ASSISTANCE

Adapted situation awareneSS tools and tallored training curricula for increaSing capabiliTie and enhANcing the proteCtion of first respondErs

European Commission

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ASSISTANCE SA platform adaptation

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[1] PU: Public; PP: Restricted to other programme participants (including the EC services); RE: Restricted to a group specified by the Consortium (including the EC services); CO: Confidential, only for members of the Consortium (including the EC services).

ASSISTANCE

Nowadays different first responder (FR) organizations cooperate together to face large and complex disasters that in some cases can be amplified due to new threats such as climate change in case of natural disasters (e.g. larger and more frequent floods and wildfires, etc.) or the increase of radicalization in case of human-made disasters (e.g. arsonists that burn European forests, terrorist attacks coordinated across multiple European cities).

The impact of large disasters like these could have disastrous consequences for the European Member States and affect social well-being on a global level. Each type of FR organization (e.g. medical emergency services, fire and rescue services, law enforcement teams, civil protection professionals, etc.) that mitigate these kinds of events are exposed to unexpected dangers and new threats that can severely affect their personal safety.

ASSISTANCE proposes a holistic solution that will adapt a well-tested situation awareness (SA) application as the core of a wider SA platform. The new ASSISTANCE platform is capable of offering different configuration modes for providing the tailored information needed by each FR organization while they work together to mitigate the disaster (e.g. real-time video and resources location for firefighters, evacuation route status for emergency health services and so on).

With this solution, ASSISTANCE will enhance the SA of the responding organisations during their mitigation activities through the integration of new paradigms, tools and technologies (e.g. drones/robots equipped with a range of sensors, robust communications capabilities, etc.) with the main objective of increasing both their protection and their efficiency.

ASSISTANCE will also improve the skills and capabilities of the FRs through the establishment of a European advanced training network that will provide tailored training based on new learning approaches (e.g. virtual, mixed and/or augmented reality) adapted to each type of FR organizational need and the possibility of sharing virtual training environments, exchanging experiences and actuation procedures.

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Disclaimer

Executive Summary

This deliverable provides a clear description of the development and implementation of the new ASSISTANCE system capabilities for visualizing the information from sensors according to indications stated by the project end-users.

The main visualization capabilities developed and the methodology followed for reaching an agreement with the end-users on these capabilities are described in detail in this document.

In addition, a wide description of GESTOP system is performed for clarifying what the pre-existing capabilities are and what has been completely developed during ASSISTANCE project, following the advice of the PO and the reviewers' team during the first project review.

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Acronyms

ASSISTANCE	Adapted situation awareneSS tools and taIlored training curricula for increaSing capabiliTie and enhANcing the proteCtion of first respondErs
AB	Advisory Board
CO	Carbon monoxide
CO2	Carbon dioxide
D#.#	Deliverable number #.# (D1.1 deliverable 1 of work package 1)
DoA	Description of Action of the project
EC	European Commission
EU	European Union
GA	Grant Agreement
GESTOP	Operatives Management (In Spanish)
GIS	Geographical Information System
H2020	Horizon 2020 Programme for Research and Innovation
HMI	Human Machine Interface
HTTPS	Hypertext Transfer Protocol
IPR	Intellectual Property Rights
M#	#th month of the project (M1=May 2019)
PC	Project Coordinator
PIC	Project Implementation Committee
PPM	Parts-per-million
PSB	Project Security Board
PSC	Project Steering Committee
SA	Situation Awareness
SAP	Situation Awareness Platform
SIMACET	Command and Control System of the Spanish Army
TL	Task Leader
TLS	Transport Layer Security
UAV	Unmanned Aerial Vehicle
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
WP	Work Package
WPL	Work Package Leader

1. Introduction

This deliverable is composed by 6 sections, a part of this introduction section, which describe in detail all different changes and adaptations performed on GESTOP system in order to become the ASSISTANCE Situation Awareness Platforms (SAP).

In section 2 GESTOP system is described in detail in order to clarify what has been the starting point of the developments and what has been added and/or changed during ASSISTANCE. These new developments have been described in the next sections of the document.

In section 3 the main adaptations in terms of sensors, platforms and network and communications capabilities have been described.

In section 4 the consensus process with the end-users and the final agreements on visualization of the new information provided by the platforms and sensors included in ASSISTANCE has also been described.

In sections 5 and 6 two new capabilities proposed by the end-users for increasing their security such as the areas and perimeters introduction on the GIS and the capability of customizing the information that is visualized in each moment by the FRs have been described.

Finally, in section 7 the main conclusions of this deliverable are stated.

1.1. Purpose

The purpose of this document is to compile the main activities and developments performed in Task 5.1. In the 6 sections described above this deliverable shows what have been the main changes, capabilities and new development added to GESTOP system for adapting it to the FRs environment and information needs.

One of the main objectives of this deliverable is also to clarify what was the GESTOP situation before the adaptation and what have been the new developments and capabilities added during ASSISTANCE in order to evolve GESTOP system into the ASSISTANCE SAP.

1.2. Scope

This deliverable describes in detail the developments performed in order to achieve the ASSISTANCE SAP, which is the core platform on the rest of modules implemented during the project will be integrated for building ASSISTANCE overall system.

This document also describes the close collaboration between the technical partners and the end-users in order to ensure that the technical results achieved during the project cover real needs and requirements on the end-users.

The methodology followed by the consortium for achieving the necessary agreements for the information visualization and other capabilities development has also been included in this deliverable.

1.3. Relationship with other work packages

This deliverable draw information from the following tasks:

- Task 2.2 User requirements gathering analysis and tracking
- Task 2.4 System and Network Architecture Design
- Task 3.1 Sensor Abstraction Service Adapted Interfaces Definition

The output from this task is the complete ASSISTANCE SAP, which will be the core of the overall ASSISTANCE system. Specifically, it contributes to the following tasks:

- Task 5.2 SA advanced modules development
- Task 5.3 Robust Land Mobile Communications Infrastructure Development
- Task 5.4 Advanced Modules, SAS & Communications Infrastructure Integration in ASSISTANCE SA Platform
- Task 7.2 Integrated system test bed

2. GESTOP System description

The core SA system that has been adapted during the project for becoming the ASSISTANCE SAP is based on the civil version of the Spanish Army Friendly Force Tracking (SIMACET-FFT), developed by UPVLC and currently deployed in Afghanistan, Lebanon and Mali (TRL9). This civil version of SIMACET-FFT is called GESTOP system.

This system is a complete SA solution capable of integrating several sensors and offering advanced SA and Command and Control (C2) capabilities. ASSISTANCE will use and modify some of these pre-existing SA capabilities and implement new ones in the adaptation process for reaching the ASSISTANCE SAP, which will be tailored and updated during the project according to the end-users' needs in terms of information visualization and new SA capabilities. This ASSISTANCE SAP and its adaptation process is the system that is described in detail in this deliverable.

On the other hand, innovative SA modules and FRs protection modules have been developed for being integrated into ASSISTANCE SAP in order to build the overall ASSISTANCE system. These innovative SA modules and FRs protection capabilities will be described in other deliverables that will be mentioned later on in this section. The ASSISTANCE overall system building process is described in the following figure.

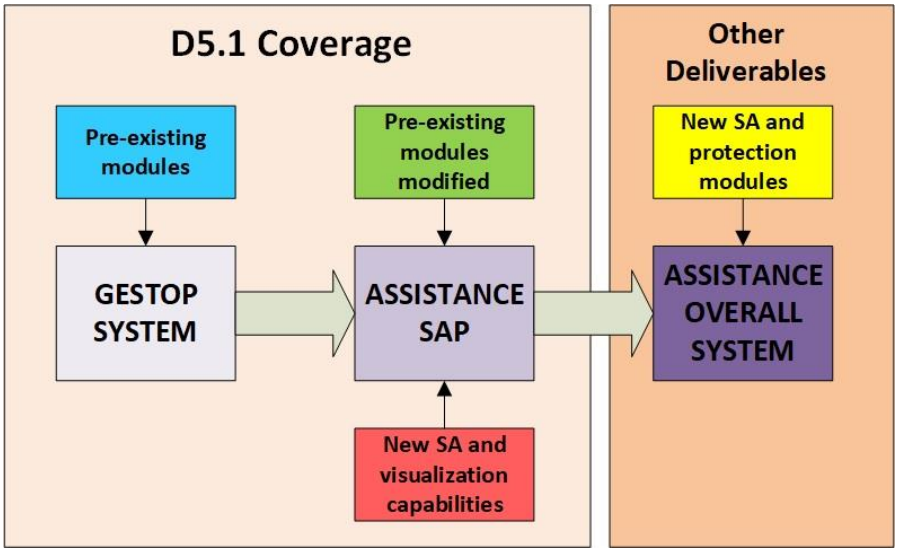

Figure 1. ASSISTANCE overall system building process schema

ASSISTANCE overall system high-level building schema is shown in Figure 1. In this figure, the GESTOP pre-existing modules, which has not been modified during ASSISTANCE, are depicted in blue colour. The GESTOP pre-existing modules that have been modified during ASSISTANCE for the SAP adaptation are depicted in green and the new SA and visualization capabilities that will be developed during the project as part of the SAP adaptation are depicted in red colour. The yellow modules developed in the project (e.g. CBRN, DAL&R, MMM) will be integrated for achieving the overall ASSISTANCE system.

2.1. Pre-existing modules and modifications performed

2.1.1. Advanced Sensors and units' information visualization

GESTOP system already had a dedicated HMI for visualizing information from units and sensors in the field. The main information shown by GESTOP HMI was units' location, video flows from fixed cameras on vehicles or wearables cameras, humidity and temperature sensors information in numerical format when clicking on the sensor icons.

This GESTOP HMI has been widely improved and modified during ASSISTANCE. The SAP HMI includes new ways of presenting the different kinds of information from the different new sensors (e.g. cameras from mobile platforms, wearable sensors, gas sensors, etc.) and data sources (e.g. atmospheric information from robots) according to the end-users' needs in order to provide an improved SA to the operations managers and FRs teams in charge of mitigating a disaster. On the other hand, unit's visualization has also been changed during ASSISTANCE allowing a different kind of colours code in the units icons represented on the map for distinguishing quickly the different kind of FRs units (e.g. firefighters icons in red colour, sanitary staff icons in white colour and police units in blue colour). The visualization improvements on sensors and units' information above mentioned are described in detail in section 4 and 5.

2.1.2. Tailored information visualization

The basic information represented in the SA platform HMI can be tailored easily depending on the FRs information needs in each moment of the operation. This feature allows to each concrete type of FRs organizations on field (e.g. firefighters, LEAs, medical staff) to customize the information they want to see in each moment and change it when the operation requires different information on the screen. This way, the SAP HMI avoid the information overload of showing all information available at any time. The improvements for tailoring the information visualization above mentioned are described in detail in section 6.

2.1.3. Messaging

The consortium has only updated the core application messaging module for including it in the ASSISTANCE SA platform, since its functionalities were applicable to the FRs environment. This way it will be fully operational in a crisis environment and capable of sending and receiving text messages to/from the units in field. In addition, messages history will be available in order to review the operations performance.

The messages will be able to be sent over different transmission means and the SA platform will adapt the transmission of the message automatically and reception to the more suitable communication mean available at each moment.

2.1.4. Data & Sensor management

The consortium has developed from scratch all logical interfaces of the SAP, according to WP3 recommendations, in order to integrate the information provided by the new sensors involved in ASSISTANCE. The new main SAP database has also been developed during ASSISTANCE in order to properly store all data received from external sources or sensors. This module also ensures the availability of all information stored in the database in order to be shown to the FRs, commanders where necessary (e.g. videos, aerial resources location, units on field locations, sensors measurements, data from other sources (e.g. wind speed and direction), etc.). The improvements for receiving correctly the data from sensors and its management above mentioned are summarized in section 3 and its detailed description is performed in its corresponding deliverables.

2.1.5. SA platform Geo-tools

Part of the GESTOP geo-tools has been used in ASSISTANCE with just small changes.

- Quick distance measure between two points on the map.
- Dynamic data (units & assets) filtering and visualization
- Terrain 3D view
- Terrain profile between two points on the map.

Nevertheless, the new manner of representing perimeters and areas stated by the end-users as new visualization capabilities have been completely developed from the scratch during ASSISTANCE in order to enhance the current set of Geo-tools and allowing the FRs to perform the following actions:

- Synthetic perimeter representation, allowing selection of different colours depending on the type of perimeter.
- Synthetic restricted areas representation, allowing selection of different colours depending on the type of area.

The improvements for drawing restricted areas and perimeters above mentioned are described in detail in section 5.

2.1.6. SA Platform Security & Privacy

The core SA application security access module has been improved during ASSISTANCE in order to allow each end-user access to a different set of data, e.g. vital signs according to the type of organization of the user logged.

In addition, security transmission protocols such as HTTPS or Transport Layer Security (TLS) are used for transmitting all data from the SA platform.

3. ASSISTANCE platform adaptation

One of the main adaptations performed in GESTOP system in order to become the ASSISTANCE SAP has been the development of the new logical interfaces needed for integrating new sensors and platforms for providing all this data to the FRs in order to increase their security and safety.

This section summarizes the new interfaces and capabilities development during ASSISTANCE, since their complete description has been done in WP3 and WP4 deliverables (D3.1, D3.2, D4.1 and D3.3)

3.1. New sensors, tools and platforms integration

In this section, the implementation of sensor abstraction service (SAS) technologies, the protocols and methods as an interoperability platform for the different components of the ASSISTANCE system is going to be summarized, since they are widely explained in other deliverables as stated above.

SAS is a platform formed by different microservices and a persistence layer on Mongo data base. The SAS platform microservices offer a Rest API, a DDP protocol on web-sockets to be able to interact directly from the web sphere and a service bus with NATS protocol for the satellite services that make up the ASSISTANCE ecosystem.

SAS also offers a metrics service to be able to register changes in the data over time in order to obtain KPIs or forensic analysis on the sensors. Metrics information is stored in a time-oriented database such as InfluxDB.

SAS also offers a management interface and a 3D KPI and mapping visualization to position the sensors and view their properties.

The consortium has created a new software connector, specifically CITRIC connector, to be able to connect to SAS by means of software. CITRIC Extends SimpleDDP and provides methods to interact with a CITRIC server for ASSISTANCE via DDP. CITRICHTTP provides methods to interact with a CITRIC server for ASSISTANCE via HTTP.

The consortium has also created an MQTT server to send all the data collected by the sensors and that will also be provided for testing. This is a Rabbitmq queue that will collect the data according to the topics to send and store it in the MongoDB ASSISTANCE database so that it can be later forwarded using the different technologies.

The collections created in the system will be used as follows:

- Collections: sensors, resources, missions, metricFeatures, alarms, plumes, pointsOfInteres, mapping.
- Time series of data: telemetry, measures.

Some data collections have been slightly modified like Plumes and Mission, for showing through the SAP the results of the different tools that form part of ASSISTANCE system.

The collection with all the sensor readings, before called HistoricalMeasure now is called measures and TelemetryRegistry and has been merged with Telemetry in a collection called Telemetry, which is a time series of the telemetry records.

Regarding Robots, PIAP Gryf® is provided for the project as a ready to operate autonomous UGV. In the scope of ASSISTANCE, neither base platform nor core software used inside the base platform is modified. Modifications to UGV are described in detail in D4.1 chapter 7.3. Modifications are mostly focused on mechanical and electronical integration of multiple selected sensors and effectors, followed by extending existing software services to handle all additional data as well as adding software modules that will allow for integration of this data with ASSISTANCE communication interfaces – specifically SAS.

Regarding drones, all interfaces for integrating the sensors mounted on them are widely described in D3.2 and the way that this information/data will be visualized is described in detail in the following sections of this deliverable.

4. ASSISTANCE units and sensors information visualization

4.1. Methodology

ASSISTANCE has followed from the very beginning a user-driven approach for all its activities and developments. In this case, for the selection of the more suitable information visualization aspects, the participation of the end-users has been very important. The consortium has wanted to encompass the real needs of FRs to develop a real useful system that increases their safety and improves their operational decisions.

The methodology followed for reaching an agreement on the final manner of visualizing the new information provided by ASSISTANCE, has been based on an iterative process of continuous meetings and teleconferences between technical partners and end-users.

The first meeting where technical partners and end-users discussed the way of visualizing the information was during the first plenary meeting in Rome in month 6, two months before starting task 5.1.

After this meeting, different bilateral teleconferences and meetings were performed between the coordinator, the partner responsible for developing the SAP HMI, and different project end-users. During these bilateral discussions, the end-users stated what would be the best way of visualizing the new information provided by ASSISTANCE that really helps them for improving both, their decision-making process and their safety.

The coordinator consolidated all these suggestions in a document, which was discussed by the whole consortium during the second plenary meeting that was held on-line in month 11 due to COVID19 outbreak.

Finally, a teleconference, with all end-users attending, for refining the visualization agreement achieved took place and as a result of this the final visualizations approaches for the different data provided by ASSISTANCE were agreed by the whole consortium.

After of this iterative process described above the final developments for accomplishing the end-users' visualization needs to be continued in Task 5.1, for adapting GESTOP system properly for becoming the ASSISTANCE SAP. The results of these developments and the different visualization approaches agreed will be described in detail in the next sections of this deliverable.

4.2. Units on field visualization

For the visualization of the units on field the consortium reached two main agreements, which suppose large changes in GESTOP system in order to provide a new way of representing the FRs units in ASSISTANCE system according to the needs addressed by the end-users.

The first one was to use an international standard icon set for representing the different FRs units and assets deployed on field. The coordinator proposed several standard icons sets and finally, the United Nations emergency icons set was selected UNOCHA[2]. Some FRs stated some very concrete aspects not covered by this standard set of icons, but all of them agreed that for the project purpose this set of icons was perfectly valid. If later on, ASSISTANCE system was selected for becoming a final product for a FR organization then the icons set would be tailored and personalized to the client concrete needs.

The second agreement was to show in a different colour the icons of the different FRs organisations deployed, since it was stated as very important for all FRs organizations to see all FRs deployed and not only the ones belonging to their organization.

For this reason, in order to be able to identify their own resources quickly and also the rest of FRs units, it was decided to use different colours for the icons of each FR organization when they are represented on the map. In this case was selected the red colour for firefighters' units, blue colour for police units and white colour for the sanitary staff units. In the following figure are described FRs units from different organizations represented with different colours using UNOCHA icons set in the real SAP HMI.

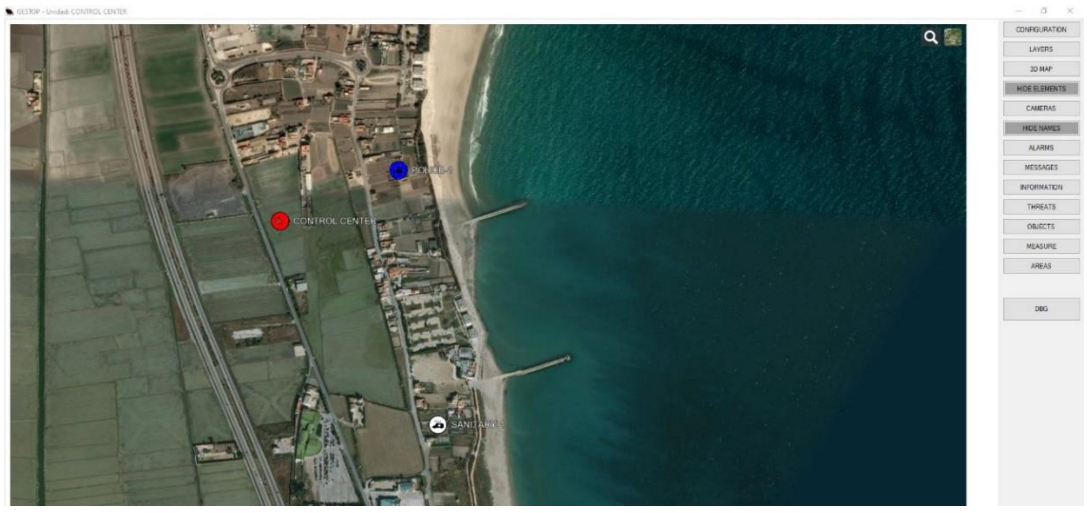

Figure 2. FRs Units visualization

[2] https://www.unocha.org/story/iconography-part-un%E2%80%99s-humanitarian-efforts-ocha-releases-new-humanitarian-icons

In addition to the unit's representation, UNOCHA standard icons for emergency relief also provide the capability for displaying standardized threats, feature that it is also used in the system, as shown in the next figure:

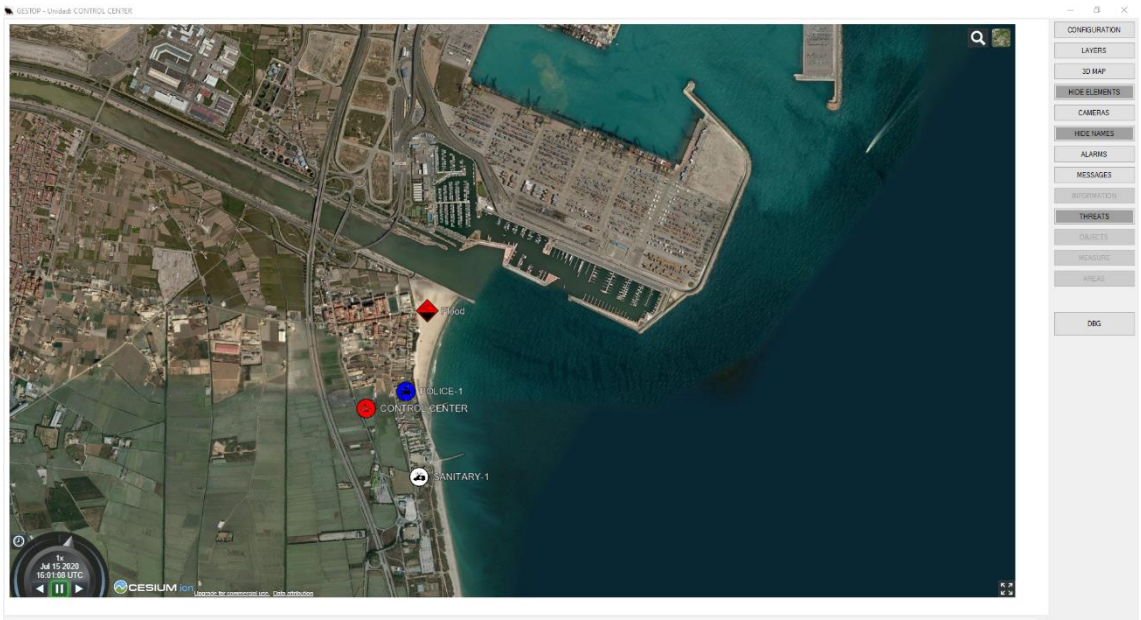

Figure 3. UNOCHA threats

In the previous screenshot, the icon for the flooding incident is used as an example of this capability.

In the following figures some units are represented on the map with the terrain 3D view activated.

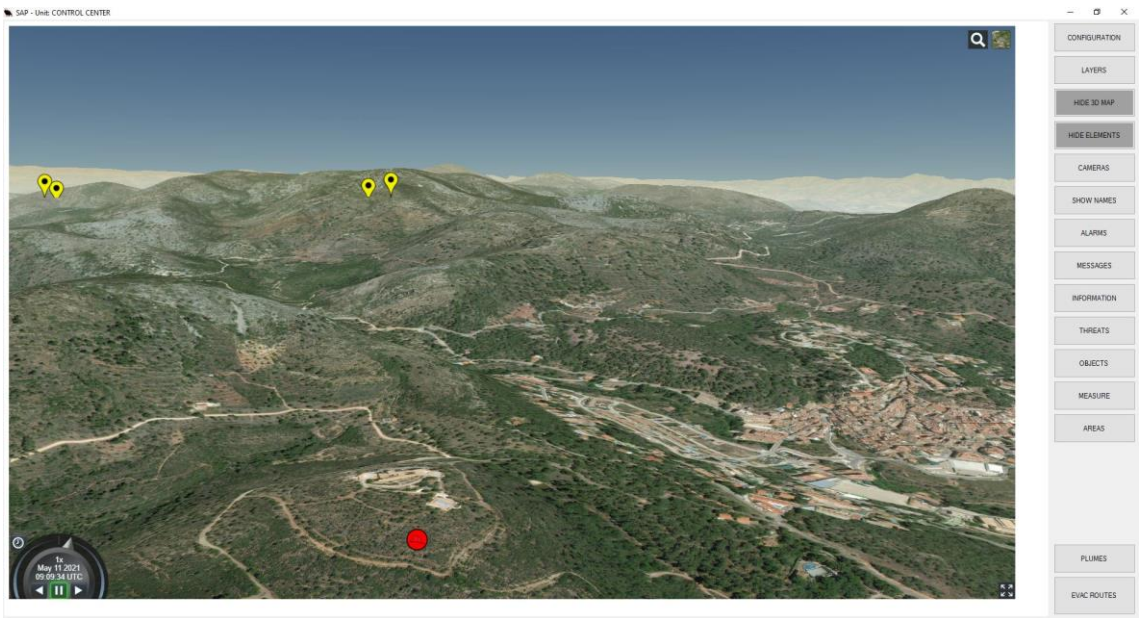

Figure 4. Units represented on the 3D view of the terrain

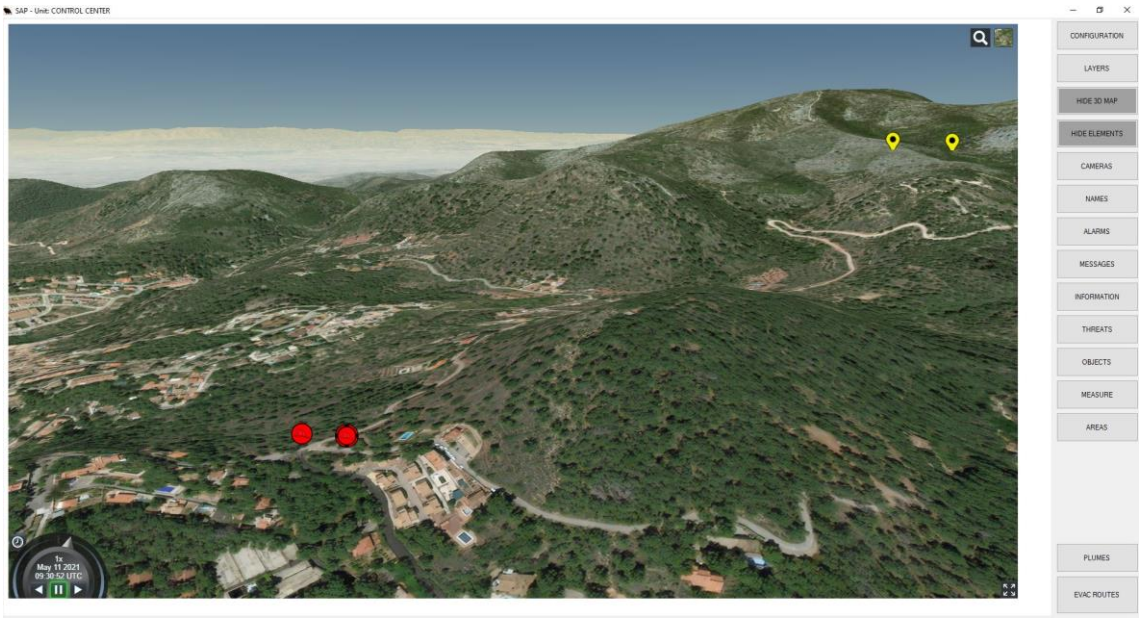

Figure 5. Units represented on the 3D view of the terrain

4.3. Video flows visualization

The way selected by the end-users for visualizing the video flows from cameras mounted on drones, robots or wearables was as follows:

First, FRs have to click on the icon of the units that have the video camera attached (Drones, robots or FRs units). After that, the interface of the selected units appears showing real-time information of the unit such as; location, name of the unit, etc. and also showing several buttons for accessing to the information provided by the different sensors integrated into this unit (e.g. video camera, IR camera, vital signs, measurements, etc.).

In the following figure, the interface of a unit is shown.

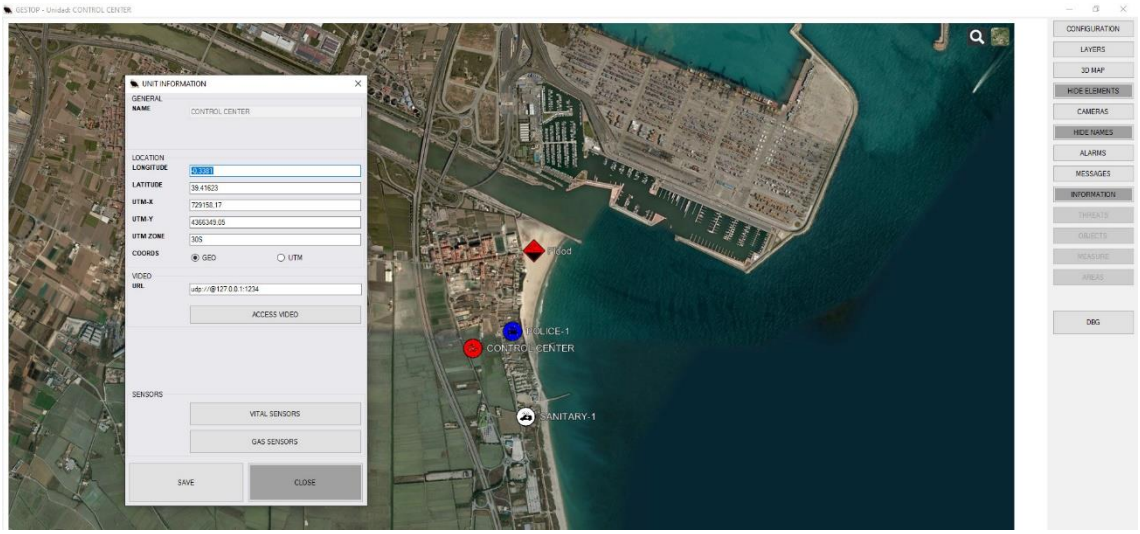

Figure 6. Interface for unit info (I).

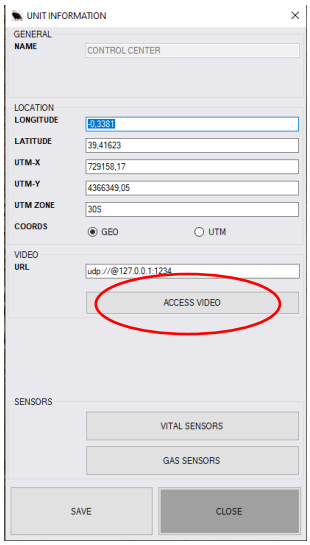

Figure 7. Interface for unit info (II)

Finally, by clicking on the "access video" button the video flow appears in a different window on the map as is described in the next figure.

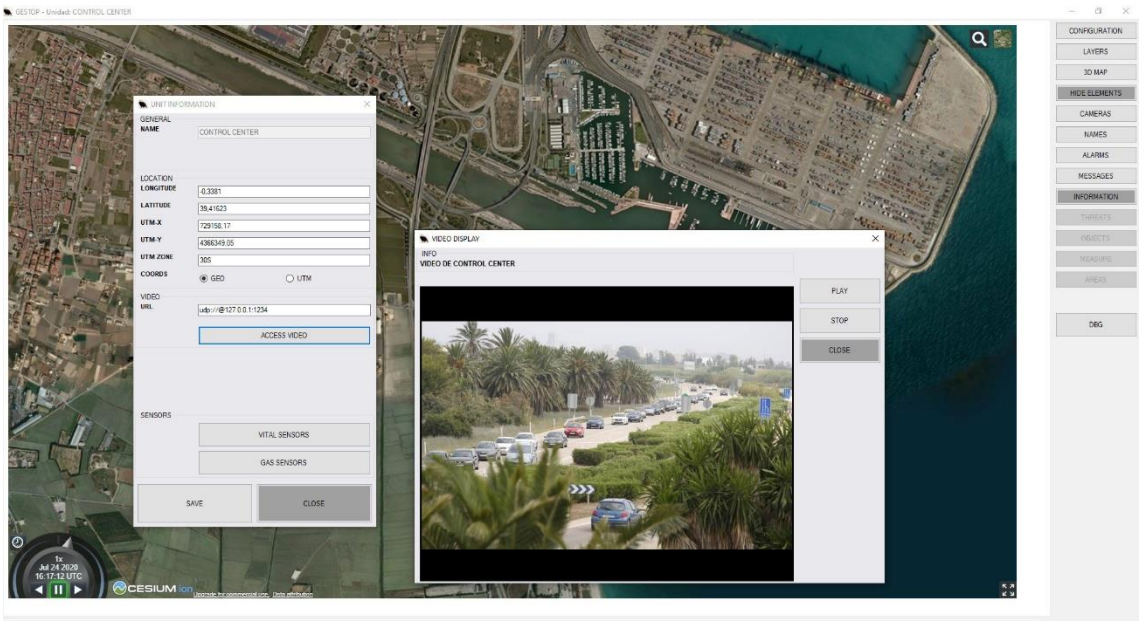

Figure 8. Video flow visualization in ASSISTANCE SAP.

The FRs have the possibility of stopping the video, play it again and close the windows.

4.4. Vital signs sensors information visualization

One of the new information that ASSISTANCE provides to the FRs and that has been valued as very important for their safety during the operations, is their vital signs data. The visualization of this information has been completely developed during ASSISTANCE.

These vital signs information is provided by a wearable sensor the Cossinus Two[3].

This sensor has been selected for its ergonomic and technical characteristics that are summarized in the next paragraph and that can be widely consulted in the reference below.

Figure 9. Example of wearable sensor

The sensor measures the following elements:

- Core Body Temperature
- Heart Rate
- Blood Oxygen Saturation
- Respiration Rate

Derived from the prior, it can calculate:

- Interbeat R-R interval

Perfusion IndexData is sent by means of Bluetooth technology to a small, on hot spot gateway which delivers data to the overall ASSISTANCE architecture by means of Wifi or 4G networking.

The main data provided by this sensor are the heart rate and the temperature of the FR. This data has been visualized following the agreement reached with the consortium FRs and that can be visualized by clicking on the unit icon and after that, clicking on the vital signs button of the unit interface.

[3] https://www.cosinuss.com/

The process can be seen in the following figures:

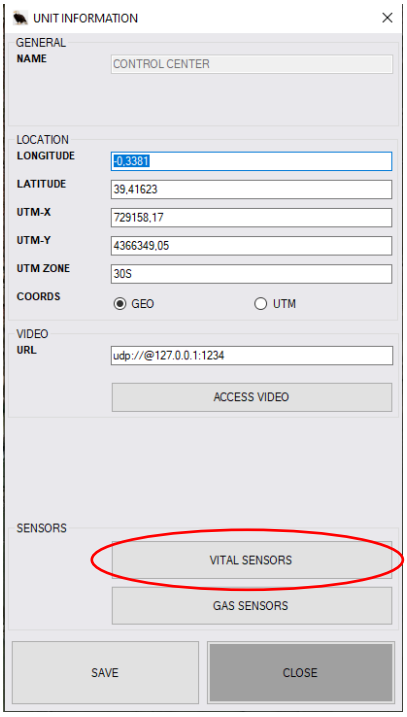

Figure 10. Unit interface with the vital signs button

Once the vital signs button is clicked, the information appears as described in the following figure:

- Timestamp of the measurement shown
- Body temperature in Celsius degrees
- Heart Rate in beats per minute
- A graphical representation of both measures
- The status of the sensor of the unit.

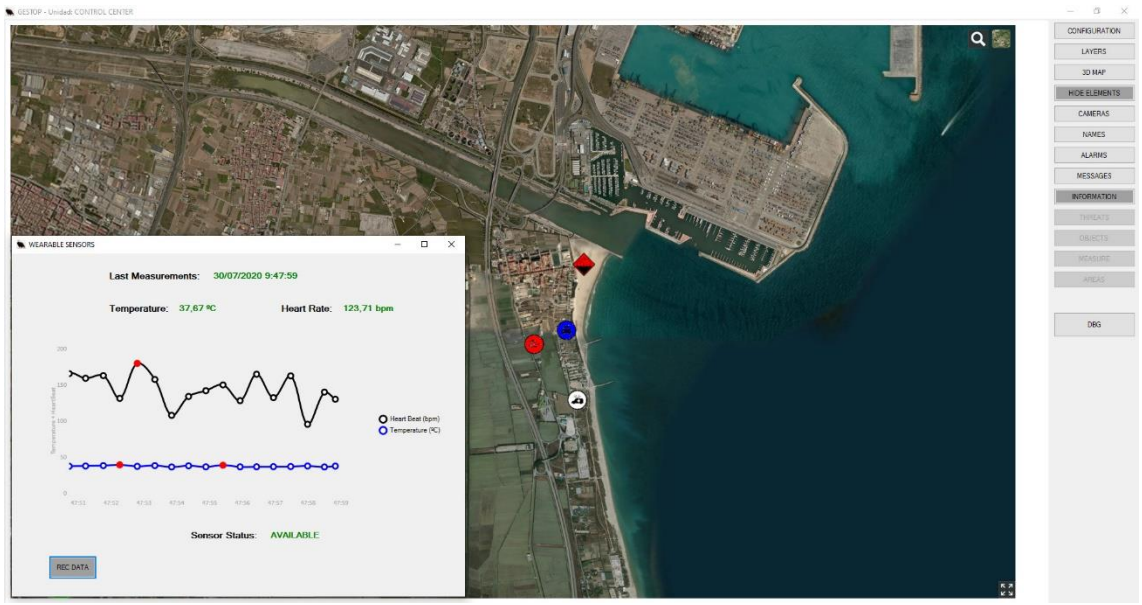

Figure 11. Vital signs visualization according the FRs needs

Vital sensors data is obtained and shown in real-time. If no data has been received for a particular unit, then the interface will be as follows:

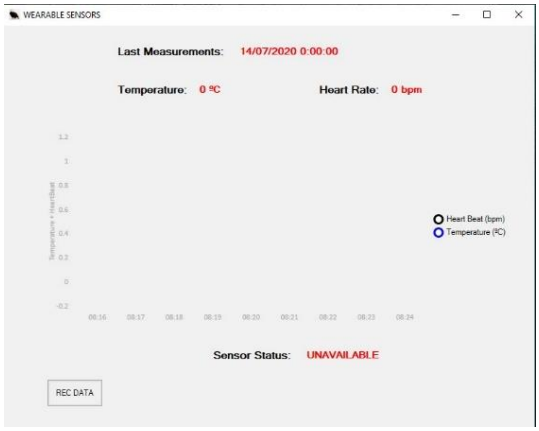

Figure 12. Vital signs interface (I)

If data reception is interrupted, the real-time graph displayed will be as in the following figure:

Figure 13. Vital signs interface (II)

Which can be compared with a real-time data streaming from a sensor whose data has been received more recently that a given time threshold, which can be configurable.

Figure 14. Vital signs interface (III)

As can be seen in the past two figures, the system displays with text and colour codes, if the sensor is available, when was the last received measure, if the measures are within an acceptable and configurable time threshold and also if values exceed or not a given and configurable threshold for both heartbeat and temperature.

If the user wants to see the given value of a particular measurement, placing the mouse over it will provide a tooltip with that extra information, as can be seen in the following figure:

Figure 15. Vital signs interface (IV)

The user can stop at any time the visualization update with the button 'REC DATA' in order to analyse a given time frame.

In order to increase the security of the FRs it was also agreed that if the heart rate or the temperature overcome some thresholds established by the end-users, then the system will put a red circle around the unit affected in order to inform the operation managers on this fact.

This way the affected unit can be informed on his/her status and order he/she to come back to the rear post or even the nearest units can be informed for helping this unit if he/she needs help.

In the following figure, the automatic alarm is described (See sanitary unit icon highlighted with a red circle indicating that this unit has overcome some of the established thresholds.

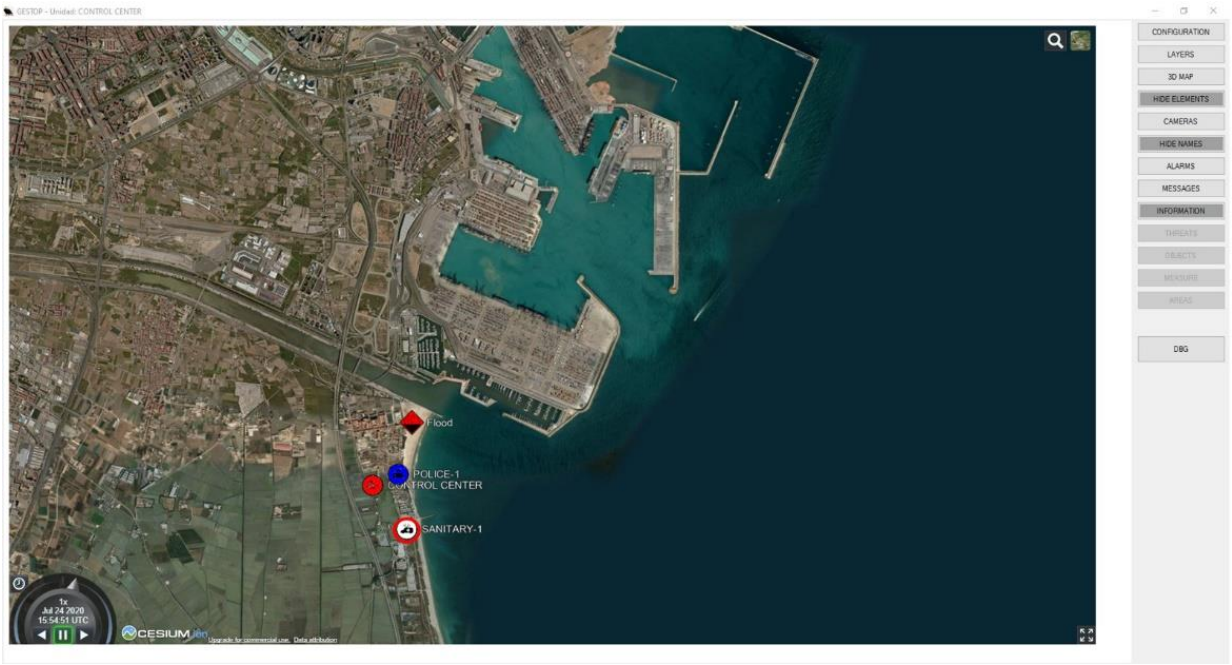

Figure 16. Alarm for thresholds overcome in a unit (See red circle)

4.5. Gas sensors information visualization

Another important visualization capability that ASSISTANCE SAP provides to the FRs and what has been completely developed during the project is the visualization of the gas concentration measured from the sensors installed in the drones and robots available in the consortium.

To explore the concept, in ASSISTANCE just CO2 and CO sensors have been installed in the mobile platforms for avoiding any measurement of more dangerous gases e.g. chlorine gas, sulphur gas, etc. In the same way, and using the same interfaces, other sensors for measuring these kinds of dangerous gases could be installed in the mobile platforms.

The way of visualizing this information has also agreed with the FRs during the meetings and teleconferences held and is described in the next paragraphs.

The first step for visualizing the gas measurements is the same that has been described in the previous sections, to click on the drone/robot icon and select the sensor through its interface.

When the user clicks on the gas sensor button, a visualization interface appears with the measurement and a message marked with a colour code (red, yellow, green, etc.) depending on some thresholds provided by the FRs. Also, in this case, the interface includes the timestamp of the last measurement shown and the sensor status (if available).

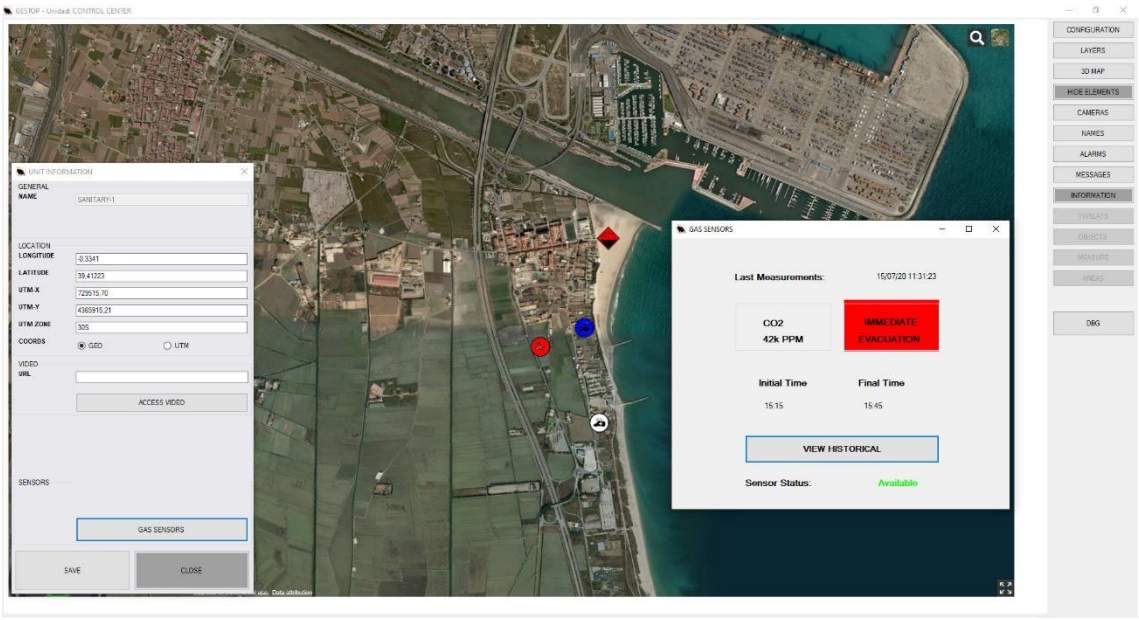

Figure 17. Gas sensors interface

Examples of color code provided by the end-users for representing different concentrations of CO2.

1. The normal concentration is 415 ppm or **0,0415%**

2. From **0.1%** (1,000 ppm), CO2 becomes one of the factors of asthma or the building syndrome. This concentration is the maximum allowed for the design of air conditioning systems, inside buildings and homes.
3. Above **0.5%** (5,000 ppm), it is the maximum occupational exposure that is allowed in most countries, and the maximum allowed for the design of air conditioning equipment in airplanes should not exceed it.
4. 3 times that rate (**1.5%**, or 15,000 ppm) is the maximum occupational exposure for a maximum of 10 minutes.
5. **From 4%** of CO2 in the air (40,000 ppm), the threshold of irreversible effects on health is reached (the minimum threshold that requires immediate evacuation of the premises).
6. **From 10%** and exposure greater than 10 minutes without a quick resuscitation remedy, death occurs.

The difference of this interface with the previous one is the possibility of selecting the time window of the measures that will be visualized.

The user can introduce the initial time and the final time of the time window for visualizing the gas measurements and after that, click on the button “Historical” (See figure 16). This button will allow to visualize the different measurements taken during the UAV route in a time period stated by the user.

The measurements will be shown using points with the colours of each measure according to the thresholds colour code previously shown.

Once clicked on ‘Historical’ the following will be shown as can be seen in figure 16. It is important to note that the measurements shown are dummy data due to the impossibility of performing real test flight at the time of closing this deliverable. Nevertheless, the results with real data will be exactly the same in term of visualization.

Figure 18. Gas sensors visualization (I)

As can be seen, there is a collection of points in a 3D GIS, following the previously described colour convention, which corresponds to the measurement taken at the location where it was done by the sensors carried by the UAV.

The UAV is also shown as a 3D animated model on the current location, as can be seen in the following snapshots:

Figure 19. Gas sensors visualization (II)

Figure 20. Gas sensors visualization (III)

If the user clicks on a given point (measure) on the map, it will be highlighted by a green square and a billboard will pop up showing the measurement taken (see figure 19).

In particular, it will show:

- The UAV which took the measurement and its photo
- The sensor name
- The measurement value in PPM
- The date and time the measurement was taken
- The location of the measurement

Figure 21. Gas sensors visualization (IV)

As can be seen, both the rose wind and the wind direction are activated and shown.

There is also the functionality to click on the UAV which carries the sensors and visualize its information, as seen in the following figure:

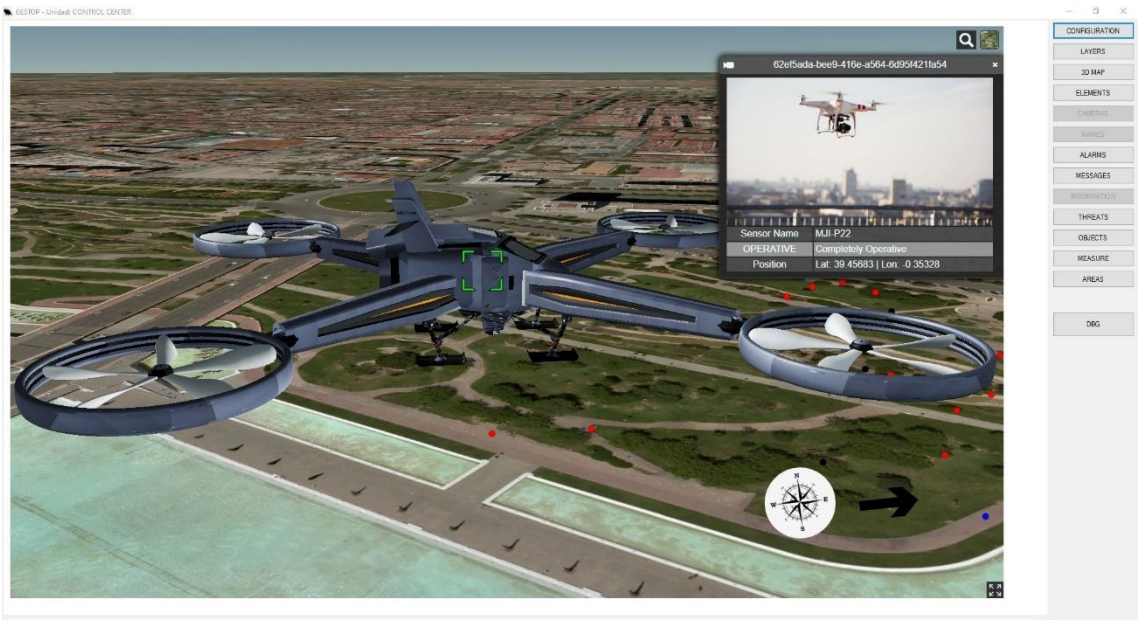

Figure 22. Gas sensors visualization (V)

Which mainly includes the UAV name and photo, the status and the location.

As mentioned before, the system will include a button for showing the wind speed and its direction. This information will be gathered from sensors mounted on mobile platforms, e.g. atmospheric sensors mounted on robots, or from external sources, e.g. weather forecast sources.

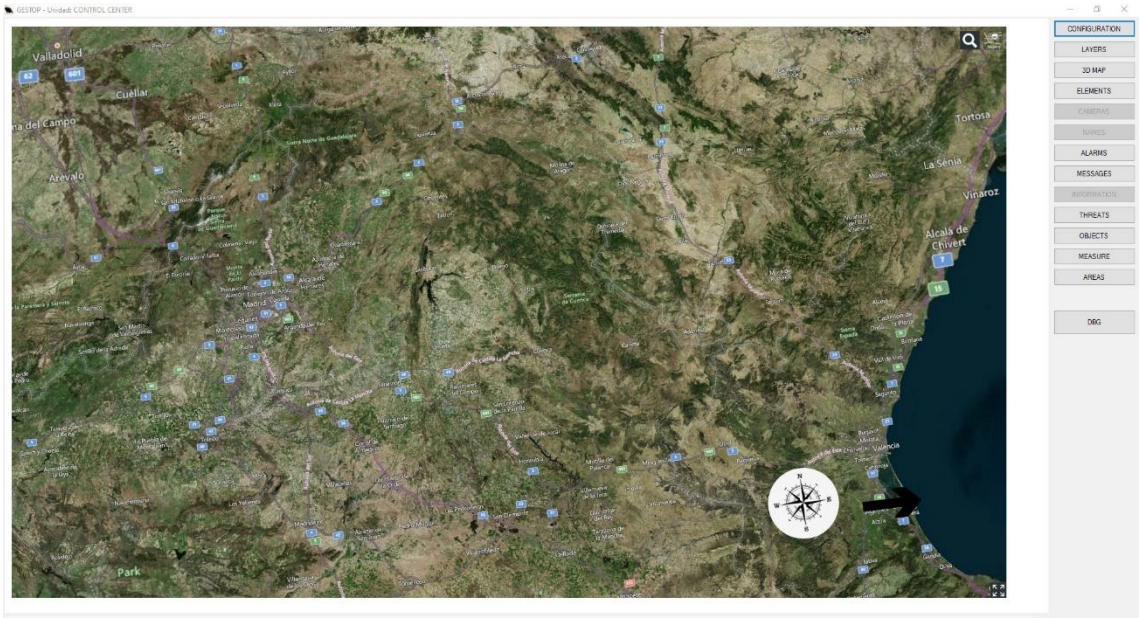

Figure 23. Rose wind (I)

Figure 24. Rose wind (II)

5. Geographical areas creation and visualization

During the meetings and teleconferences with the FRs, it was stated that one important visualization characteristics that ASSISTANCE SAP should include was the capability of drawing areas and perimeters. This new feature has been completely developed from scratch during ASSISTANCE.

For areas is understood a polygon with the area in a semi-transparent texture. For perimeter is understood a polygon without internal area, just lines determining their sides. The perimeters represent zones for different purposes depending on the colour of the perimeter lines. The areas represent different security/danger levels in the event location.

The system allows the real-time drawing of areas on the map in order to inform all FRs involved in the operations on the different level of security/danger in the operation theatre (Red, Yellow and Blue). Inside these areas, different types of perimeters can also be drawn for stating different types of zones depending on their colours. e.g. restricted zones, the zones for triage, the zones of resources storage, etc…

FRs have also stated that for describing each type of perimeters and areas during the operations a colour code could be used for easy identification.

Using this information, the ASSISTANCE SAP allows applying a different colour code of each type of perimeter and area in order to identify them just looking at the map.

To do so, the user clicks on the ‘Areas’ button on the system and an interface management screen pops like the following:

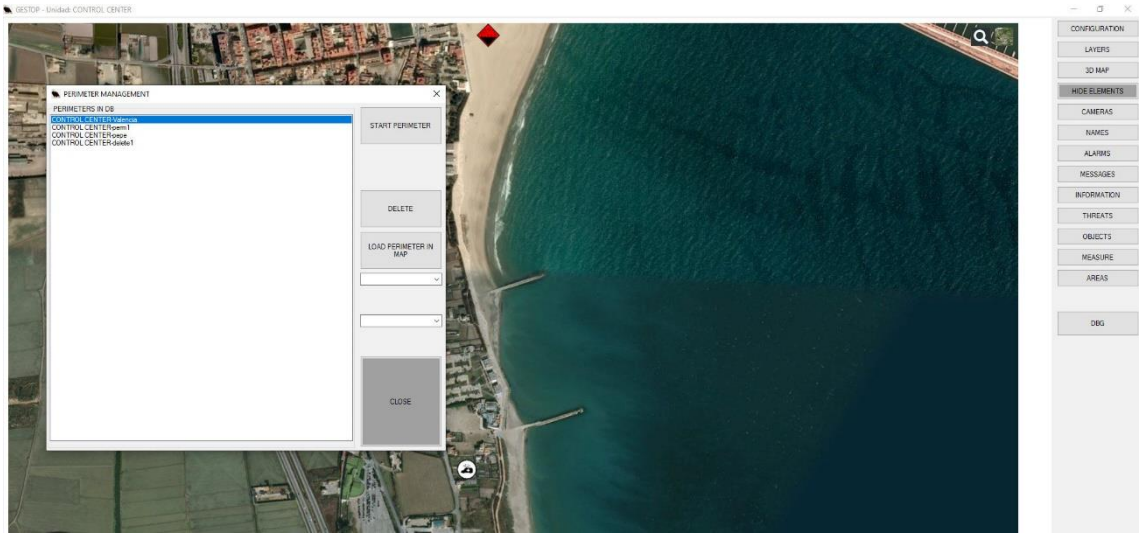

Figure 25. SAP zones visualization (I)

The FRs stated as necessary the following types of areas:

- DIFFERENT LEVELS OR PROTECTION AREAS:
  - RED AREA (High Risk)
  - YELLOW AREA (Moderate Risk)
  - GREEN AREA (Secure Area)

The FRs also stated as necessary the following types of perimeters, which would be drawn for delimitating the different types of zones:

- TRIAGE ZONE
- TREATMENT ZONE
- AMBULANCE ZONE
- HELICOPTER LANDING ZONE + (ICON)
- DECONTAMINATION ZONE
- MEDIA ZONE
- INTERVENTION ZONE
- RESTRICTED ZONE
- HOLDING AREA FOR VEHICLES (RESOURCES RECEPTION ZONE)

The user can upload to the GIS previously generated areas and perimeters currently existing on DB by selecting on the left panel or generate new ones. To do this last action, the user must define if he/she is going to generate areas or perimeter. The control to select red, yellow or green areas can be seen in the following figures:

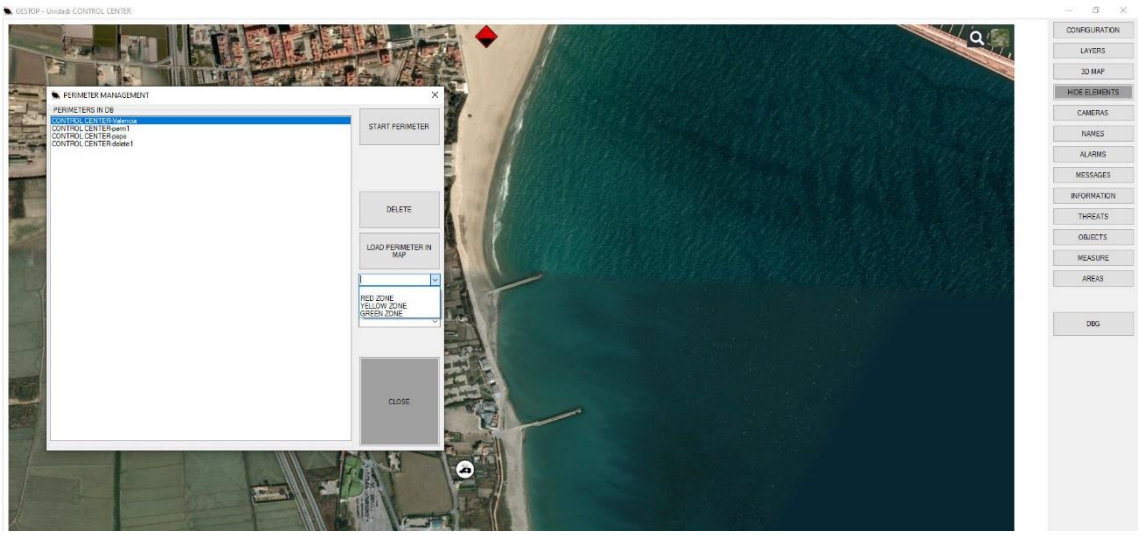

Figure 26. SAP zones visualization (II)

And to specify that what is going to be generated is a perimeter, the interface for this action is as follows:

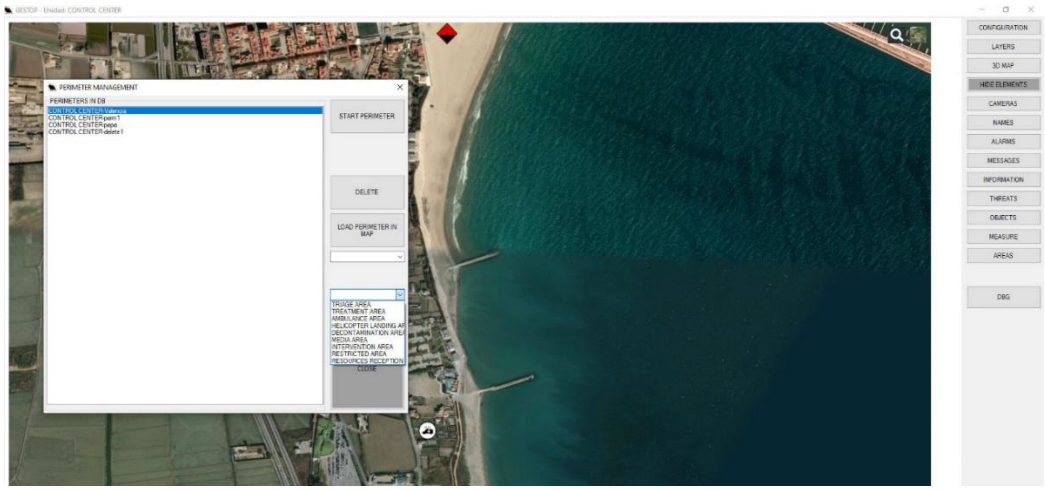

Figure 27. SAP zones visualization (III)

Once the user has set the kind of perimeter that is going to be drawn, he/she has to click on the button 'start perimeter' and click on the map to point out the perimeter outlines.

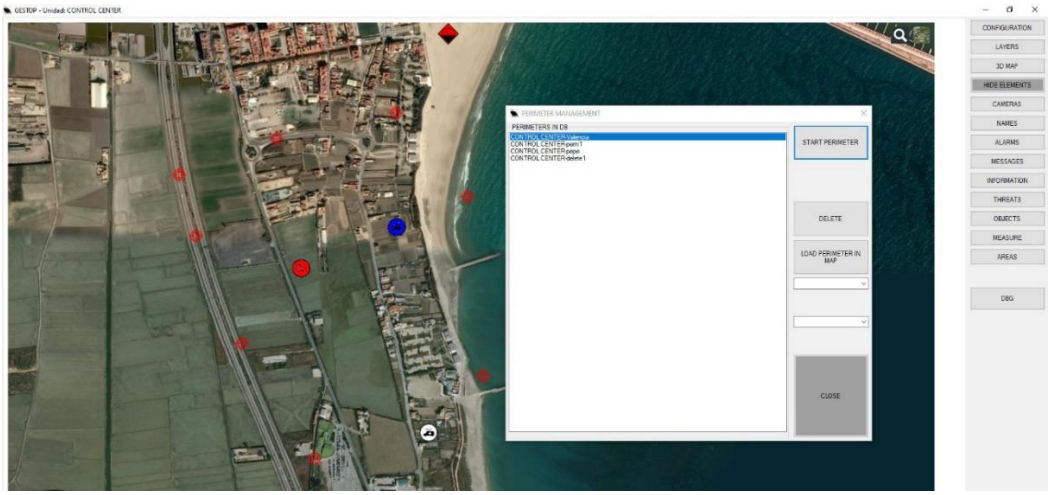

Figure 28. SAP zones visualization (IV)

When all point of the perimeter has been located, then the system will show the new perimeter on the map:

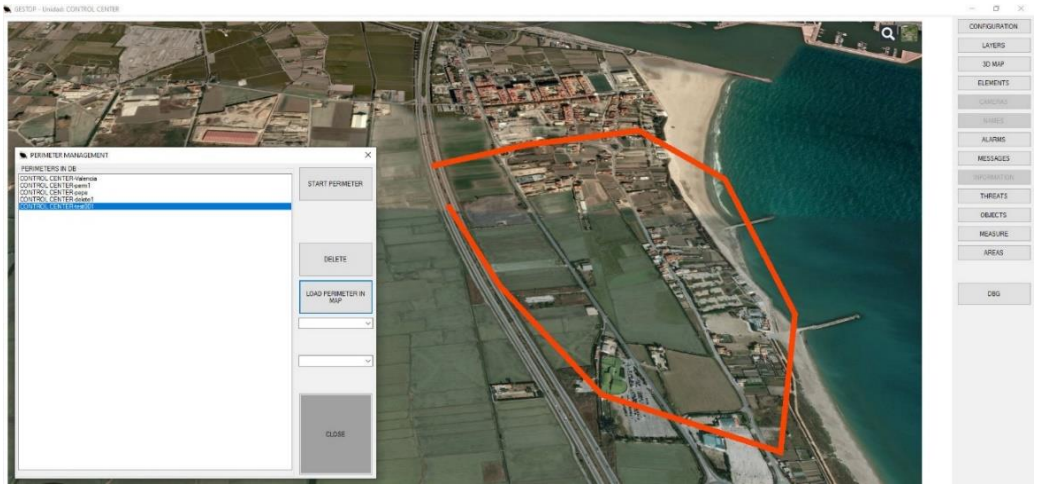

Figure 29. SAP zones visualization (V)

Depending on the type of perimeter, one colour or another will be used:

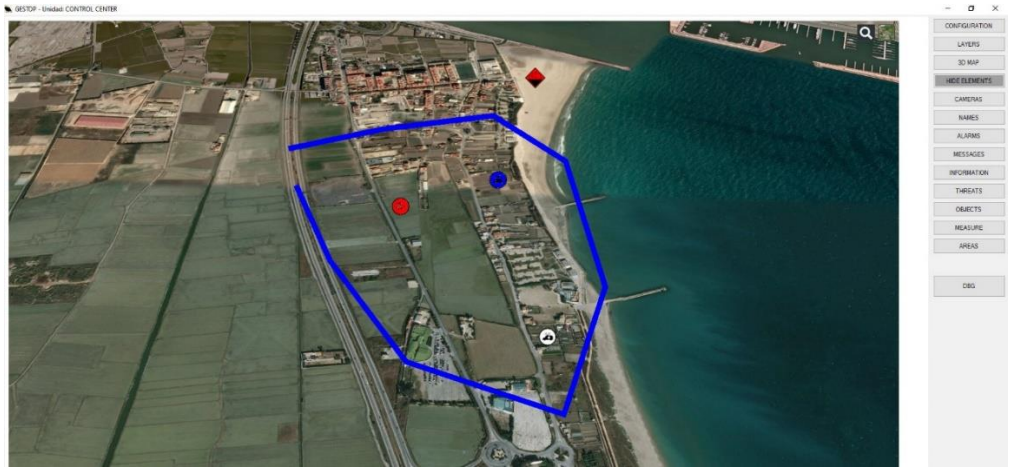

Figure 30. SAP zones visualization (VI)

If the map is shown in 3D, the areas and perimeters will be shown clamped to ground, as seen in the following figures 29 and 30:

Figure 31. SAP zones visualization (VII)

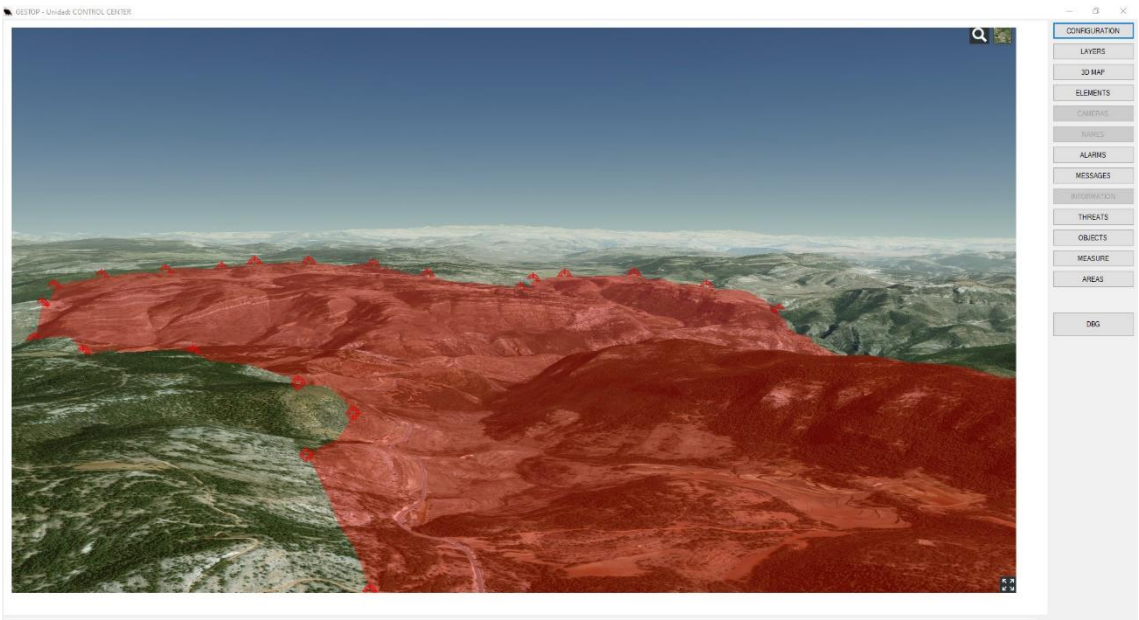

Figure 32. SAP zones visualization (VIII)

Moreover, once the area or perimeter is created and shown on the map, whenever the user clicks on it, it will display some relevant information. In particular, and as stated by the end-users:

- the type of the area or perimeter (for instance green zone):
- the unit or user who created it
- the date and time of creation
- the perimeter of the area or zone and its area.

It can be seen in figure 31:

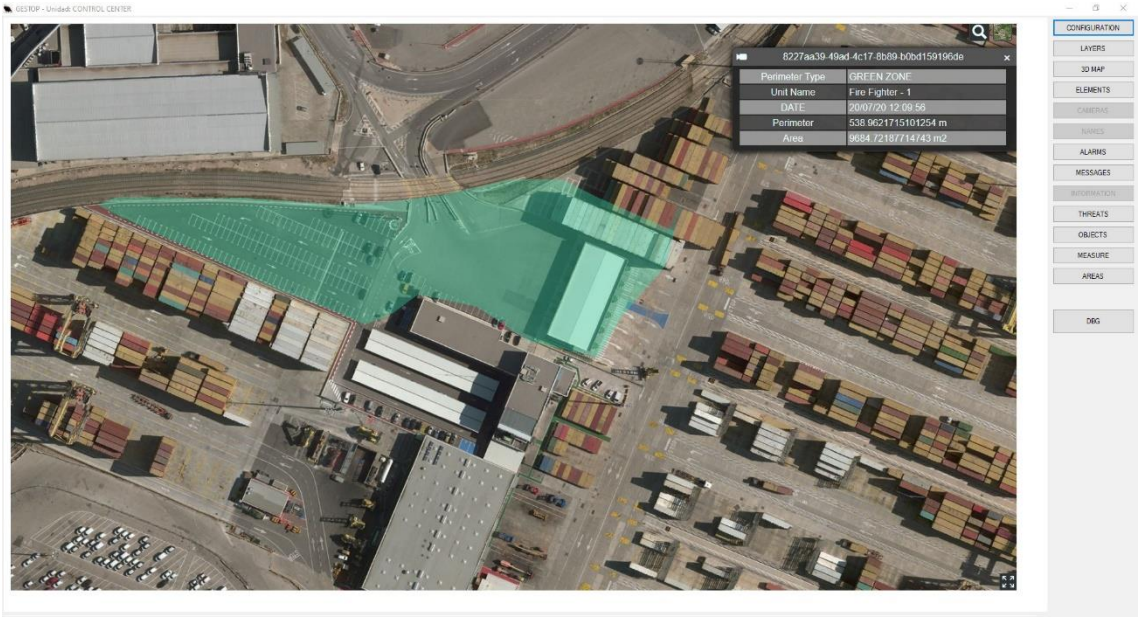

Figure 33. SAP zones visualization (IX)

There will be a possibility of drawing circular perimeters and areas selecting a point as centre of the circle and including the length of the radius also accomplishing the end-users' visualization requirements.

6. Information customization

It was written in the proposal that the consortium would provide a dedicated HMI for each FRs organization, which provide them with the more suitable information for performing their work in a more secure manner. After the different meeting with the project end-users, they state clearly that all information provided by the ASSISTANCE system could be useful for them in certain moments of the operation.

For this reason, the consortium decided to provide them with a flexible interface for tailoring the information that each FRs organization can visualize at any moment.

This way, all information available in the system will be able to be used by all FRs organizations, since they expressed this need as very important.

Nevertheless, when they ask for visualizing vital signs sensors information, the FRs of each organization just can see the information from the FRs belonging to their organization. That's mean that one firefighter just will be able to see vital signs of other firefighters and not from police nor sanitary staff. This is the unique restriction they have for visualizing information.

When a FR wants to tailor the information that is going to visualize in the SAP HMI will click on the button "tailored information" in the main menu.

Then an interface showing all information available in the system appears allowing the FR to select what information need to see by clicking on the checkboxes. After that, the FRs accepts his/her selection and this will be the information that will appear the SAP HMI. In the following figure, the interface for tailoring the information that will be visualized is shown.

- ✓ Gas sensors
- ✓ Video Sensors
- ✓ Units icons
- ✓ Units icons and names
- ✓ Zones
- ✓ Areas
- ✓ Wind speed and direction
- ✓ Vital sign sensors

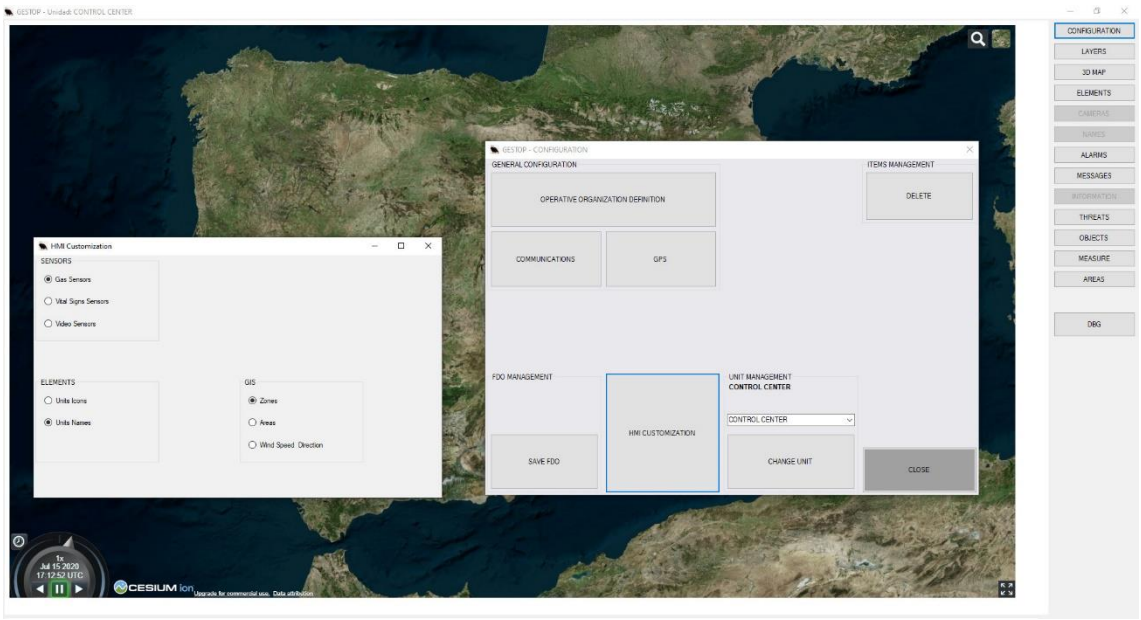

Figure 34. SAP HMI customization

The user will mark through a customization interface what information is useful for them in each moment.

This way, in another moment some of the available information could not be needed and then it could be removed from the customization interface and therefore this information will disappear from the main HMI of this user.

- Gas sensors
- ✓ Video Sensors
- ✓ Units icons
- Units icons and names
- Zones
- ✓ Areas
- Wind speed and direction
- ✓ Vital sign sensors

7. Conclusions

In this deliverable, all developments performed for performing the adaptation of the ASSISTANCE SAP has been described in detail. These new developments for visualizing the information provided by the sensors have been agreed with the project end-users according to the methodology described in section 4.1, following the user-driven approach stated in ASSISTANCE proposal, in order to offer a really useful system for them at the end of the project.

The technical effort performed by the consortium for implementing the information visualization wishes expressed by the end-users has been huge. However, the obtained results that are described in this document are very satisfactory for the whole consortium.

All new capabilities built on GESTOP system for becoming ASSISTANCE SAP will help the FRs from different organizations to have a more secure working environment and having new information/data for taking more accurate decisions during their crisis management activities.