a description to help the users recognize it. The system manages automatically the timestamps to record when the mission was created and the last time it was modified.

2.1.2 Point data

The user will be allowed to create point like data called **events**.

An event will carry information about something specific occurred or observed in a location.

An event carries the following information:

- Title, a short description; when added through a shortcut, it can be generated automatically and the user can modify it
- Description, a longer description of free text left to the user preferences, who can modify it later
- Timestamp, internally stored in UTC: this time reference relates to the moment the event has been created and cannot be edited
- Position, the longitude and latitude coordinates of the event that cannot be edited
- Metadata, a set of key/value pairs generated by the software for specific purposes, e.g. telemetry or other sensor related information
- Attachments, a set of pictures, video, sounds and documents that the user can add, delete and share

The events must provide the option to manage a polygon attached to them (see below), including a preferred rendering colour. Though all versions will display them, the mobile application is not required to allow enter the polygon data.

2.1.3 Lines data

The mobile application will provide the feature to track the operator's movements, even in standby, as long as allowed by the power policy of the operating system. The positions recorded will be stored in a **track** object, that carries the following information:

- Title, a short description generated automatically recording the date and the time the track was started
- Points, the collection of all the positions recorded. When possible, on top of the coordinates, each point should record additional information, such as the altitude, the timestamp, the quality of the satellite observation and the number of observed satellites

2.1.4 Polygon data

All events may be equipped with a polygon, a collection of points (pairs of longitude and latitude coordinates) to be used as a close area and displayed properly.

The mobile app is not required to allow inserting such information. This feature should be present in the web interface.

The polygon will be described also by a preferred rendering colour, that the user interface should use. E.g., the colour will be used for the contour and a transparent version of it will fill it.

2.2 Multimedia

Together with the events, the user will find a collection of multimedia. These will include:

- Pictures, stored in the formats used by the mobile devices' cameras, they will be presented as thumbnail, allowing the user to enlarge them. The user must be able to insert a new event just by taking a picture. More than one picture can be added

to an event, either by using the camera or from the device memory. The website should add as an overlay the time and position coordinates and possibly a logo as a copyright indication

- Sounds, depending on copyrights not all formats will be available (e.g. mp3 can be restricted). All user interfaces must allow their playback. The user must be able to insert a new event just by recording a sound. More than one recording can be added to an event, either by using the microphone or from the device memory.
- Videos, stored in the formats used by the mobile devices' cameras, they can be massive and the user should be warned to limit the recording time. All user interfaces must allow their playback. The user must be able to insert a new event just by recording a video. More than one video can be added to an event, either by using the camera or from the device memory.
- Documents, at least pdf, word and excel document should be supported, since usable on all smartphones. More than one document can be added to an event, selecting it from the device memory.

2.3 Ease of use

The user interfaces will be developed adhering to the best practices to guarantee usability and to smooth the learning curve. Impact areas of commands will be large enough to use the software without using a pen or a stylus, but not enough to be used with gloves. All main functionality must be available from the main interface, including:

- Return to the map visualization
- Access to the list of missions
- Adding a new event
- Centring on an event/mission or the user location, whichever the most appropriate
- Saving/uploading the mission data
- Starting/stopping the tracking, where appropriate
- Accessing the configuration options

The map visualization will allow the use of different reference layers including aerial/satellite pictures and road/geographical rendered data. The users will choose the reference using the configuration options.

The user interfaces will use the system settings as much as possible to be compliant with the users' preferences. Additional settings will allow selecting the coordinates' visualization, either as decimal degrees or using degree, minutes and seconds, and the time references visualization in local time or as Universal Time Coordinates (UTC).

2.4 Low profile

The device required to run the mobile software should be as simple and cheap as possible: entry level devices should be up to the task. It means that massive GIS components and complex application frameworks should be avoided. External dependencies from licensed components should be as few as possible.

Basic smartphone functionality are sufficient, as long as GPS and network connectivity are provided. Approximately one megapixel display resolution will be enough.

2.5 Interoperability

Using a web site as an information hub will require using http(s) protocol to transfer data to and from the mobile application.

Data transfer will use xml formats (georss) or json formats (geojson), the most widely adopted data formats for this use.

While it is not necessary for the mobile application, standard data format should be handled by the platform. The web site must provide the means to export the information in standard geographic formats (GPX, Shapefile, KML/KMZ).

The web site will also produce a draft report with all the information of a mission, including maps and pictures. The output document will be in a MS Word compatible format, open to be modified by the user, who will flesh out the contents.

2.6 Identity

In order to win the users to the use of the tool, it is very important they feel to own it. The user interfaces will therefore be translated in as much EU languages as possible.

Another way to enforce the ownership of the tool is the adoption of the users' visual identity: colours and logos of the users must be easily accommodated in the user interface, as long as they do not pose serious usability issues (e.g. low contrast colour choice for texts).

3 Software and User Interfaces

The prototype developed in collaboration with the IFB was used to refine the design and to assess which technical choices suited best the user requirements.

This section will introduce screenshots and descriptions of the developed software to show how the user requirements were fulfilled.

3.1 Mobile application

The reference mobile application was developed as a Universal Windows Application, an application based on the Universal Windows Platform (UWP), the app platform for Windows 10.

With this platform, it is possible with just one app package, and one store to reach all Windows 10 devices. At the core of UWP apps is the idea that users want their experiences to be mobile across all their devices, and they want to use whatever device is most convenient or productive for the task at hand.

The outcome was that a very short development time (twelve weeks not full time) was required to have the first prototype ready to be tested on the field by real users.

3.1.1 Authentication

In order to access the central repository of the information, that is implemented by the web application itself, the user needs to be authenticated. This is not required to perform simple activities, nevertheless the application requires the user's identity to be confirmed. The authentication process is network based and it is not possible to require it for all FRT's uses, otherwise the connectivity would become a requirement for all uses: FRT must be available at any time, even if no connectivity is available.

For this reason, following a successful network based authentication, the user will be required to set a PIN to unlock the application and to perform as the user previously authenticated. The user can change the identity in any moment by performing another full authentication.

All the means to protect the authentication information have been implemented: when using a clear channel (http) the password is hashed together with other information, otherwise it is sent as a text when protected by the channel encryption (https).



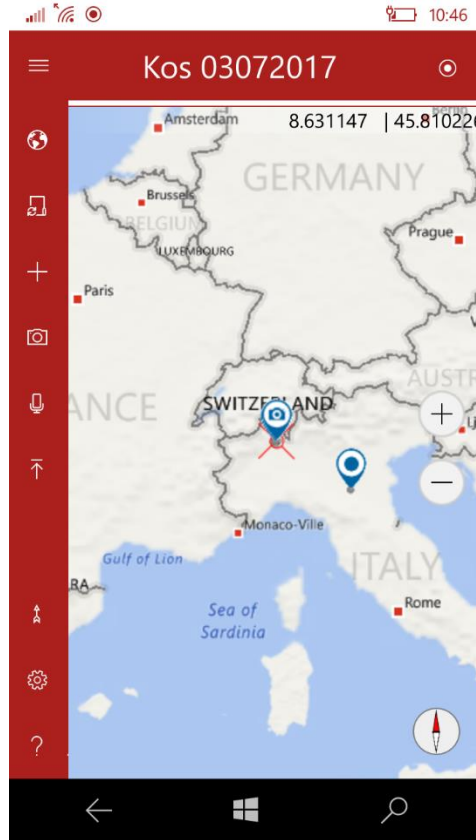
1 User authentication interface



2 PIN-based access

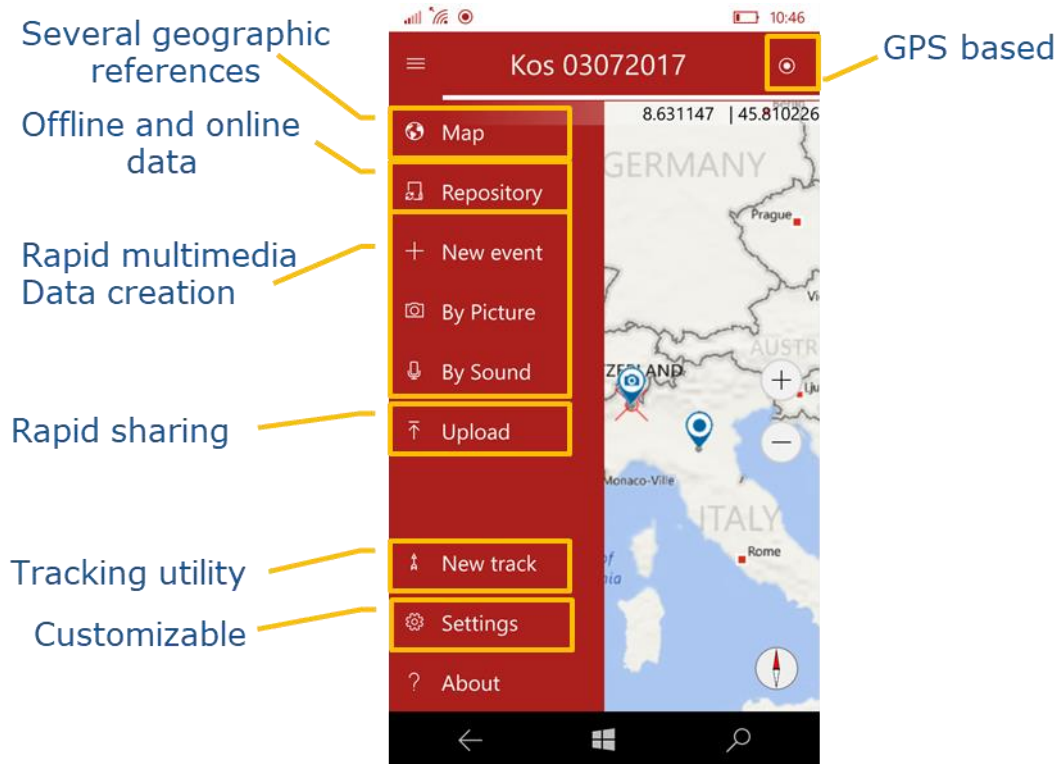
3.1.2 Main activities

The user interface is organized around a main area that displays the map, the information browsers or the configuration settings. Moving from a display to another requires touching the screen one or two times.



3 Main user interface

In order to provide the user with a reference, the side menu is self-explaining.



4 User interface with open menu and explanations

On the map the information related to the current mission are displayed together with others the user can select like previous missions or other users' mission downloaded from the server. The mission format is simple enough to accommodate other data like geographical references. All icons refer to an event and clearly show if there are multimedia attachments. The tracks of the current mission are drawn in brighter colours than other missions' tracks. A cross shaped red symbol is placed in the user's location. In case it is not shown, the user can centre that location on the map by using the location service button in the upper right corner.

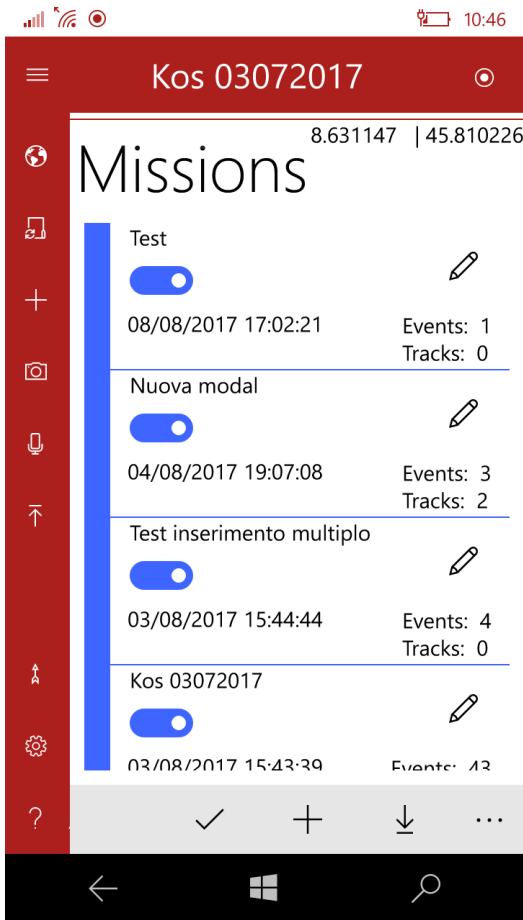
The user can configure the map changing its background layer to display satellite images or drawings of the roads, city and country borders and the like. It is also possible configuring the map to display always the north on the top or to follow the user movements and to show on top the directions he aims to.

In order to add information, the side menu provides shortcuts that the user can select, including:

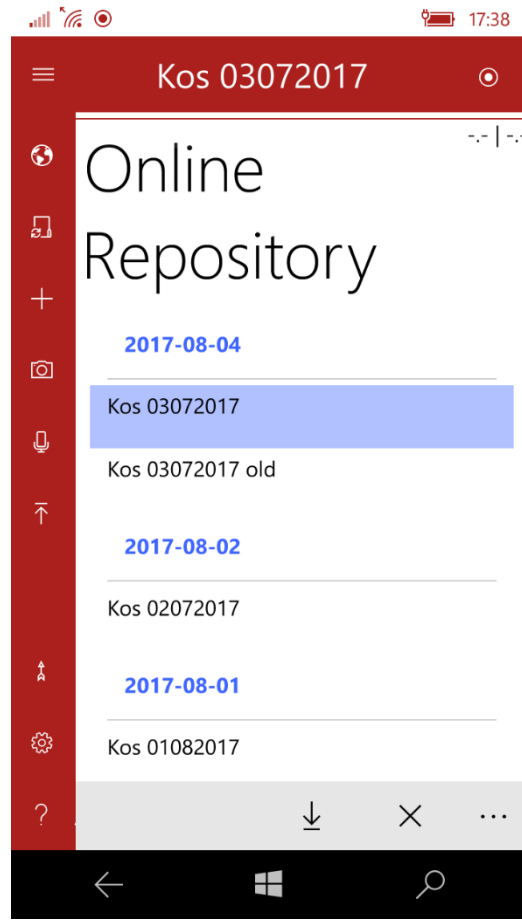
- Adding a new event by inserting text information about it
- Adding a new event by taking a picture
- Adding a new event by recording a sound
- Adding a new event by shooting a video
- Starting or stopping tracking the user's movements

3.1.3 Information browsers

The user can access the local repository of missions to select the current mission, to create a new mission, or to access the remote repository. This is the only action that requires Internet connectivity.



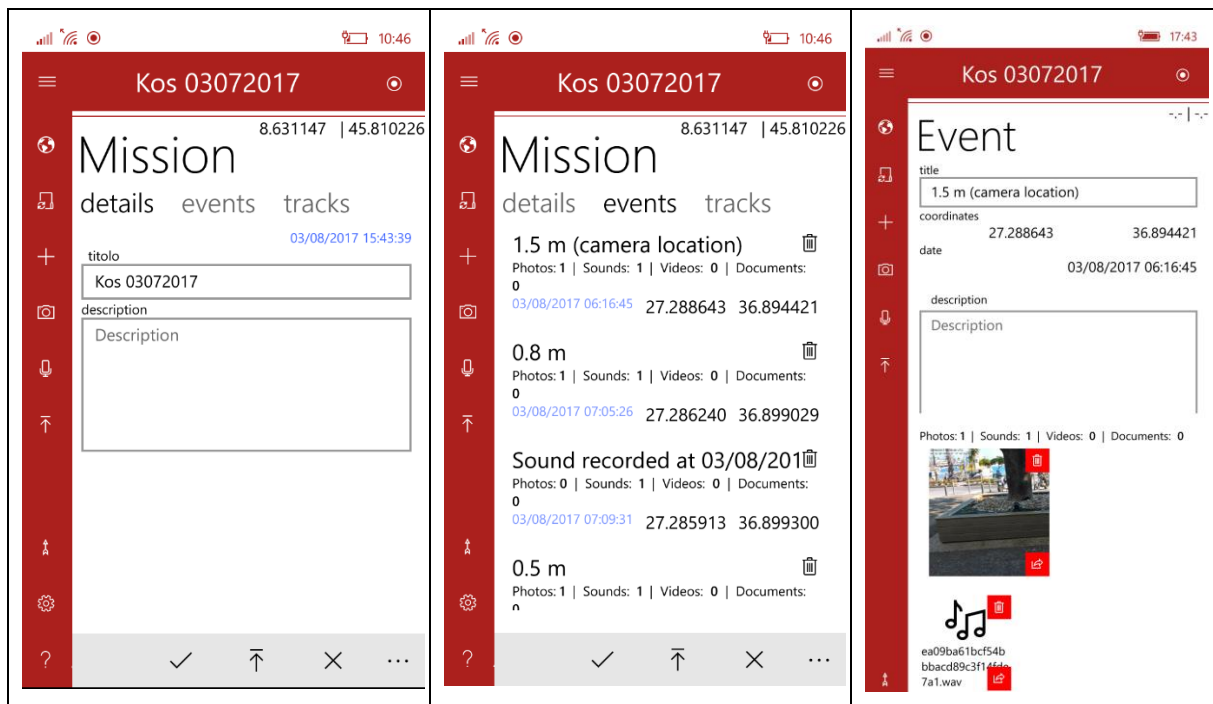
5 Local repository interface



6 Remote repository interface

Accessing the mission information is possible through the pencil icon. The current mission is always available by touching its title on the top of the screen.

The user can then view the information related to the mission or list its events and tracks. For each event, the user can access its data and the attached multimedia. It is possible to change the information, to add or delete attachments and to share attachments by using other applications.



3.1.4 Configuration

The application complies with the system settings, including the language to be used, if available, English being the default. Presently, the available languages are Italian, English, French, Spanish, Polish, Rumanian, German, Portuguese and Greek.

The user can customize the experience by means of three categories:

- User interface
- Map
- FRT

User interface

These settings include

- The format for the coordinates: decimal degrees or degrees, minutes and seconds
- The date reference: local time or Universal Time Coordinates
- A flag to exit the mission page after the upload completion
- The selected shortcuts

Map

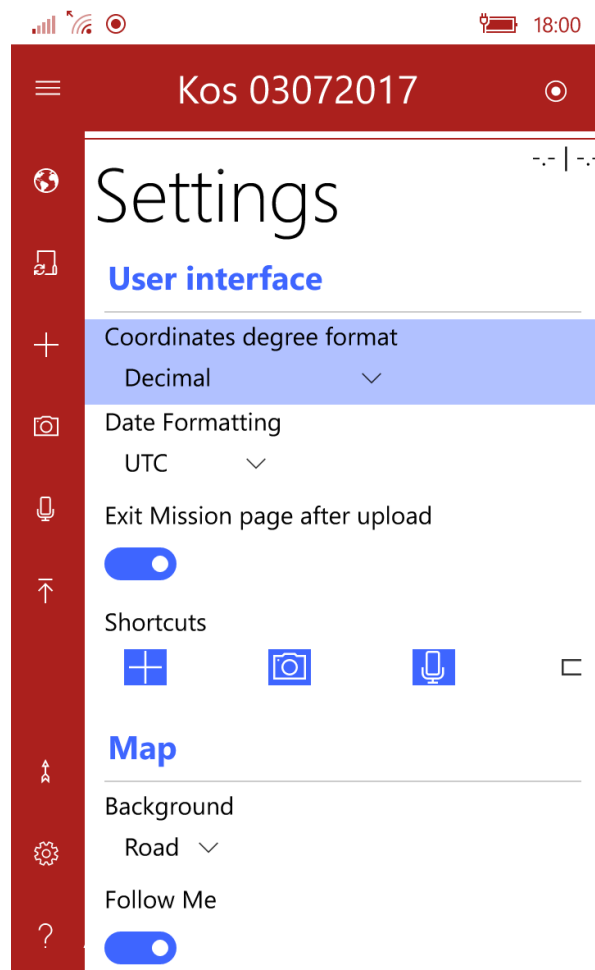
These settings, as mentioned before, include

- The map background
- A flag to force the map to include always the user's location
- The heading of the map, either north or depending on the user's movements

FRT

These settings customize how the data are managed and include

- How often the data should be automatically uploaded: never, every five minutes, every ten minutes or every half an hour
- A flag to force the event and track lists to be uploaded each time
- A distance: as long as the user remains below this distance from the previous event, new data will be added to the event, instead of creating a new one. It can be zero
- A flag to upload the data each time a new information is added, deleted or changed
- The url of the web based repository
- The protocol to be used to access the repository: safe (https) or unsafe (http)
- A flag to start automatically tracking the user when the application starts



7 Configuration settings interface

3.2 Web application

In order to store and exchange the information collected, a web site operates as information hub, allowing FRT to use it as a repository and as authentication service.

The web application was developed as a simple ASP.Net application, requiring only a few javascript libraries to improve the user experience: OpenLayers, Bootstrap and jQuery.

The application is better suited to display the information than to add them, but it provides some input features as well.

3.2.1 Authentication

The web application shares the same users and credentials used by the mobile application. The user must authenticate in order to browse and display the site contents.



The screenshot shows a web browser window with the URL 'Log in - FRT'. The page header is red and contains the logo of the 'CORPO NAZIONALE DEI VIGILI DEL FUOCO' and the text 'Dipartimento dei Vigili del Fuoco, del Soccorso Pubblico e della Difesa Civile'. There are links for 'About' and 'Language'. Below the header, there are navigation links for 'FRT' and 'FRT App', and buttons for 'Register' and 'Log in'. The main content area is titled 'Log in' and has three buttons: 'Log in', 'Register', and 'Forgot Password'. Below these buttons, there is a form with the following fields: 'User Name' (text input), 'Password' (password input), and 'Remember me' (checkbox). A 'Log in' button is located below the form. At the bottom of the page, there is a red footer with the text '© 2017 Developed by and in collaboration with the European Commission Joint Research Centre, Space, Security and Migration Directorate (JRC)'.

8 Website login page

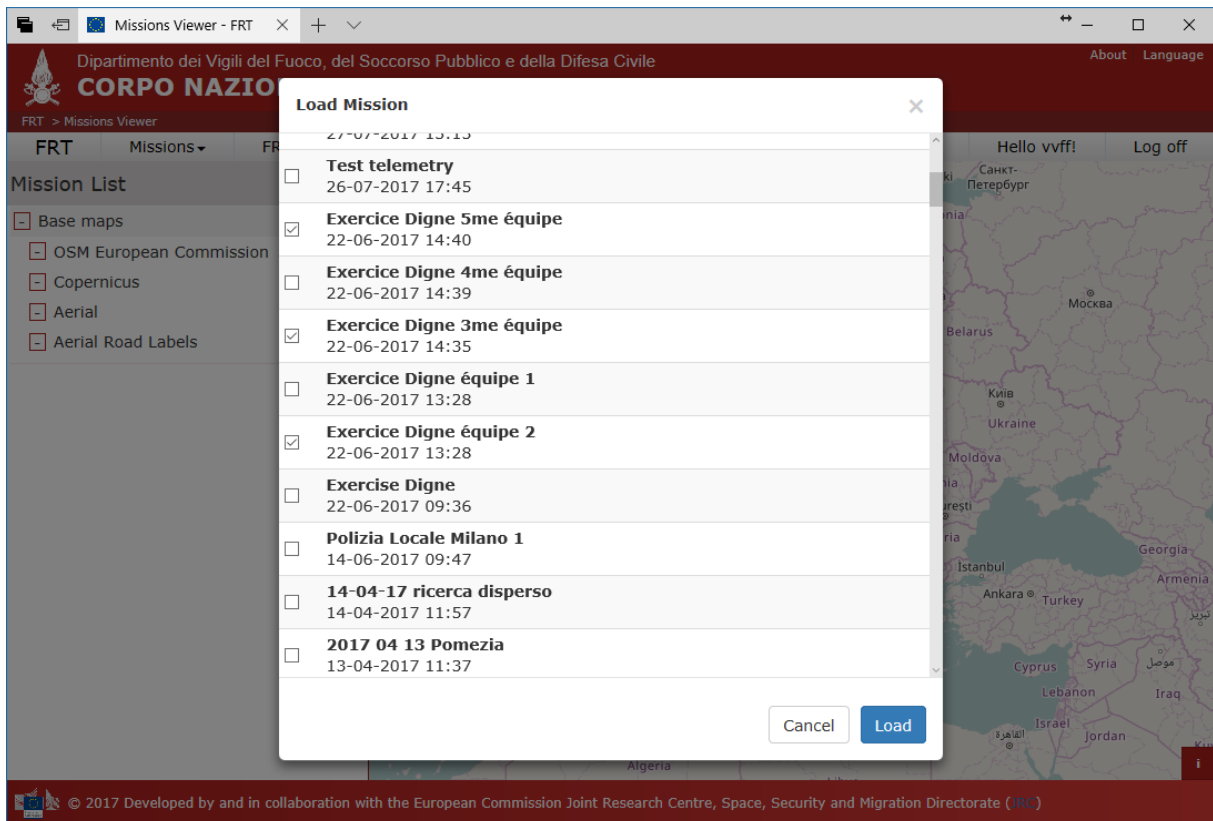
3.2.2 Main activities

All the missions uploaded by the user will be shown in an easy to browse list, based on the creation date of each mission.



9 Online repository browser

The mission browser allow also the selection of several missions to be composed together in the same map.



10 Mission multiple selection

Usually, the user will concentrate on a single mission. The web application will then present all the information together, synchronizing the map with the list on the left. The single events can be browsed and highlighted on the map and their attachments displayed and downloaded. It is worth noting that the pictures uploaded onto the repository are analysed, their time and geographic information extracted and overlaid. Optionally a copyright logo can be also added to the picture.



11 Mission visualization page

The visualization can be customized selecting which information will be displayed and which geographical reference will be used for the background.

Activating the editing mode, the user can add events to the mission just clicking on the map. It is also possible to request an automatic periodic refresh of the mission information, in order to display new information uploaded from the field.



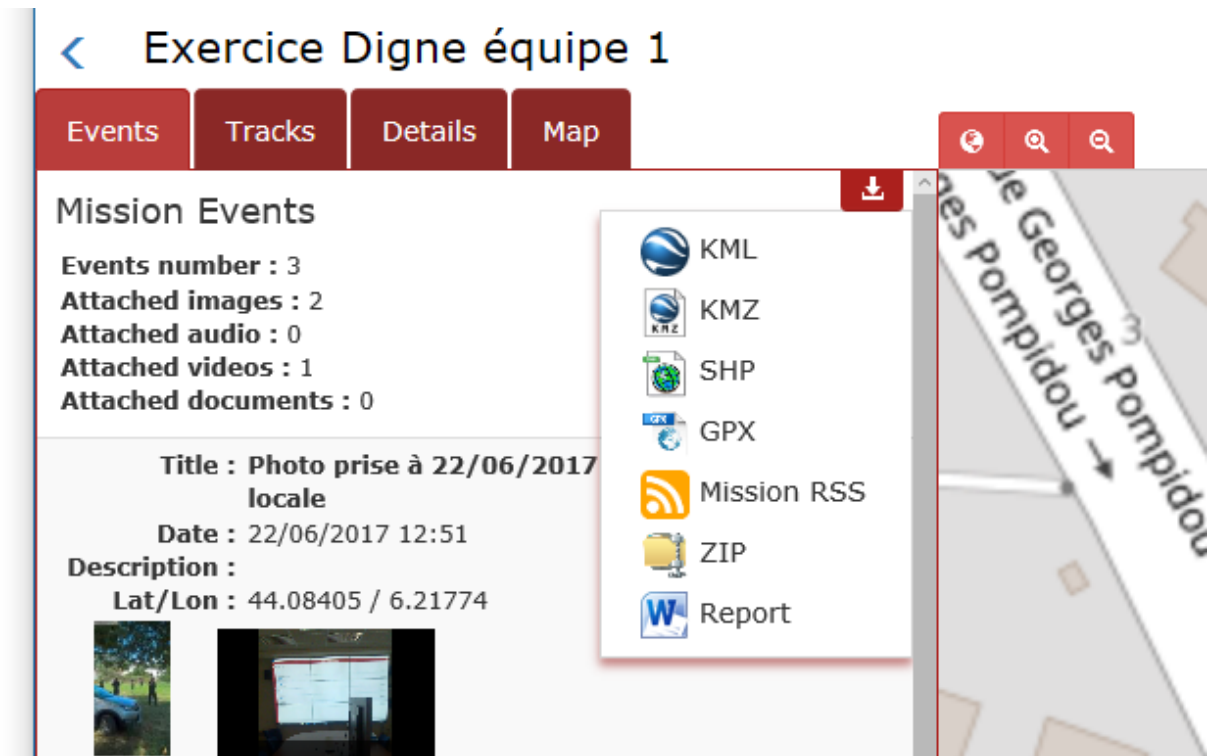
12 Mission map options

3.2.3 Exports

A very important feature provided by the web application is related with the capability to export the contents of the missions in several well-known formats: KML/KMZ, Shapefile, GPX, GeoRSS. The whole content of the mission can also be downloaded in a ZIP file.

Based on a MS-Word template, it is also possible to generate a draft report of the activity. It will include all the data related to the activity, including general maps and a card for each event including its information and the attached pictures.

This will require the user to flesh it out adding his observations, maybe exploiting the recordings attached to the events.



3.2.4 Configuration

The web application will try to comply with the general settings of the client, but the language can be chosen explicitly. Presently, the available languages are Italian, English, French and Polish.

4 Exercise

On Thursday June 22nd 2017, the SDIS 04 organized a *Demonstration Exercises of Tools Developed in the Framework of the European Project Prodigé*.

During the morning, the attendees were invited to follow the activities to take care of a lorry falling off-road as it happened for real in the past. This exercise was performed using equipment to improve the exchange and the processing of information between the operational command post located in the area of a disaster and the departmental fire and rescue centre: these included transmission equipment (wi-fi bubble), software "Cartotactic" for sharing tactical situation, etc.

The operational command post is a mobile solution for crisis management implemented with a containerized solution.

The Wi-Fi bubble is a fundamental mean to provide connectivity in the area of the disaster: a vehicle is equipped with a satellite dish to link with the Internet through the satellite network and to relay this connection to other devices. Presently, this solution provides data and VOIP connection, but it already reserves a third channel to relay radio-communications. The present satellite contract provides 40Mb downstream and 6Mb upstream, up to the SDIS04 needs in comparison with the cost of the service. More bandwidth can be achieved with higher costs.



Figure 13 Wi-Fi bubble unit

The afternoon started with a presentation of JRC Field Reporting Tool developed in collaboration with the Italian Fire Brigade. After an introduction, a team of five operators, managed by Roberto Dutto, from the IFB Command of Cuneo, deployed on the field to simulate a search and rescue activity.

All FRT activities were monitored remotely: the connection was provided by the Wi-Fi bubble technology demonstrated in the morning. Even if the website failed to display the information (a technical problem solved the day after), data were exchanged with the operating room and all users were enthusiast of the capabilities of the system.

A dummy simulated the person to be searched for.



Figure 14 The team deployed on the field



Figure 15 The dummy was found and safely recovered.

During the search and rescue activities, many information were collected and posted on the website, even if the activity lasted just fifteen minutes: three texts, eight pictures, nine recordings and one video. All the information collected were immediately available and could be aggregated by the application, showing in details which area was already covered.

The time allocated for the demo did not allow to interview the operators involved or to compile evaluation forms; nevertheless, during the debriefing the operators showed their appreciation of the tool, mainly because the information were promptly shared, but also because the reporting was facilitated: all the information were easily and quickly added to the activity, without slowing down the search and rescue activities.

A final meeting was requested by SDIS04 to go through the Collaboration Agreement JRC is proposing them. After an explanation of all the topics listed there and a precise description of the deliverables to be produced, the President of SDIS04, Claude Fiaert agreed about the collaboration. At the time of writing, the workflow for this is near to the end.

5 Conclusions

The FRT proved to be close to the maturity needed to be used extensively in daily and extraordinary activities. Its ease of use was demonstrated, when quite no time was needed to teach the operators its basic features.

Presently, the JRC and SDIS04 are finalizing the collaboration agreement to start as soon as possible an extended test of the tool. In the meanwhile, steps have been taken to use the Windows based prototype to develop a new version, which will be available also on iOS and Android based devices. This new version will also require an extended test, but it will focus mainly on bugs, given that the features will already be completely defined thanks to the users' feedback.

The developments on the Windows platform continue, in order to test new paradigm of User-Machine interaction: a tablet-oriented version of the application is available to add information by using pen devices. This approach already proved to be much more effective.

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