xR4DRAMA

Extended Reality For DisasteR management And Media planning

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D5.3

Prototypes and mobile development

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Description

This iterative deliverable will document the different development phases of xR4DRAMA platform and its architecture, GIS system, XR environment and awareness apps.

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Executive Summary

Briefly written, the deliverable D5.3 is documenting the progress achieved on two fronts of the xR4DRAMA platform: i) the system integration and more specifically the backend components, and ii) the awareness app for the public. Hence, the 1st year achievements on the backend and the storage, as well as the Geographic Information System (GIS) are reported. The architecture of the connection among these components are established and the communication with the services and the frontend components is tested. The progress towards the 1st prototype is as scheduled and no delays are reported. The awareness app for the citizens, which serves the Disaster Management scenario has also reached its 1st version, providing basic capabilities for the users. This deliverable does not report on the XR applications, as these are reported separately in the dedicated deliverables D4.1 (AR interactive environment and applications) in M13, D4.3 (VR environment and collaborative tools v1) in M12, and D4.4 (VR authoring tool v1) in M12. The deliverable accompanies the demos (in the form of videos, screenshots, and web available documentation) provided by the corresponding partners (NURO, U2M, CERTH) that present an overview of the 1st year achievements and mark the achievement of the 1st prototype development MS2, as far as WP5 is concerned.

Abbreviations and Acronyms

API	Application Programming Interface
AR	Augmented Reality
DEM	Digital Elevation Model
DIAS	Data and Information Access Services
DoA	Description of Action
DB	Data Base
DSS	Decision Support System
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
HCI	Human Computer Interaction
IO	Innovation Objective
IA	Innovation Activity
IMU	Inertial Measurement Unit
KB	Knowledge Base
MR	Mixed reality
OSM	OpenStreetMap
PUC	Pilot Use Case
TA	Technological Activity
TO	Technological Objective
VR	Virtual Reality
WP	Work Package
WFS	Web Feature Service
WMS	Web Map Service

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1 Introduction

1.1 Tasks

This deliverable reports on three separate tasks of the WP5 - Platform development:

- T5.2: Backend framework: Integration, communication and data management of the xR4DRAMA system.
- T5.3: 3D GIS for navigation and data geo-localization.
- T5.4: Awareness apps for end users.

The description of the tasks as given in the Description of the Action (DoA) is as follows:

T5.2: Backend framework: Integration, communication and data management of xR4DRAMA system.

The main goal of this task is to develop a backend infrastructure that helps in the management of data in a secure manner. The backend will support the integration of the components and will be based on the architecture developed in T5.1. The backend will manage all the videos, images, data, voice recordings and 3D models that can be accessed by the tools. The integration will also integrate various APIs that the platform can offer to provide maximum compatibility during the project and once the project ends.

The task lasts from M06 to M22, and the leader of the task is NURO with 7PM (other contributors are CERTH (2PM), U2M (2PM), UPF (2PM), STX (2PM)).

T5.3: 3D GIS for navigation and data geo-localization.

This task aims at providing a geospatial database with 2D and 3D content (from T4.4) and a reference frame to be the underlying localization platform that will allow all relevant data to be suitably placed in 3D space. The geographic information system (GIS) will connect to all relevant processed data of WP3 and will manage them in the geo-referenced system via geospatial queries, in order to support the AR interaction. Information will be served to users either on demand, or via their spatial coherence and other sets of rules implemented through spatial queries. All available 2D information and 3D reconstructed areas/buildings of interest will be organized in layers accessible to the AR module . The GIS will be developed in QGIS and run as part of the xR4DRAMA platform. U2M will build the GIS and the rules to execute geospatial queries as the mission proceeds, whereas NURO will create the triggers in the platform backend to retrieve from the GIS spatially relevant information and present them in the XR applications.

The task lasts from M06 to M22, and the leader is U2M with 8PM (another contributor is NURO (1PM)).

T5.4: Awareness apps for end users.

While the decision support system is necessary for the planning teams (especially for control rooms in disaster management) to minimise the impact of the disaster, it is often the case that an incident, after a crisis has emerged, could have been prevented in the first place if the users involved had been aware of a threat and sufficiently motivated to avoid it. Accordingly, this task will develop a VR-enabled mobile application that, depending on the

context, will inform the user about likely threats, spanning from depicting geo-localised problematic areas to emergency guidelines.

The task lasts from M06 to M22, and the leader is CERTH with 5PM (other contributors are DW (1PM), AAWA (1PM)).

1.2 Objectives

WP5 in its entirety aims at the development of the xR4DRAMA platform, in means of system architecture, communication and integration, as well as the development of the GIS services for geo-localisation of information, and the awareness app for the citizens. The platform development and the citizens' app reported here correspond to various project objectives (Innovation – IO, or Technological -TO ones), and their most important impact is on the ones that follow.

The innovation objective **IO3: Develop enhanced interactive AR applications for outdoor media production and disaster management** aims to deliver an integrated platform for remote outdoor observation and planning of tasks and actions. It corresponds to two innovation actions.

IA3.1 Visualization of DSS results in AR: Augmented Reality (AR) modules will enhance the physical world via applying layers of information based on the first responders' needs, when operating on the field. This information will be streamed from available data sources into the xR4DRAMA platform: the stakeholders' "archives", the data captured during the response process by xR4DRAMA tools, i.e. news coverage, social media streams, visual data, prediction models and the results from the analytics in DSS. AR sensors and glasses will allow to position first responders' findings in real 3D space by seamlessly merging the real space with the virtual data connected to the GIS and, hence, the xR4DRAMA platform. This data to superimpose on the real world will be narrative information (e.g. history, protocols), real-time streamed data and 3D information, such as infrastructure, obstacles and restricted areas etc. The AR sensors will also provide real-time information and a view from the actor's viewpoint (1st responder, or local source). Stakeholders in the control room can use this information for support, supervision, and advise to the on-site personnel. In the media use case, this kind of interactive walkthrough can enhance the planning process.

IA3.2 Visual and GIS-assisted uninterrupted navigation for AR: This activity is responsible for deploying the appropriate technologies for supporting the 1st responders and journalists navigation in the real world via the xR4DRAMA AR module. 3D models of the landscape and the infrastructures referenced to a GIS will be combined with appropriate sensors on the AR device (GNSS, IMU, Gyro, WiFi) to fulfill this objective. Navigation is an important feature of the AR module as the quality of the user experience depends on this.

Work package 5 also serves the technological objective **TO2: Interactive Situation Awareness Platforms**, which corresponds to three Technological Activities (TA):

TA2.1 System development, integration, communication and data management: This activity will create first an architecture for the development, communication and integration of the platform that can manage all the data in a secure manner. The activity will then work towards the implementation of the architecture to integrate all the services developed. We plan to have a proper data management plan in this activity to ensure data security and GDPR compliance.

TA2.2 3D GIS for navigation and geo-localization: This task will develop a Geographic Information System (GIS) which will incorporate positioning and space scaling information for all assets of xR4DRAMA that are required to be positioned in the real world via the AR tools. The GIS will connect the 3D terrain with all assets that are requested from the field agents and the DSS to be projected in AR. Additionally, it will facilitate the need for spatial queries in the database to select information to be displayed in AR based on the location of the field agents (1st responders/ journalists).

TA2.3 Awareness apps for citizens: This activity will develop a situation awareness mobile application for the wider public. The mobile app will be able to detect the user context based on variables such as location, time and proximity to dangerous areas, and will inform the user about the event's current status, possible threats and alerts, presenting them coherently on a mobile AR environment, using input from TA1.3, TA1.4 and IA2.3.

1.3 Timeline

Table **1** shows the timeline of the WP5. The milestone MS2 corresponds to the 1st prototype is at M13.

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Table 1. Timeline of the WP5.

1.4 Position

The components described here are completing the 1st prototype of the platform.

Currently the first version of the ***data storage*** and the ***REST API*** are deployed which allows the front-end tools to register new users, create new projects and view and manipulate data of the project. The current version also allows the user to send requests to the text crawler to crawl new data for the project and save it. The next versions of the REST API and Data storage module will allow for notifications that can be sent to the users of different tools in real-time. The next version will also include data analysed by the knowledge base to be displayed as insights on the any user tool that wants to use the data as well as store GeoTiFF files for the disaster management use case to run simulations.

The ***GIS service*** has been integrated with the 3D reconstruction service, the visual analysis service, the satellite service and the AR app, as well as the backend and its user authentication system. After some iterations, it is also at a form that can support most of the user requirements and the desired information documented in D6.2. In the following months, the GIS service is to be evaluated by the users and field tested during the forthcoming user meeting in Corfu for the PUC2 Media Planning trials. Further integration with all the platform services that use or produce georeferenced information is pending, as well as the backend service. Furthermore, the database schema will be updated based on

the project evolution and a more appropriate communication schema will be developed. New spatial functions will be developed to support the routing feature and the navigation of the AR app in the real world. More information on the future tasks is given in the following sections.

The work carried out within task T5.4: "***awareness application*** for end users" can be split in three phases which took place from the start of the project until now (M12-M13):

- The first phase included requirement gathering and design of the application. It kicked off by setting up the functional requirements and specifications to be supported by the citizen application in collaboration with the xR4DRAMA end users and finalized by producing the initial mockup plans of the application.
- The second phase was mainly the development task for the prototype version of the application based on the initial design. It is important to mention that not all the functional requirements foreseen in the initial design will be supported in the prototype version, mainly due to lack of time, but it is expected that all of the functionalities will be supported by the final version that will be delivered at the end of the project.
- The third and final phase includes integration of the application with the rest of the xR4DRAMA platform components and live testing of the supported functionalities. This is currently still going on and is expected to be finished by the end of M13.

The final version of the citizen application development will follow a similar three phase approach which will begin after the PUC1.

The completed functionalities within this first development cycle are:

- Citizen text report creation and submission to the xR4DRAMA platform.
- Citizen audio report creation and submission to the xR4DRAMA platform.
- Automatic attachment of geo location of the user to the submitted reports.
- Situation aware notification system (text alerts) to inform the user regarding the event status.
- Inclusion of a first responder mode that will connect and organize the physiological signals to the xR4DRAMA database.
- Authentication for first responders.

The list of functionalities to be added within the second development cycle are:

- Citizen video report creation and submission to the xR4DRAMA platform.
- Situation aware notification system (map alerts) to inform the user about his/her proximity to the danger areas, routes to the safe zones, etc.

1.5 Outline

The rest of the deliverable is as follows: Section 2 describes the progress in the backend and storage development, Section 3 describes the GIS services and its subcomponents, Section 4 gives an overview of what it is done in the AR application and the user requirements, which

is reported in detail in D4.1, and Section 5 describes the available geoportals in the GIS Services. Section 6 describes the deployment and its requirements. Section 7 and section 8 provide an overview on augmented reality applications and citizen awareness application. Finally, the deliverable ends with a short summary, the main conclusions and next steps in section 9. All these components of the platform are documented and relevant demos are provided.

2 Platform backend

The platform backend component consists of two subcomponents:

1. Data Storage module
2. REST API module

Both subcomponents are hosted on the same server but work as independent services in terms of the architecture. Both components are described in the next sections.

2.1 REST API Module

The xR4DRAMA REST API provides the functionality necessary for front-end applications to query and retrieve assets from the xR4DRAMA platform. The RESTful API provides specific calls to query through any number of metadata fields, such as project information, data crawled from social media, analysed data and user generated data. The following functionalities are available in the backend right now:

1. Create a user
2. Search users
3. Create project
4. Get project information and all the projects the user has access
5. Get all project information of a particular project
6. Get all users associated with the project
7. Leave a project
8. Notify text crawler to crawl new data

For integration purposes the developers of other components can use a swagger-based interface to integrate their module in the system. Figure 1, shows the screenshot of the swagger interface.

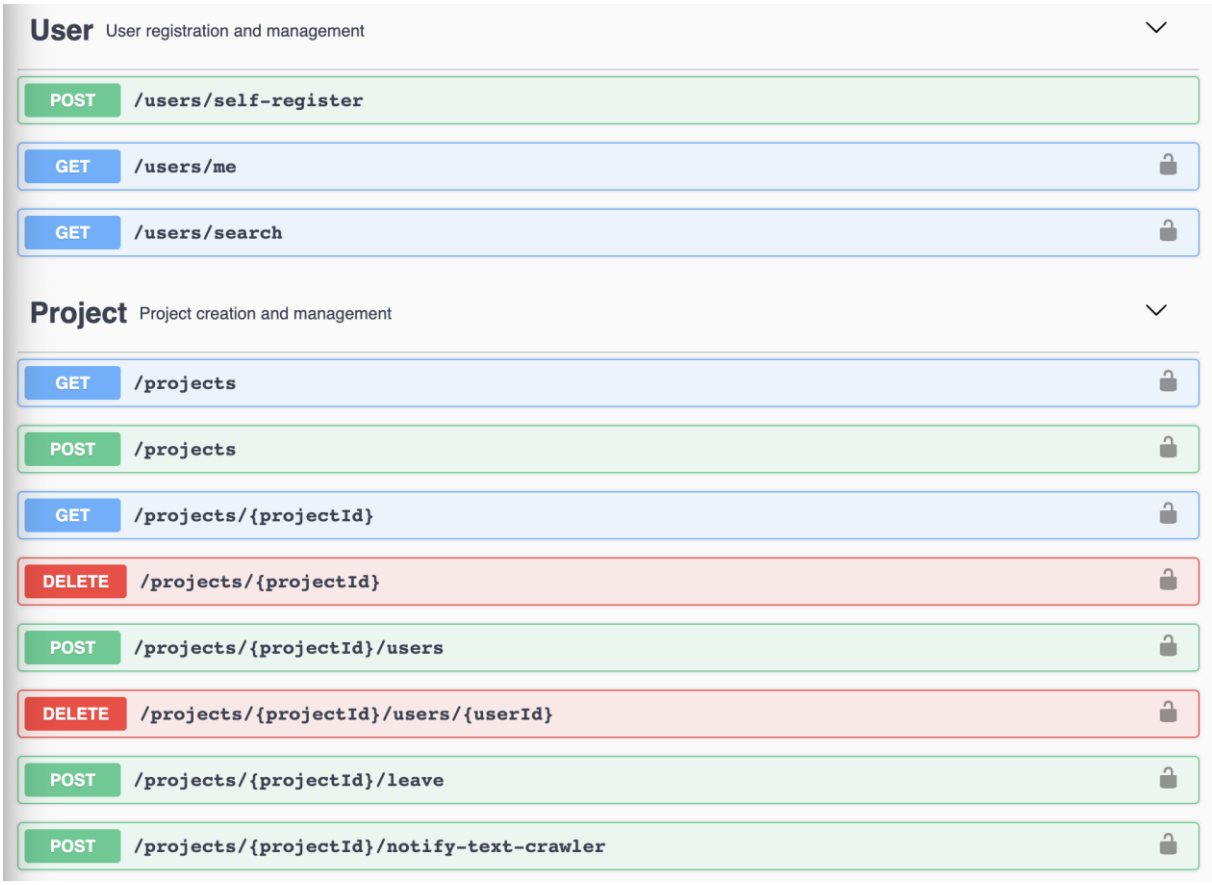


Figure 1. Screenshot of the REST API Swager

The REST API module is constantly being upgraded to provide more functionalities to the end user tools.

The following data is needed in the request to create a user and a project.

Create user:

```
user_create{
        email*          string($email) maxLength: 255
        username*       string maxLength: 255
        password*       string
}
```

Create project:

```
project_create{
        name*           string maxLength: 255
        description*    string
        location_nw*    geolocation_details{...}
```

```
        location_se*        geolocation_details{...}
        start_date          string($date) nullable: true
        end_date            string($date) nullable: true
    }
```

The swagger can be accessed at:

https://xr4drama-integration.nurogames.com/server/swagger/

The code of the tool is available on the Gitlab[1] of xR4DRAMA.

2.2 Data Storage

The data storage acts as the main data storage for the platform. All the project information, user information and user generated data is saved to the data storage. The module is a SQL table based solution hosted on a cloud server. The data in the storage can be accessed and manipulated through the REST API module. The data stored in the storage is the following:

User details:

```
    user_details_full{
        id          integer($int64)
                    minimum: 0
                    readOnly: true
        email       string($email)
                    maxLength: 255
                    readOnly: true
        username    string
                    maxLength: 255
                    readOnly: true
    }
```

Project Details:

```
    project_details_full{
        id              integer($int64)
                        minimum: 0
                        readOnly: true
        name            string
                        maxLength: 255
        description     string
        owner           user_details_short{...}
        users           [...]
        location_nw     geolocation_details{...}
        location_se     geolocation_details{...}
        start_date      string($date)
                        nullable: true
```

[1] https://gitlab.com/x358

```
        end_date                                string($date)
                                                nullable: true
        text_crawler_status                     {...}
        last_time_text_crawler_request_sent     string($date-time)
                                                nullable: true
                                                readOnly: true
    }
```

Geolocation Details:

```
    geolocation_details{
                    latitude*           number($double)
                                        nullable: true
                                        maximum: 90
                                        minimum: -90
                    longitude*          number($double)
                                        nullable: true
                                        maximum: 180
                                        minimum: -180
    }
```

The code for the data storage is available on the xR4DRAMA GitLab.

3 GIS SERVICE

3.1 Overview

xR4DRAMA is a location dependent platform that aggregates georeferenced information from various sources as its knowledge base. The GIS Service describes the backend component, responsible for collecting and organizing the aforementioned database in a location-coherent format, easily representable on a map and accessible to the users of the platform. It is also responsible for processing the georeferenced information, enabling various location-dependent functionalities (e.g. point-to-point navigation) to be accessible inside the platform. The service gathers information from various sources e.g. online geo-information databases, other xR4DRAMA services, or by the users of the platform.

Primarily, the GIS Service functions as a support to the AR app and, at the next phase, the Authoring and the VR frontend tools, by providing a geospatial database[2] with content of different modalities (2D and 3D visual content, audio files and generic data such as PDF files). The provided content is aggregated to a common reference coordinate system and serves as the underlying localization platform that will allow all relevant data to be suitably projected in 3D space. Simultaneously, the GIS Service offers the ability to execute geospatial queries that provide the user with the ability to navigate between two physical points given a set of rules, the ability to retrieve the closest points of interest (POIs) relevant to the user's GPS location, the ability to reason on overlapping areas, as well as the ability to reason on spatial coherence. All information can be organised, reformed, and served to the client apps in multiple suitable formats. At the same time, the GIS Service is assisting the AR app navigation in the real world's physical space.

To better explain the GIS Service, its support to the AR app is elaborated here as example. The xR4DRAMA AR app is a *location-aware* application that extracts data points from OpenStreepMap[3] (OSM), and user-defined online sources and aggregates them into various points of interest (POIs) and regions of interest (ROIs). These POIs and ROIs have been divided into thematic categories, and sub-categories, which contain relevant information about the geographical landmarks they represent, in order to much the User Requirements. The users of the application can interact with these points and update them to better suit one's needs, e.g. to update existing info, either in 2D view screens, or in Augmented Reality (AR) screens. Noticeably, the xR4DRAMA AR app is a *project-based* and a *location-based* application, where the world space boundaries (project geofence) of each project delimit the POIs that will be available to the project's registered users. The project boundaries essentially represent the field-of-action of a project, inside which all application functionalities are available, whereas outside these only some of the functionalities are available, i.e. the ones that are not related to AR and to the user's physical location.

[2] https://en.wikipedia.org/wiki/Spatial_database

[3] https://www.openstreetmap.org/#map=6/51.330/10.453

3.2 GeoService network

The GIS Service can be viewed as the central component of the GeoService network, an architecture logic that encapsulates all georeferenced components into a concrete end-to-end system. The GeoService network is responsible for overseeing the various requests originating from and to the GIS Service.

It essentially serves as a wrapping bundle, containing all logic related to geolocation operations.
The ***GeoService*** architecture consists of the following services:

- **GIS Service** is the main component of the GeoService architecture. It exposes an API that communicates with various open-source *Geoportals* to download geospatial information, builds the GIS database, and processes the database information to satisfy geospatial requests.
- **SubAPI** is a sub-application of the **GIS Service** that handles data provided by various other services of the xR4DRAMA platform. For now, it only handles the data provided by the visual analysis module.
- **GeoServer** is responsible for visualizing the geospatial data using standard practice communication protocols (WFS - Web Feature Service (WFS), WMS - Web Map Service).
- **Satellite Service** is an independent application that downloads and serves satellite data (satellite image or digital elevation model - DEM) from EU data and information access services - DIAS. The *Satellite Service* publishes the raster data to the ***GeoServer****, allowing the* users to access them through *the WMS* protocol.

The communication between the various geo-related processes is managed by the deployed Redis[4] server. The following graph (Figure 2) shows the base architecture of the *GeoService:*

[4] https://redis.io/

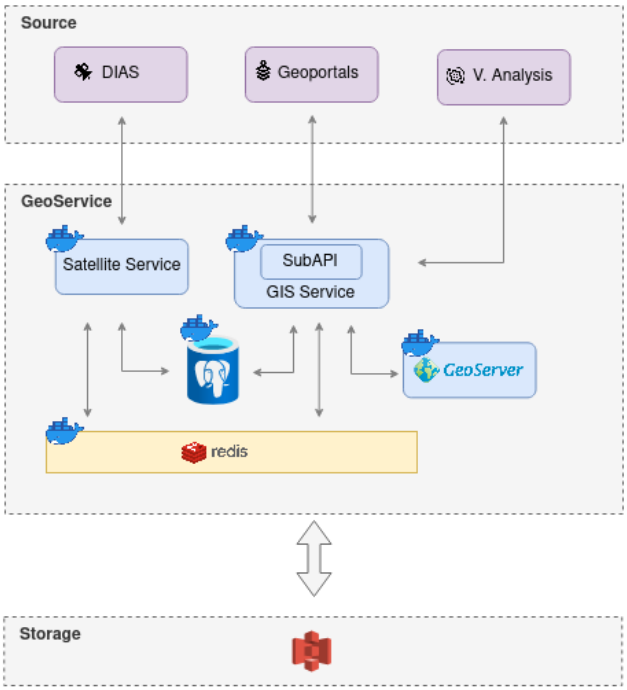


Figure 2. The base architecture of *GeoService*

3.3 GIS Service functionalities

Overall, the *GIS Service* provides the user with the following functionalities. It should be noted that these functionalities are tightly tied to the AR app, but also to the authoring tool and the VR collaboration tool, due to the fact that the frontend tools serve as the visualization medium in most cases, as well as the user interface for interacting with the GIS Service. Of course, the users can also connect to the GIS Service using typical desktop GIS tools.

- Create a new project
- Get information on existing projects and data categories
- Create new and edit existing POIs
- Navigate to a user-specified location
- Send a risk report to mark a dangerous area

The aforementioned functionalities will be briefly described below.

3.3.1 Create a new project

When a new project is created, the GIS Service is responsible for downloading relevant geospatial information inside the project's boundaries. The information acquisition process aims to facilitate the two distinct use cases of the xR4DRAMA platform:

- civil protection in dangerous weather conditions (*Disaster Management* use case of AAWA, PUC1)
- media planning (*Media Planning* use case of DW, PUC2)

More specifically, the GIS Service collects geospatial data using various Geoportals, the most prominent of them being **OpenStreetMap**. Detailed information about the available Geoportals is presented in the following sections.

Depending on the location of each project, one or more of those portals will be synced and used during the data aggregation procedure. **OpenStreetMap** stands as the most flexible geoportal, able to generalize and provide accurate information in most cases. The remaining portals, although specialized, can greatly augment the knowledge base of projects that fall under their scope. After aggregating all relevant information provided by the geoportals, the GIS Service extracts data from the *Visual Analysis* service of the xR4DRAMA platform through the SubAPI component.

3.3.2 Get Information on projects and data categories

The GIS Service is responsible for serving available information on registered projects and various data categories to the requesting users. Mostly through the AR app, a user is able to query the GIS Service and gain access to all available information of the projects they are part of. Inside a project's scope, one can query the service on various data categories to view relevant geospatial landmarks, represented in the application as points on a two-dimensional map (points of interest).

3.3.3 Create new and edit existing POIs

As it was already briefly explained, the geospatial landmarks are represented inside the GIS Service as self-contained points of interest (POIs). Using the GIS Service API, a user can create new POIs as user specified landmarks, or even edit and append new data elements to existing ones. More specifically, the data fields available for manipulation by the user of the service are:

- name
- description
- phone
- media files (images, videos, audio)

When creating a new POI, the user must specify the main and subcategory of the landmark. Those categories must be carefully selected, as they cannot be edited once the new POI is registered. More information about the categorization hierarchy of the landmarks is presented in the following sections. Out of the various data fields presented above, only the name field is essential to register a new POI. Moreover, when editing an existing POI, the user can manipulate any of the aforementioned data fields freely.

Concerning the media files, whenever interacting with a POI, a user can attach an arbitrary number of them and upload them to the GIS database. Those media files are tied to the chosen POI and serve as visual / acoustic descriptors of the landmark. Whenever media files are uploaded, the GIS Service is responsible for processing them if needed, to accommodate for a better user experience when interacting with them through the xR4DRAMA user

interface endpoints. More specifically, the potential processing steps that can be applied depending on the type of the image files, are described below:

- Create a thumbnail of the prototype image or video with size 250 x 250 pixels
- Resize the prototype image in *full HD* quality (1920 x 1080 pixels)

3.3.4 Navigate to a user-specified location

Furthermore, the *GIS Service* supports a navigation function, which finds and suggests the optimal road route by calculating the shortest path between a source point (user location) and a user-specified destination point.

In a nutshell, the basic steps to prepare the road network for the optimal route calculation are described below:

- Split the nodes of the roads via the ***pgr_nodeNetwork*** function
- Build a network topology based on the geometry information via the ***pgr_createTopology***

The following image (Figure 3) shows the result of the road network.

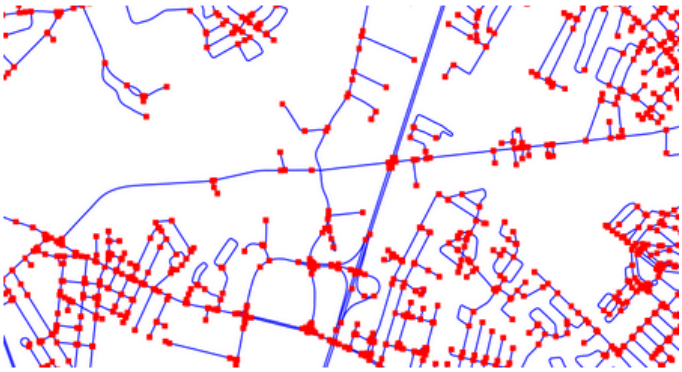


Figure 3. Road network served by the GIS Services

By taking advantage of the pre-calculated road network, the GIS Service uses the *pgr_dijkstra* path-finding algorithm to solve the shortest path problem with non-negative edge path costs (Figure 4).

Figure 4. An example of shortest path for routing (navigating) between two points

Another navigation feature, currently under development, concerns the addition of navigation modes (driving, walking). Such a feature will enable the user to choose the means of transport, thus affecting the cost calculation parameters.

The idea behind this new feature focuses on calculating the shortest route for available navigation modes.

- In case of **walking mode**, the cost of the shortest path results from the length of the network lines.
- Conversely, in case of **driving mode**, the cost is calculated by dividing the length of the lines by the maximum speed for each road type. In this navigation mode, road direction information (and one-way roads) is also taken into account by the algorithm.

3.3.5 Send a risk report to mark a dangerous area

One of the most crucial functionalities of the GIS Service is the ability to add emergency information by labeling a designated location as *danger area*. Specifically, when a user sends

a *risk report*, the service enables the ***risk_level*** (True / False) flag for each element inside the designated area, belonging to one of the following categories:

- roads
- railway
- buildings
- public services
- transportation
- naturals
- facilities
- infrastructure
- dines
- stores
- user-specified POIs

The *Risk report* feature concerns civil protection. Expressly, the elements in the danger zone are set to the database as dangerous destinations and may change the behavior of GIS the navigation service.

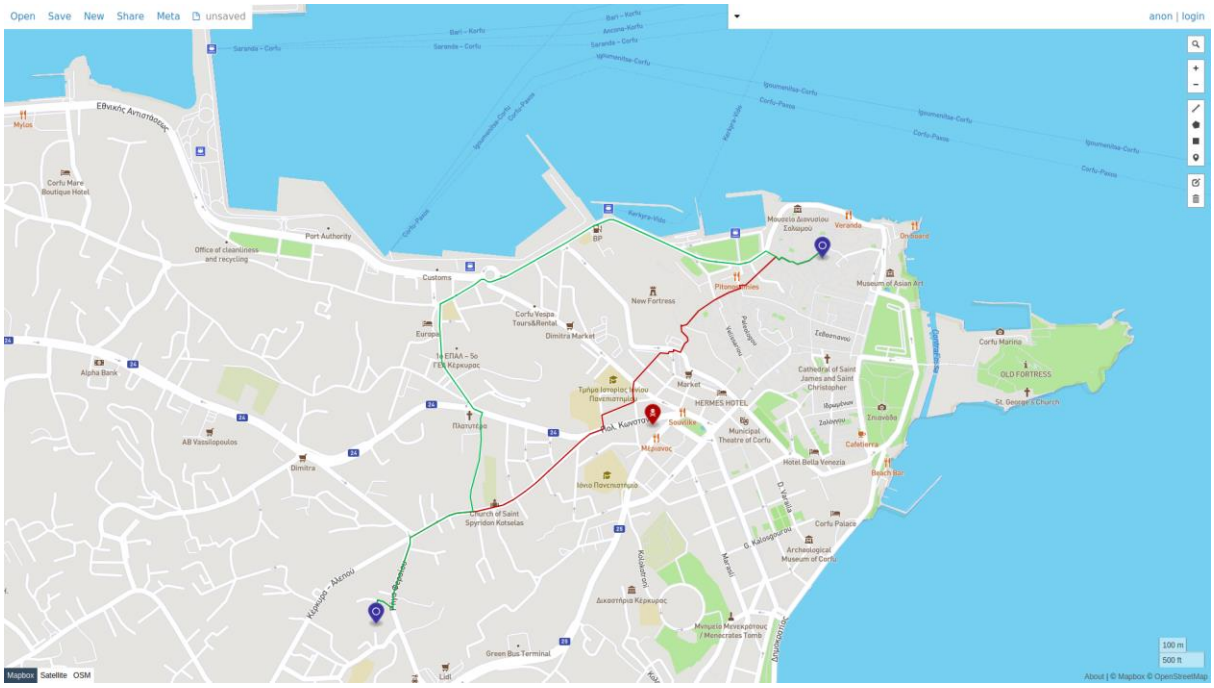


Figure 5. Above: estimation of the shortest path; below: estimation of the shortest path taking into account the risk reports

3.4 Data Response

In this section, the communication logic between the various components of the GeoService network will be analysed. The following analysis will describe both the intended

communication logic between the encapsulated components of the GeoService architecture, as well as the communication between the architecture and various other services, that are part of the xR4DRAMA platform.

Briefly, the idea behind the geospatial information display architecture is to have the *GIS database* and *GeoServer* encapsulated behind the GIS Service. Any other service that wants to access or manipulate geospatial information, can only interact with the GIS Service API, which is then responsible for sharing available information with the various GeoService components, when needed. The service API has also the ability to redirect into WMS and WFS access URLs, which can be parsed by the requesting services seamlessly (Figure 6). **Figure 6**

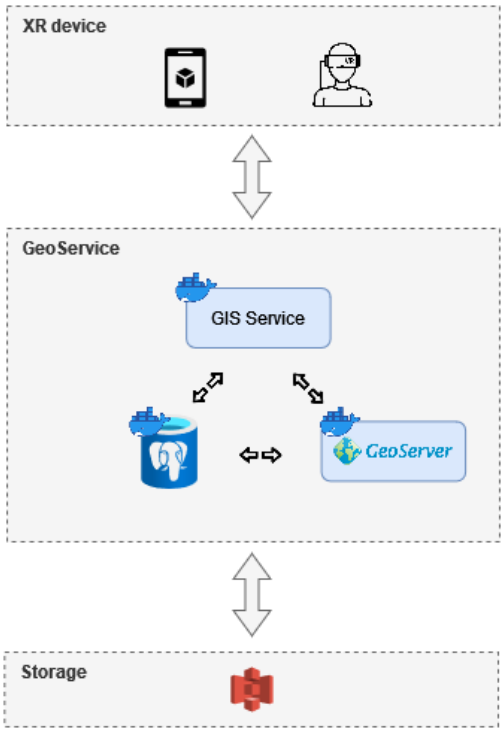


Figure 6. GIS Service architecture when serving the data

Another core component of the GeoService network architecture, responsible for managing communication between the various geo-related processes is the deployed Redis server. Redis is a flexible communication framework that organizes and simplifies asynchronous communication between subscribed processes. In the scope of the GeoService network, Redis is meant to enable efficient communication between the inner processes of the network. More specifically, the Redis server enables:

- Communication between services as event bus system (Pub/Sub)
- Caching data for fastest response
- Run tasks in the background of the service

To visualize the Redis server role and functionality, the architecture diagram presented below describes the background tasks running for the following *workers*:

- Create a new project

- Delete Project
- New scan request

Specifically, the various tasks are stored in Redis server queues and are executed in a serial manner:

- Project queue: Manages the creation and deletion of a project
- Scan request queue**:** Manages the satellite data collection from DIAS

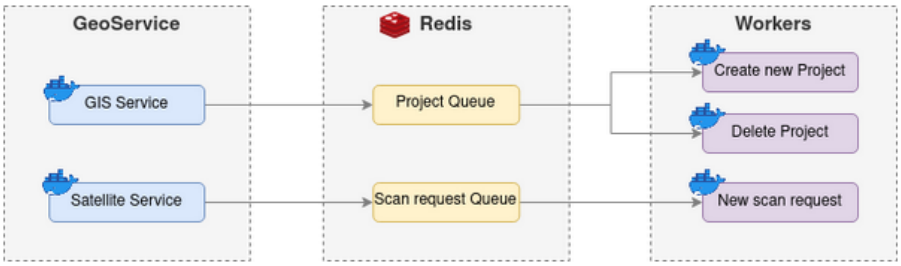


Figure 7. Asynchronous tasks via Redis server

4 User requirements fulfilled

Table 2, Table 3, Table 4, and Table 5 document the User Requirements (UR) that are supported and related to the GIS Service. Table 3 refers to the system requirements addressed by the GIS Service; Table 4 shows the general information requirements that relate to the GIS Service and Table 5 and Table 5 refer to the PUC specific requirements. All POIs can be updated with info from the user. Also, some info that are not available now, can be supported if the user (authoring tool or AR app) inserts them as POIs, or ROIs, in the 2nd version of the platform.

Req ID	Name	Description
SYS-2	End-user interface	An HCI that allows end-users to easily communicate with the system
SYS-3	Location ingest	Possibility to define a specific location
SYS-4	Location-query	A functionality of the system that allows end-users to initiate a query regarding a specific location in web- and cloud services
SYS-5	Aggregation of query status and results	The capacity of the system to observe the query and aggregate the identified content (e.g. videos, images, text) in an organised manner (categories, clusters, order)
SYS-6	Immersive visual representation	A functionality that visualises the location and additional information to enhance situation awareness (e.g., VR, AR)
SYS-10	Add own data	Control room staff can add images, videos, models or scans to improve data, or change certain data points that might not have been available, e.g., availability of public parking
SYS-12	Mobile application	An application that allows for operating the system in and from the field
SYS-14	Remote access to Level 1 situation awareness	The capacity of the system to grant remote users (e.g. location scout) access to a Level 1 situation awareness representation (partly or in total) via the mobile application. Citizens (PUC 1 only) should receive useful information such as alerts, risk zone warnings about areas at risk, position of safe areas, sand-bag distribution, shelters.

Table 2. System related requirements addressed by the GIS Service.

Info -ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
G-01	Accessibility	Transportation	Quality and type of road (highway, street, path), distance to railway	User/ OSM / opendata.gov.gr / Vicenza.gov.it	Transportation	Subway station, Bus station, Aerodrome, Road	Point	

			station and airport, public transport			quality, Tram station	
G-02	Geography, Surroundings	Buildings, Monuments	The shape, look and size of buildings, the purpose of buildings	OSM	GeometryView	Buildings	Polygon
				OSM	Leisure	Monument, Theatres, Attraction, Cinema	Point
G-03	Geography, Surroundings	Landmarks	Indication of high voltage lines, windmills and other landmarks	User/ Visual Analysis	Miscellaneous	Landmark	Point
G-04	Geography, Surroundings	Roads, Railroads	Indication of roads, highways, railroads	OSM	GeometryView	Railway, Roads	Lines

Table 3. Information-related requirements (General information) addressed by the GIS Services.

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
PUC 1-01	Geography, Surroundings	Rivers, Embankments	Indication of rivers, water courses, riverbanks	User/ OSM	Naturals	River	Polygon	
				User/ OSM / Vicenza.gov.it	Infrastructure	Embankments,	Point	
PUC 1-02	Geography, Surroundings	Manholes, electrical and gas pipes	Indication of manholes, electrical and gas pipes	User/ OSM/ Vicenza.gov.it	Infrastructure	Manhole	Point	
PUC	Genera	Areas of	Information on	User/	Risk	Safety	Point	

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
1-03	l information	attention, safe waiting places, shelters	the presence of areas of attention, safe waiting/parking places, shelters, sand-bag distribution areas	OSM	Prevention	areas		
				OSM	Naturals	Park	Point	
PUC 1-07	Flood risk management	Flooded elements	Information on flooded elements (e.g. cars and people inside the river)	User/ Visual Analysis	Risk Prevention	Elements in water		This subcategory will be renamed as Flooded elements, as well as and the endpoint of SubAPI
PUC 1-08	Flood risk management	River embankment's overtopping and/or breaking	Information related river embankments overtopping or breaking	User/ Visual Analysis	Risk Prevention	Overtopping water	Point	
PUC 1-09	Flood risk management	Elements at risk	Information on the presence of elements at risk and the degree of emergency	User	Risk Prevention	Risk reports	Polygon	The GIS Service provides a Danger Zones subcategory (Risk reports) to add emergency information
PUC 1-14	Accessibility	Navigation routes	Possibility to define an appropriate escape route or a suitable way to reach an intervention area					The GIS Service computes a route dynamically, considering the Danger Zones (Risk Reports)
PUC	Flood	Populatio	Information on	Visual	Risk	Eleme	Point	“Elements in

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
1-16	risk management	n potentially in danger	the potential presence of people in areas at risk	Analysis	Prevention	nts in water		water" subcategory for visual analysis service could be an approach to serve this requirement.
PUC 1-17	Flood risk management	Cultural heritage/ natural sites potentially in danger	Information on the potential presence of cultural heritage/natural sites	User	Risk Prevention	warnings	Point	At the point being, the GIS service have the POIs that regard the cultural heritage sites, so a user can manually identify what is at risk.

Table 4. Information-related requirements PUC1 (Disaster management)

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
PUC2-01	Environmental factors	Noise pollution	Identification of possible sources like busy roads or highways, crowds of people, factories, airports, railway stations, railway tracks	User/ Visual Analysis services	Miscellaneous	Noise pollution	point	
PUC2-02	Environmental factors	Light Pollution	Identification of possible sources like streetlights,	User/ Visual Analysis	Miscellaneous	Light pollution	Point	

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
			ads etc.					
PUC2-03	Accessibility	Parking	Availability of parking	User/ OSM	Facilities	Parking	Point	
				User/ OSM	Facilities	Wi-Fi	Point	The GIS Service also provided the availability of access Wi-Fi POIs.
PUC2-04	Legal Issues	Necessity of filming permit on the ground	Necessity of a permission for filming on the ground with a crew	Vicenza.gov.it/ Geodata.gov.gr	Prohibited zones	Ground	Polygon	The GIS Service also creates buffer zones at some specific subcategories when the project has a generic location.
PUC2-05	Legal Issues	Necessity of filming permit in the air	Type of permission for filming with drones, possible restrictions for filming	Vicenza.gov.it/ Geodata.gov.gr	Prohibited zones	Air	Polygon	The GIS Service also creates buffer zones at some specific subcategories when The project has a generic

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
								location.
PUC2-06	General information	General information on site/buildings	Textual information on specific sites/buildings in the area of interest					Only if available from OSM
PUC2-08	Facilities	Power	Availability and accessibility of power outlets	User/ OSM	Public Service	Charging station, Car rental, Fuel, Police, Pharmacy, Hospital, Bank, Atm	Point	
				User/ OSM	Public Service	Car rental	Point	
				User/ OSM	Public Service	Fuel	Point	
				User/ OSM	Public Service		Point	
PUC2-09	Facilities	Bathrooms	Availability and accessibility of bathrooms	User/ OSM	Facilities	Toilets	Point	
PUC2-10	Facilities	Restaurants, Cafés etc.	List of/indication of available places to eat/drink	User/ OSM	Dines	Café, Bar, Pub, Restaurant, Fast food	Point	
				User/ OSM	Stores	Supermarket, Grocery store, Minimarket	Point	
PUC2-11	Facilities	Props & Gear	Possibility to put props/decoration/etc. in the environment	User	Miscellaneous	Props & Gear	Point	The user can add the location, which has the

Info-ID	Category	Name	Description	Source of information or data	Category	Subcategory	Geometry	Comments
								possibility to put props.
PUC2-14	Environmental factors	Noise situation on site	The noise situation on site recorded by the location scout via a Smartex device as mp3-file	User	Miscellaneous	Noise pollution	Point	The user can upload a media file with the recorded noises, in a specific POI.

Table 5. Information-related requirements for PUC2 (Media production planning)

5 Available Geoportals in the GIS Service

In this section the available GeoPortals used by the GIS Service to extract geospatial information will be briefly described.

5.1 GeoPortals used

The following GeoPortals are currently taken into account when populating the GIS DB at project creation. The number of portals actually used during the creation processes depends tightly on the project's geographic location:

1. OpenStreetMap (OSM)
2. Vincenza authorities portal from AAWA (risk maps, flood maps, sandbags, shelters, etc.)[5]
3. Radar[6]
4. Open geodata from the Greek authorities[7]
5. Cadastre information from Greece (orthomaps)[8]
6. Open geodata from Berlin[9]

Each specific portal needs to be treated by creating a specific interface to populate the xR4DRAMA GIS Service DB.

5.2 Other GeoPortals

Other available GeoPortals that are currently investigated and might be deployed in later development phases are listed in Table 6.

	Site	Description	Data
1	HOT export tool (OSM data)	The Export Tool is an open service that creates customized extracts of up-to-date OSM data in various file formats. Download and use the data simply by crediting the OpenStreetMap contributors.	shapefile (.shp), GeoPackage (.gpkg), Garmin (.img), Google Earth (.kml), OSM (.pbf), MAPS.ME (.mwm), OsmAnd (.obf), MBTiles (.mbtiles)
2	USGS Earth Explorer	For satellite and aerial imagery, the USGS Earth Explorer is one of the largest free sources of data.	Landsat (.tiff), Sentinal(.tiff), DEM (.tiff), Point cloud (.tiff), Aerial imagery

[5] http://sit.comune.vicenza.it/SitVI/SitVi_conf/download/index.php?gruppo=Cartografia%20di%20base

[6] https://dpc-radar.readthedocs.io/it/latest/services.html

[7] https://geodata.gov.gr/

[8] https://www.ktimanet.gr/CitizenWebApp/Orthophotographs_Page.aspx

[9] https://opendata.gelsenkirchen.de/

	Site	Description	Data
3	DIVA-GIS	DIVA-GIS is a free computer program for mapping and geographic data analysis. With DIVA-GIS you can make maps of the world, or of a very small area, using, for example, state boundaries, rivers, a satellite image, and the locations of sites where an animal species was observed.	administrative boundaries, roads, railroads, altitude, land cover, population density, Elevation data (90M resolution), Global climate data
4	The Humanitarian Data Exchange	The Humanitarian Data Exchange (HDX) is an open platform for sharing data across crises and organisations.	.shp, .tif, .csv, .xls, .pdf
5	Natural Earth	Data themes are available in three levels of detail. For each scale, themes are listed on Cultural, Physical, and Raster category pages.	cultural (.shp), physical(.shp) raster(.tif)
6	Open Topography	Provides a portal to high spatial resolution topographic data and tools.	Point cloud, DEM (.tif), USGS 3DEP
7	SASPlanet	SASPlanet is a program designed for viewing and downloading high-resolution satellite imagery and conventional maps submitted by such services as Google Maps, DigitalGlobe, Kosmosnimki, Yandex.Maps, Yahoo! Maps, VirtualEarth, Gurtam, OpenStreetMap, eAtlas, Genshtab maps, iPhone maps, Navitel maps, Bings Maps (Bird's Eye) etc.	High resolution satellite imagery (.kmz, .png, .jpeg, .geotiff)
8	UNEP Environmental Data Explorer	The Environmental Data Explorer is the authoritative source for data sets used by UNEP and its partners in the Global Environment Outlook (GEO) report and other integrated environment assessments.	climate, disaster, ecosystem etc mostly in world extent
9	Copernicus Open Access Hub	Sentinel-2 is the highest resolution satellite imagery available to the public for free. Its interface is the Copernicus Open Access Hub.	Sentinal (tiff)
10	Terra Populus	Terra Populus (TerraPop for short) integrates census data from over 160 countries around the world. In fact, it spans up to six decades for household-level and aggregate data for more than 80 countries.	Environmental, Land use, Land cover, Climate
11	FAO GeoNetwork	It is the portal of free GIS data from the United Nations. The focus of GeoNetwork is to improve global sustainable development. For example, global agriculture, food security, and fisheries are some of its key free GIS data.	Agriculture, fisheries, land resource GIS data
12	CKAN	This is a demo site for CKAN, the leading Open Data portal sofware. Data hosted on this site might be deleted at any time!	.geojson, kml, .geotiff, .shp, .csv

	Site	Description	Data
13	PALSAR Forest/Non-Forest map	A very detailed (50m resolution) forest map for the whole globe, created from SAR data.	PSRFITS
14	UNEP WCMC	Variety of datasets from the United Nations Environment Programme including global wetlands, global distribution of coral reefs, mangrove distributions and more.	Dryland, Biogeographic, Mountains, Forest, Wetland
15	UNEP GEOdata	A wide range of data from the United Nations Environment Programme including Nighttime Lights, Pollutant Emissions, Commercial Shipping Activity, Protected Areas and Administrative Boundaries. To get data, choose Advanced Search and select Geospatial Data Sets from the top drop-down link	environment, oceans, elevation, society, climatoogy, meterology
16	GADM	Global administrative boundaries, with extensive attribute sets. Covers countries and up to four levels of internal administrative boundary (states, departments, counties etc).	Administrative boundary (.shp, .rds, .kml, geopackage)
17	World Borders Dataset	World country borders with attributes including country codes (FIPS, ISO etc), area and populations.	Administrative boundary (.shp)
18	Global Land Use Dataset	Gridded data at 0.5 degree resolution showing population density, potential natural vegetation, cropland extent, grazing land extent, built-up land extent, crop extent (for 18 major crops) and land suitability for cultivation	Veretation, cropland extent, built-up land extent etc.
19	OSM Metro Extracts	City-sized extracts of the OpenStreetMap dataset, updated weekly for cities across the world	.geojson, OSM (.PBF)
20	Geofabrik	OSM data extracts which are updated everyday	.shp,.geojson, OSM (.PBF)

Table 6. Portals with various information that can be considered for the 2nd prototype.

5.3 Geospatial information category hierarchy

The geospatial information provided by the available GeoPortals during project creation is organized by the GIS Service in a two-level category format. Each information element essentially contains a main and subcategory tag, representing its thematic footprint. The following table briefly depicts the available categories and their subcategory divisions. The category hierarchy below, aims to match the “Final user requirements” of D6.2 presented in 3.5 section. It should be noted that hierarchy includes some main categories and subcategories that were not explicitly described in D6.2 but are derived through discussions with other partners of the xR4DRAMA project (Table 7).

Categories	Subcategories
Transportation	Subway station
	Bus station
	Aerodrome
	Road quality
	Tram station
Geometry view	Railway
	Buildings
	Roads
Facilities	Parking
	Wi-Fi
	Toilets
Dines	Cafe
	Bar
	Pub
	Fast food
	Restaurant
Leisure	Archaeological site
	Museum
	Theatres
	Attraction
	Cinema
Public services	Pharmacy
	Police
	Hospital
	Bank
	ATM
	Fuel
	Car rental
	Hotel
	Charging station
Infrastructure	Power lines
	Embankment
	Manhole
	Substation
	Generator
	Pipeline
Stores	Supermarket
	Grocery store
	Minimarket
Miscellaneous	Light pollution

Categories	Subcategories
	Noise pollution
	Props & Gear
	Landmark
Prohibited zones	Air
	Ground
Risk Prevention	Warnings
	Safety areas
	Overtopping Water
	Risky areas
	Elements in water
Naturals	Park
	River

Table 7. List of the *Categories* and *Subcategories* as organized in the GIS Service. These categories divisions are presented to the user inside the AR app and the authoring tool.

6 Deployment

6.1 General Info

The main services under the GeoService network architecture are documented in the following Swagger links (Figure 8 and Figure 9):

- GIS Service → https://geoservice.xr4drama.up2metric.com:8001/docs
- SubAPI → https://geoservice.xr4drama.up2metric.com:8001/subAPI/docs
- Satellite Service → https://geoservice.xr4drama.up2metric.com:8002/docs

The SubAPI of the GeoService handles the data elements provided by the Visual Analysis service, whereas the Satellite service processes the satellite data.

The code for the GIS Service can be found at the following link:

- https://bitbucket.org/up2metricPC/geoservices/src/master/

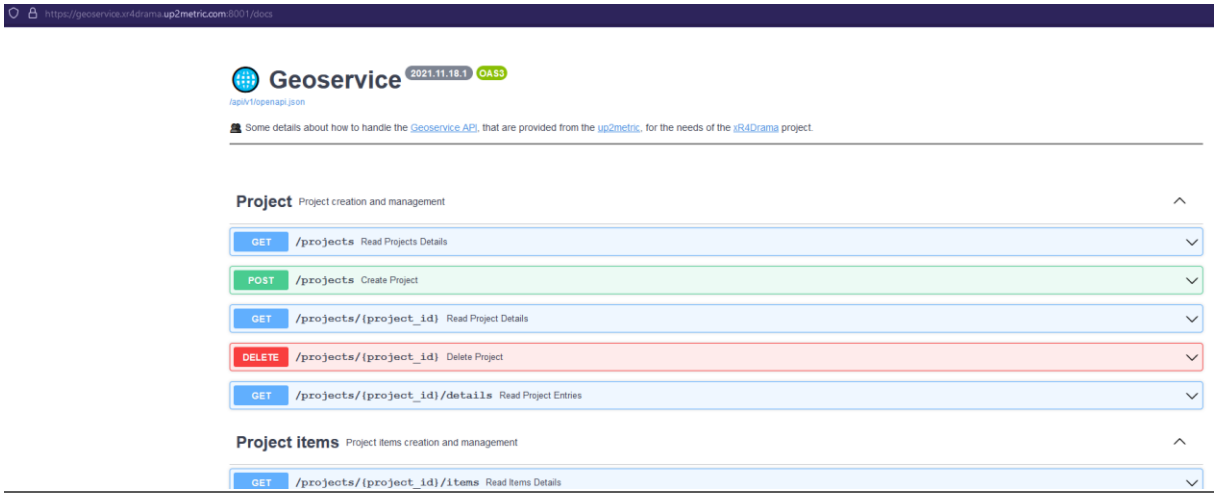


Figure 8. Online documentation (Swagger) for the GIS Service.

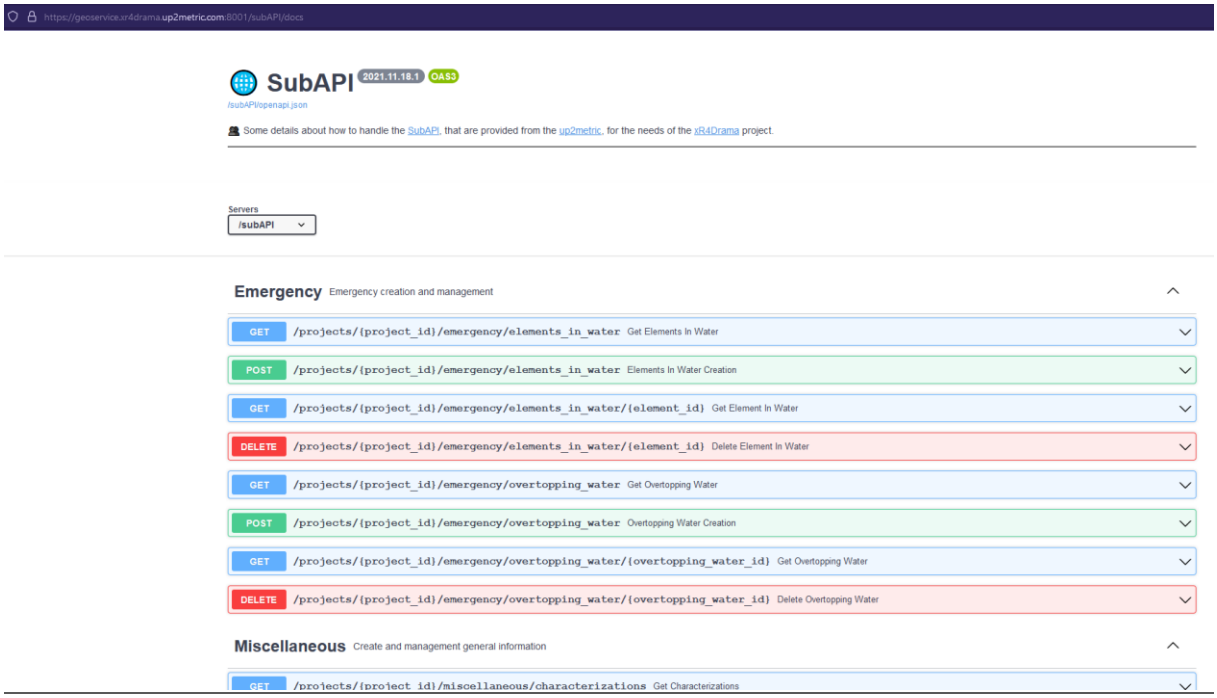


Figure 9. Online documentation (Swagger) for the SubAPI.

6.1.1 Hardware Requirements

To deploy the GIS services, the system should follow the requirements in Table **8**.

	Requirements
Operating System	Linux/UNIX
CPU power	1,8 GHz or higher
vCPU	2 or higher
RAM	4 GB or higher
Disk storage	64 GB or more

Table 8. Hardware requirements for running the GIS Services.

6.2 Demos

In this section, a variety of demos is given in order to use the GIS services as part of the GeoServices toolbox developed for the needs of the xR4DRAMA platform.

6.2.1 Access GeoServer with QGIS

Although an API has been created for the needs of the project to access programmatically the GIS data and offer a means of communication to the various services, the data in the GeoServer can be easily accessed via a typical GIS desktop application. The next guideline provides a first means of connecting and manipulating the data from QGIS[10] application.

[10] https://qgis.org/en/site/

- Access the Data Source Manager and select WFS or WMS protocol

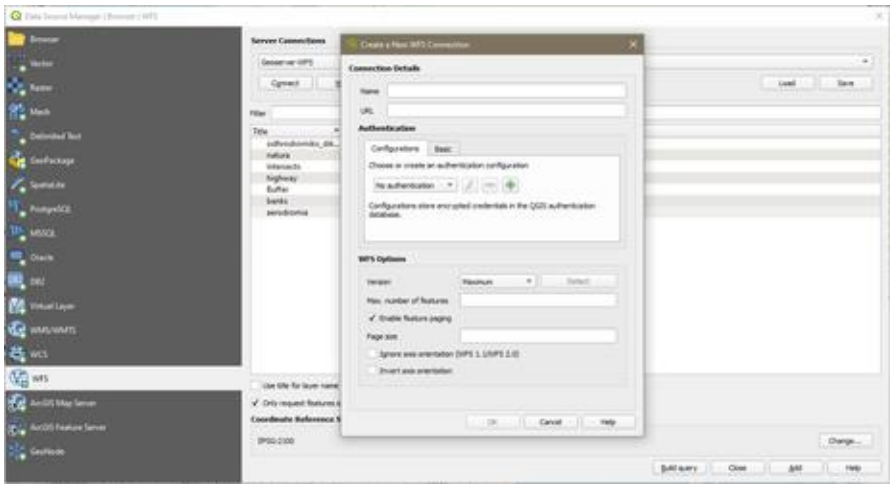


Figure 10. Create a new WFS connection

- Give some name for the connection like 'Goeserver-WFS'
- In URL tab write the following http request
    - **WFS:**https://geoservice.xr4drama.up2metric.com:8443/geoserver/ows?service=wfs&wersion-2.0.0&request=GetCapabilities
    - **WMS:** https://geoservice.xr4drama.up2metric.com:8443/geoserver/ows?service=wms&wersion-2.0.0&request=GetCapabilities

- Select the Basic tab and write the GeoServer name and Password

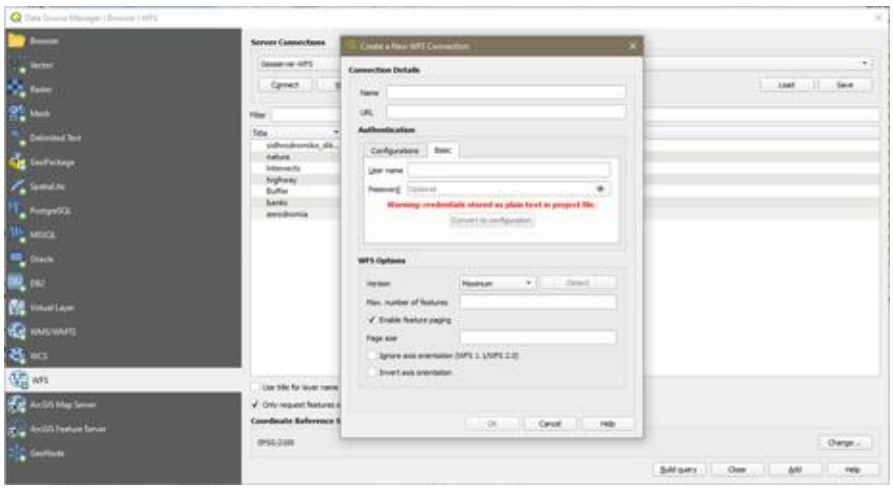
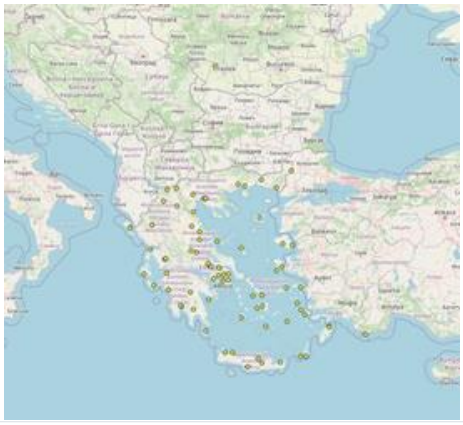


Figure 11. Create a new WFS connection using the name and password

- Select the server
- Start editing to add a new point with random id and 'test_edit' name or edit an existing point.



Data Output | Explain | Messages | Notifications

	gid [PK] integer	id double precision	onoma character varying (80)	geom geometry
64	64	64	Ικαρία LGIK JIK	0101000000E8D91...
65	65	65	Ιπποκράτης LGKO KG Κω	0101000000534D7...
66	66	66	Κάλυμνος LGKY JKL	01010000005C57B...
67	67	67	Λέρου LGLE LRS	01010000000C57E...
68	68	68	Αστυπάλαια LGPL JTV	0101000000AB3F1...
69	69	69	Σαντορίνη LGSR JTR Θήρα	0101000000CB5A...
70	70	70	Μήλου LGML MLO	0101000000F9E15...
71	71	71	Πάρος LGPA PAS	01010000006ECA9...
72	72	72	Νάξου LGNX JNK	0101000000B5199...
73	73	73	Μύκονος LGMK JMK	010100000005E4D...
74	74	74	Σύρου LGSO JSY	0101000000729D2...
75	75	1000	test_edit	010100002034080...

Figure 12. Select and edit POIs in QGIS.

6.3 GeoService communication with the back-end API

This demo regards the communication of the GIS services component with the platform backend via the developed API. The demo instructions are available in a web page[11] that is kept up to date with the latest changes to the services as the project proceeds. The following instructions guide the reader through a simple demo on how to handle the ***GeoService*** as provided by the two main components: the *GIS Service* and the *GIS database*. The following features are presented:

- New project creation at the GeoService API
- Communication among ARapp - Back-end API - GeoService
- Multimedia files upload via the ARapp
- File a risk report

[11]https://up2metric.atlassian.net/wiki/external/2032992266/NDE4NjM1ZDYzOGFkNGY0NWFlOTBlYjdjMTI1ZmZlMzA?atlOrigin=eyJpIjoiYjA4ZmUzZDgwZDkxNGFlMDgzMzQzNDE3MmY2YWMwYzIiLCJwIjoiYyJ9

- Navigate between two points

6.3.1 New project creation at the GeoService API

- POST method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Body** form-data:

Name	Type	Nullable
name	string (e.g. Corfu-project)	False
county	string (e.g. Greece)	True
city	string (e.g. Corfu)	
description	string (e.g. Project about Corfu Greece)	True
location_nw	{ "latitude": 39.82462208372805, "longitude": 19.62467160075903 }	False
location_se	{ "latitude": 39.35766163717121, "longitude": 20.12832574546337 }	False

GIS Service API responses the following body structure with status code 201:


```
{
"id": 3,
"status": "completed",
"name": "Corfu project",
"city": "Corfu",
"country": "Greece",
"description": "Mission about corfu",
"started_at": "2021-11-18 21:42:41",
"completed_at": "2021-11-18 21:46:35",
"area": {
          "height": "51.85 km",
  "width": "43.12 km"
},
"location_nw": {
  "latitude": 39.82462208372805,
            "longitude": 19.62467160075903
},        "location_se": {
       "latitude": 39.35766163717121,
  "longitude": 20.12832574546337
},
"start_date": "2021-11-19",
"end_date": "2021-12-19",
"created_at": "2021-11-18 21:42:39"
}
```

- Use the project `status` to check if the project's data are downloaded. It must be `completed`
- The name of the project must be unique. If it's not, the API returns `project name already exits` with status code 404
- if the geometry has an error, the API returns `unaccepted geometry` with status-code: 404

6.3.2 Communication among ARapp - Back-end API - GeoService

This section explains how the *ARapp* connects to the *back-end* and how it exchanges data with the *GIS services* depending on the type of the data.

- The first step from the ARapp side is to get the **authorization** from the back-end API.

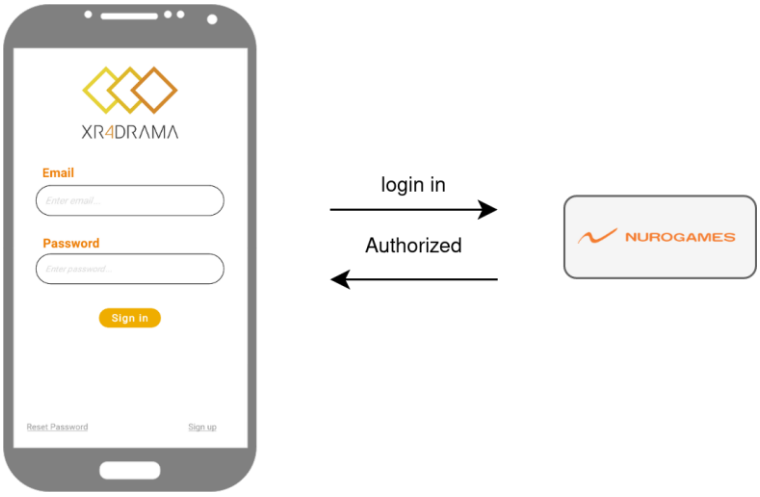


Figure 13. The User authenticates via the back-end API.

- In the second step, the ARapp needs the available projects for user access.

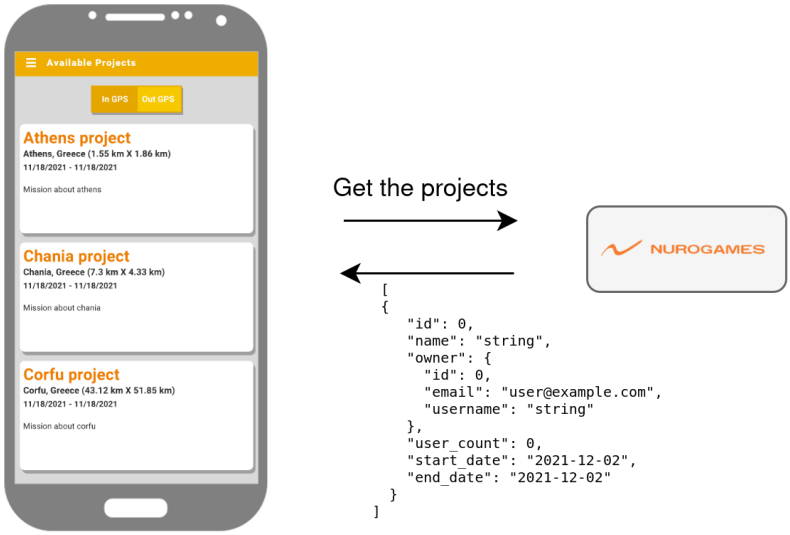


Figure 14. Retrieve user projects from NURO backend

- When the client selects a subcategory, the *ARpp* collects all the necessary information from the GIS Service:
    - Vector (WFS) / Raster (WMS) information for visualization the elements of subcategories
    - The media files (image, video, audio) and comments

Figure 15. Overview of the ARapp connection to the GeoServer.

The following structure is an example of how the ARapp gets the information from the GIS Service, to collect all the information about the dine for the area of interest defined by bounding box, at the project with id=1:

- **GET** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/1/layers?mainCategory=dines&subCategory=cafenes&output_format=geojson&bbox=-180,-90,180,90
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Request** Params:

Name	Type	Nullable
mainCategory	string	False
subCategory	string	False
output_format	string (geojson for WFS / image/png for WMS	False
bbox	min_Longitude, min_Latitude, max_Longitude, max_Latitude	False

Table 9. Example of ARapp getting information from the GIS Service

The GIS Service responds the following structure for WFS and provides the following image for WMS protocol:


```
{
  "id": 0,
  "mainCategory": "string",
  "subCategory": "string",
  "name": "string",
  "phone": "string",
  "description": "string",
  "files": [
    {
      "id": 0,
      "type": "string",
      "format": "string",
      "file_url": "string",
      "file_resized_url": "string",
      "file_thumbnail_url": "string"
    }
  ],
  "comments": [
    {
      "id": 0,
      "comment": "string",
      "created_at": "2021-12-01 01:00:35"
    }
  ],
  "corrapted_files": [
    "string"
  ],
  "location": {
    "latitude": 37,
    "longitude": 24
  },
  "created_at": "2021-12-01 01:00:35"
}
```

Figure 16. Image streamed by the WMS protocol in the demo communication between the ARapp and the Backend

6.3.3 Create new POI via the ARapp

In addition to project management, *GeoService* offers the possibility of creating or editing new points of interest for any available data categories. The ability to add a name, description, phone number and even media files (image, video, audio text files) is supported at these points.

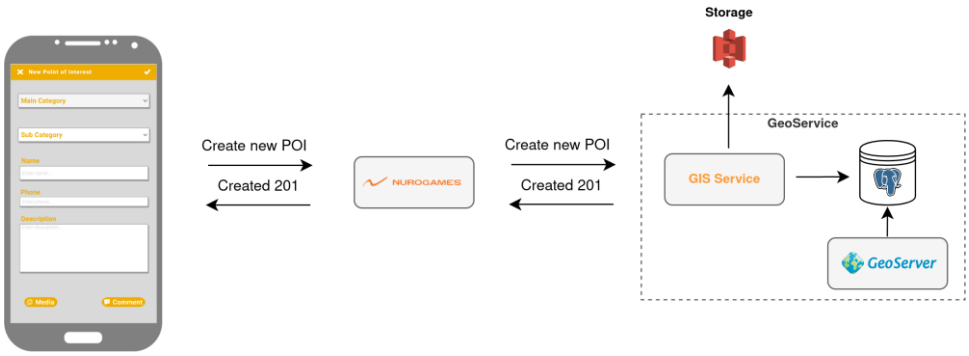


Figure 17. Overview of communications to create new POI via the ARapp

For now, the mobile app sends the information to the GeoService API with the following structure:

- **POST** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/1/items
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Body** form-data:

Name	Type
description	string
files	image, audio, video , text file
location	{"latitude": 37, "longitude": 24 }
mainCategory	string
name	string
phone	string
subCategory	string

Table 10 Example POI via the ARapp

The GeoService API response the following body structure with status code 201

```
{
"id": 0,
"mainCategory": "string",
"subCategory": "string",
"name": "string",
"phone": "string",
"description": "string",
"files": [
{
    "id": 0,
    "type": "string",
    "format": "string",
    "file_url": "string",
    "file_resized_url": "string",
    "file_thumbnail_url": "string"
}],
"comments": [
{
    "id": 0,
    "comment": "string",
    "created_at": "2021-12-01 01:00:35"
}
],
"corrapted_files": [ "string" ],
    "location": {
    "latitude": 37,
    "longitude": 24
},
"created_at": "2021-12-01 01:00:35"
}
```

6.3.4 File a risk report

The ***risk report*** is a warning of a significant event that has occurred. It can affect other categories of data by changing the risk level that is within the event. Specifically, when the user adds a *risk report*, the service searches for elements within the event and enables the ***risk_level*** (True / False). Also, it may change the navigation guides for the clients.

Risk reports have the following endpoints:

Create risk report

- **POST** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/1/risk_reports
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Body** form-data:

Name	Type
title	string
level	int (1 - 5)
description	string
location_nw	{"latitude": 37, "longitude": 24 }
location_se	{"latitude": 37, "longitude": 24 }

Table 11 Example of a risk report

The GeoService API response the following body structure with status code 201

```
{
"id": 0,
"title": "string",
"description": "string",
"level": 0,
"enabled": true,
"location_nw": {
    "latitude": 37,
    "longitude": 24
},
"location_se": {
     "latitude": 37,
     "longitude": 24
},
"created_at": "2021-12-01 01:00:35"
}
```

The users can also mark a *risk report* as disabled to close the alarm. Otherwise, it will get disabled after a fixed time (10 days) by the service.

Update risk report

- **PUT** method
- **URL:** http://localhost:8001/projects/1/risk_reports/1?enabled=False
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Request** Params

enabled True or False

The GeoService API response status code 202 without a message.

Also, ***Geoserver*** with the communication protocols (*WMS*, *WFS*) supports recovery categories at risk for a specific project.

WFS example

- GET method
- **URL:** https://geoservice.xr4drama.up2metric.com:8443/geoserver/xr4drama/wfs?service=WFS&version=2.0.0&request=GetFeature&typeName=xr4drama:elements_on_risk&viewparams=project_id:1&outputFormat=json&srsName=EPSG:4326&bbox=39.35235227593244,19.56802368164062,39.62558992070296,20.13107299804687,urn:ogc:def:crs:EPSG:4326
- **Authorization** Basic Auth:

Username	xr4drama_partners
Password	xr4drama_partners

- **Request** Params

service	WFS
version	2.0.0
request	GetFeature
typeName	xr4drama:elements_on_risk
viewparams	project_id:1
srsName	EPSG:4326
outputFormat	json
bbox	39.35235227593244,19.56802368164062,39.62558992070296,20.13107299804687,urn:ogc:def:crs:EPSG:4326

WMS example

- GET method
- **URL:** https://geoservice.xr4drama.up2metric.com:8443/geoserver/xr4drama/wms?service=WMS&version=1.1.0&request=GetMap&layers=xr4drama:elements_on_risk&viewparams=project_id:1&height=483&width=805&transparent=true&srsName=EPSG:4326&format=image/png&bbox=19.56802368164062,39.35235227593244,20.13107299804687,39.62558992070296
- **Authorization** Basic Auth:

Username	xr4drama_partners
Password	xr4drama_partners

- **Request** Params

service	WMS
version	1.1.0
request	GetMap
viewparams	project_id:1
width	805
height	483
transparent	true
srsName	EPSG:4326
format	image/png
layers	xr4drama:elements_on_risk
bbox	19.56802368164062,39.35235227593244,20.13107299804687,39.62558992070296

6.3.5 Navigate between two points

In addition, the GeoService API provides the possibility of *navigation* by calculating the shortest route, including the *risk level*. Specifically, the clients of the services can get the shortest path between the source point (location of the user) and target point.

- **GET** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/1/routing?lat_source=19.907312393188477&lon_source=39.616664597733646&lat_target=19.922504425048825&lon_target=39.62635017278915
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Request** Params

lat_source	19.907312393188477
lon_source	39.616664597733646
lat_target	19.922504425048825
lon_target	39.62635017278915

- GeoService API response the shortest path with GeoJSON format:


```
{
    "type": "FeatureCollection",
    "features": [
        {
            "id": "0",
            "type": "Feature",
            "properties": {},
            "geometry": {
                "type": "LineString",
                "coordinates": [
                    [
                        19.9071143,
                        39.6166744
                    ],...,
                    [
                        19.9223723,
                        39.6262237
                    ]
                ]
            },
            "bbox": [
                19.9071143,
                39.6166744,
                19.9223723,
                39.6263578
            ]
        }
    ],
    "bbox": [
        19.9071143,
        39.6166744,
        19.9223723,
        39.6263578
    ]
}
```


6.3.6 SubAPI communication with visual analysis

This page walks you through a simple demo on handling the SubAPI provided from the up2metric in the xR4DRAMA EU research project. The SubAPI service takes the data provided by the visual analysis service. These instructions are being kept up to date in a webpage[12].

Useful links

- URL: https://geoservice.xr4drama.up2metric.com:8001/subAPI
- Swagger page: https://geoservice.xr4drama.up2metric.com:8001/subAPI/docs
- OpenAPI: https://geoservice.xr4drama.up2metric.com:8001/subAPI/openapi.json

[12]https://up2metric.atlassian.net/wiki/external/2083520513/MzZmZWZlMzNkYWI4NGYxY2E0OTAyMzVjNTQwMzEzMmU?atlOrigin=eyJpIjoiMDFiODA4Zjc4ZDJmNDRlZDk0MGJkM2Q4OGIxNmFkYTkiLCJwIjoiYyJ9

The SubAPI service authorizes the requests using API KEYs. So, in order for a request to be authorized, it should provide an API_KEY in the header of the request, that is accepted. For example:

```
{
  header: {
    api_key: <the given key>
  }
}
```

All the requests should contain the `api_key` part in the header, except those for the Swagger page.

The main categories managed by the service are:

- General Information
  - Elements characterizations
  - Pollution
- Emergency information
  - Elements in water
  - Overtopping water

6.3.7 Miscellaneous Information

Elements characterizations

The SubAPI provides the ability to characterization of categories. Specifically, the acceptable types are:

- Building
- Road
- Landmark

Example:

- **POST** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/{pid}/miscellaneous/characterizations
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Body** raw (JSON)

```
[
 {
    "category": "road",
    "subcategory": "root",
```

```
            "location": {
              "latitude": 37.987142881365465,
              "longitude": 23.75297516584396
            }
          },
         {
            "category": "landmark",
            "subcategory": "church",
            "location": {
              "latitude": 37.987142881365465,
              "longitude": 23.75297516584396
            }
          },
          {
            "category": "building",
            "subcategory": "monument",
            "location": {
              "latitude": 37.987142881365465,
              "longitude": 23.75297516584396
            }
          }
        ]
        Response the following JSON:
        [
            {
                "category": "road",
                "subcategory": "root",
                "location": {
                    "latitude": 37.98567787856392,
                    "longitude": 23.754801750183105
                }
            },
            {
                "category": "landmark",
                "subcategory": "church",
                "location": {
                    "latitude": 37.98567787856392,
                    "longitude": 23.754801750183105
                }
            },
            {
                "category": "building",
                "subcategory": "monument",
                "location": {
                    "latitude": 37.98567787856392,
                    "longitude": 23.754801750183105
                }
            }
        ]
```

To receive all available data regarding object characterizations:

- **GET**: method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/{pid}/miscellaneous/characterizations
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Response** the following JSON:

```
[
    {
        "id": 1,
        "category": "road",
        "subcategory": "root",
        "created_at": "2021-11-11T07:33:08.698107+00:00",
        "location": {
            "latitude": 37.98567787856392,
            "longitude": 23.75480175018311
        }
    },
    {
        "id": 2,
        "category": "landmark",
        "subcategory": "church",
        "created_at": "2021-11-11T07:33:08.698107+00:00",
        "location": {
            "latitude": 37.98567787856392,
            "longitude": 23.75480175018311
        }
    },
    {
        "id": 3,
        "category": "building",
        "subcategory": "monument",
        "created_at": "2021-11-11T07:33:08.698107+00:00",
        "location": {
            "latitude": 37.98567787856392,
            "longitude": 23.75480175018311
        }
    }
]
```


Additionally, the ability to add a *Query parameter* to export a specific category is supported:

- **GET**: method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/{pid}/miscellaneous/characterizations?category=building
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Response** the following JSON:


```
[
    {
        "id": 3,
        "category": "building",
        "subcategory": "monument",
        "created_at": "2021-11-11T07:33:08.698107+00:00",
        "location": {
            "latitude": 37.98567787856392,
            "longitude": 23.75480175018311
        }
    }
]
```


Polution

The SubAPI provides the ability to add the location of the noisy or light pollution environment.

Example:

- POST method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/{pid}/miscellaneous/pollution
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Body** raw (JSON)

```
[
  {
    "noise": true,
    "location": {
      "latitude": 37.987142881365465,
      "longitude": 23.75297516584396
    }
  },
    {
    "light": true,
    "location": {
      "latitude": 37.987142881365465,
      "longitude": 23.75297516584396
    }
  }
]
```

- **Response** the following JSON:

```
[
  {
    "noise": true,
    "location": {
      "latitude": 37.987142881365465,
      "longitude": 23.75297516584396
    }
  },
    {
    "light": true,
    "location": {
      "latitude": 37.987142881365465,
      "longitude": 23.75297516584396
    }
  }
]
```

To receive the available pollution data for a specific category (*light*, *noise*):

- GET: method

- **URL:** https://geoservice.xr4drama.up2metric.com:8001/projects/{pid}/miscellaneous/pollution?category=noise_pollution
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Response** the following JSON:


```
[
    {
        "id": 4,
        "noise": true,
        "light": null,
        "created_at": "2021-11-11T10:17:37.973920+00:00",
        "location": {
            "latitude": 37.98714288136546,
            "longitude": 23.75297516584396
        }
    }
]
```


7.3.8 Emergency information

Elements in water

The SubAPI provides the ability to add the location and the number of people and vehicles that are in danger.

- **POST** method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/subAPI/projects/{pid}/emergency/elements_in_water
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

- **Body** raw (JSON)


```
[
    {
      "element_type": "car",
      "count": 10,
      "location": {
        "latitude": 39.62294550056561,
        "longitude": 19.915895462036133
      }
    },
    {
      "element_type": "people",
      "count": 2,
      "location": {
        "latitude": 39.615474467702875,
        "longitude": 19.918384552001953
      }
```

```
            }
        ]
```

- **Response** the following JSON:


```
        [
            {
              "element_type": "car",
              "count": 10,
              "location": {
                "latitude": 39.62294550056561,
                "longitude": 19.915895462036133
              }
            },
            {
              "element_type": "people",
              "count": 2,
              "location": {
                "latitude": 39.615474467702875,
                "longitude": 19.918384552001953
              }
            }
        ]
```


To receive the available data of elements in danger:

- **GET**: method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/subAPI/projects/1{pid}/emergency/elements_in_water
- **Request** Headers:

API_KEY 8t8YKQegHHl4gMCPd5TF

- **Response** the following JSON:


```
        [
            {
                "id": 6,
                "element_type": "car",
                "count": 10,
                "created_at": "2021-11-11T10:42:19.236744+00:00",
                "location": {
                    "latitude": 37.98714288136546,
                    "longitude": 23.75297516584396
                }
            },
            {
                "id": 7,
                "element_type": "people",
                "count": 2,
                "created_at": "2021-11-11T10:42:19.236744+00:00",
                "location": {
                    "latitude": 37.98714288136546,
                    "longitude": 23.75297516584396
                }
            }
        ]
```


Overtopping water

The SubAPI provides the ability to add the location of the river which overtopping water.

- POST method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/subAPI/projects/{pid}/emergency/overtopping_water
- **Request** Headers:

API_KEY	8t8YKQegHHI4gMCPd5TF

- **Body** raw (JSON)

```
[
    {
      "overtopping_water": true,
      "location": {
        "latitude": 39.62294550056561,
        "longitude": 19.915895462036133
      }
    },
    {
      "overtopping_water": true,
      "location": {
        "latitude": 39.62294550056561,
        "longitude": 19.915895462036133
      }
    }
]
```

Response the following JSON:

```
[
    {
        "overtopping_water": true,
        "location": {
            "latitude": 37.98714288136546,
            "longitude": 23.75297516584396
        }
    },
    {
        "overtopping_water": true,
        "location": {
            "latitude": 37.98714288136546,
            "longitude": 23.75297516584396
        }
    }
]
```

To receive the available data of the location which overtopping water:

- GET: method
- **URL:** https://geoservice.xr4drama.up2metric.com:8001/subAPI/projects/{pid}/emergency/elements_in_water
- **Request** Headers:

API_KEY 8t8YKQegHHI4gMCPd5TF

Response the following JSON:


```
[
    {
        "id": 8,
        "overtopping_water": true,
        "created_at": "2021-11-11T10:59:42.920672+00:00",
        "location": {
            "latitude": 37.98714288136546,
            "longitude": 23.75297516584396
        }
    },
    {
        "id": 9,
        "overtopping_water": true,
        "created_at": "2021-11-11T10:59:42.920672+00:00",
        "location": {
            "latitude": 37.98714288136546,
            "longitude": 23.75297516584396
        }
    }
]
```


6.4 Future Tasks

The GIS service has evolved to be a core backend component for the xR4DRAMA platform; thus, it is expected to have at least two more development cycles, during which the GIS service will adapt to communicate efficiently with all the project services under development and to include all user required info and its appropriate representation. Additionally, new features will be added to fulfil and facilitate user needs, especially after the user evaluation cycles. Some of the foreseen changes and additions are:

- Integration with the 3D reconstruction service
- Integration with the Satellite (remote sensing) service
- Integration with the Knowledge Base (KB) and the Decision Support System (DSS)
- Full and seamless integration with the platform backend
- Inclusion of more information related to the disaster management scenario and better handling of the existing information
- Integration with the AAWA data base
- Facilitate the *danger* and *risk zones* for the disaster management scenario
- Facilitate the *task list*, if needed to pass through the GIS DB
- Improve the routing between two world points feature:
    - Update the distance to target based on the distance already travelled
    - Estimate new routes when the user deviates while travelling
    - Rotate the map to the user's direction
    - Evaluate the routes estimated based on real-time data regarding the danger zones
    - Expand the support for regions of interest, not only points of interest, which is already supported, but it requires more integration with the frontend tools.

7 Augmented Reality application for Location scouts and First Responders

The Augmented Reality (AR) application – AR app – is documented in detail in the deliverable D4.1 “AR interactive environment and applications”. The first prototype of the ARapp includes most of the features the are presented via a 2D screen, as well as some basic features that work based on the 3D environment in the AR view, and it targets resolving the bilateral communication between the control room and the field, as far as the georeferenced data is concerned. Some more features, such as the task list as also prototyped. For more information, please check the D4.1.

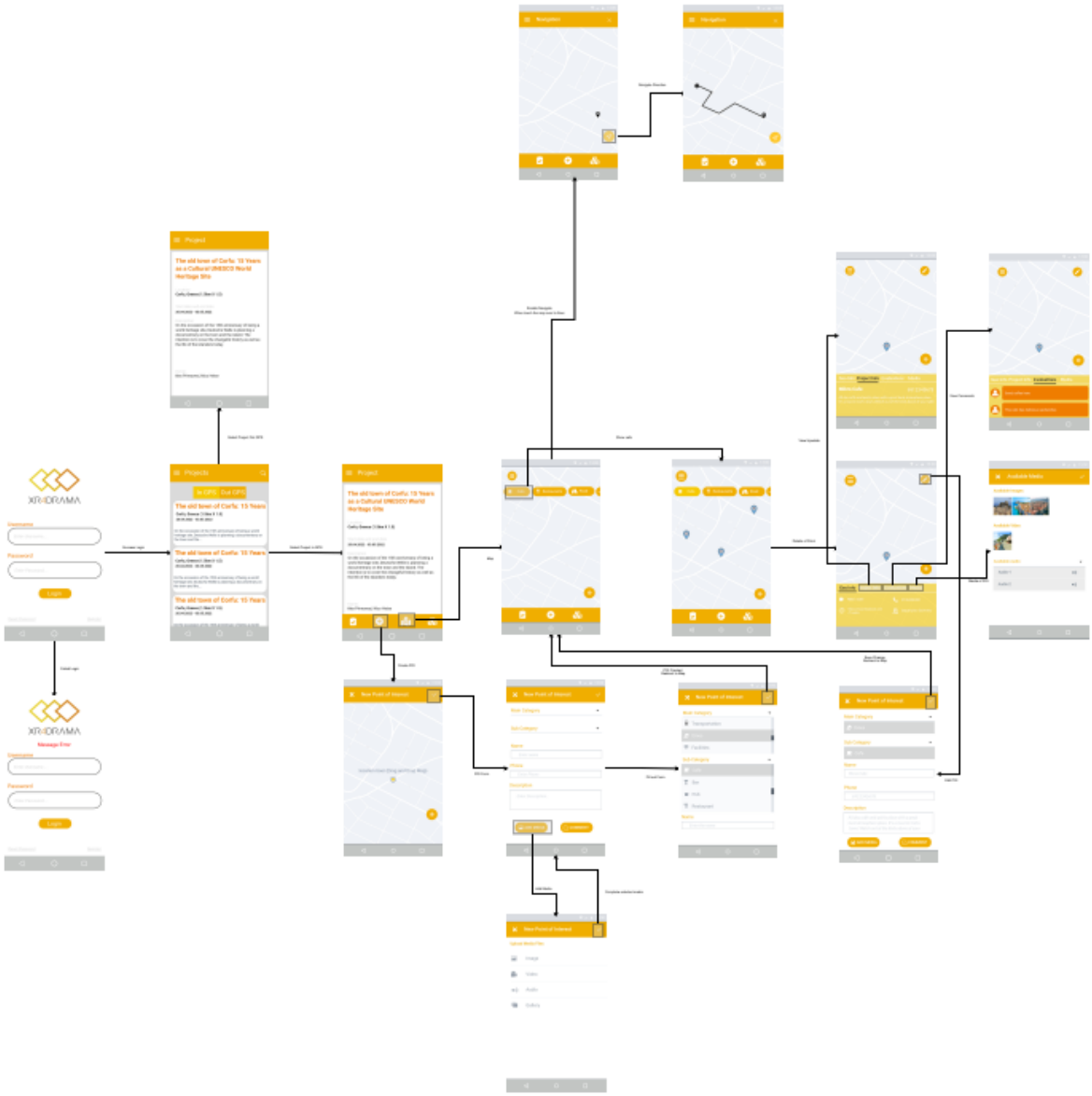


Figure 18. Overview of the 2D screens of the ARapp.

8 Awareness applications for the citizens

8.1 Citizen awareness application

Task T5.4: "awareness application for end users", focuses on the development of the situation aware mobile application that is designed for the wider public. The aim for this application is to create the habit for a citizen to become cautious about a possibly harmful situation and facilitate the authorities by acting according to their planning for the disaster management. The citizen application will be able to detect the context for the user based on location, time and proximity to the event, and will accordingly inform and alarm the user about likely threats, from location-based ones to evacuation alerts and more. Another functionality supported by the application enables the user to report an ongoing situation or make an emergency request via text, audio or video to the authorities that handle the disaster management. Finally, the citizen application includes a separate mode for the first responders only, in which the first responder can connect the mobile application with the SMARTEX garment equipped with sensors and share their physiological signals to the xR4DRAMA platform for further analysis by the tools developed in WP3. The first responder mode is integrated in the citizen application as part of T5.4 and is considered a separate mode which the wider public cannot access due to lack of authentication credentials. Thus, only the first responders will be able to utilize this feature.

The list of functional requirements which are set to be answered by the citizen application as a whole are outlined in subsection 8.2 while the list of functional requirements that are supported by the prototype version of the citizen awareness application are described in subsection 8.3.The list of hardware and software requirements of the mobile phone system are provided in subsection 8.4 as well as the integration of the application within the xR4DRAMA architecture is described in 8.5. Finally, a detailed description of the first version of the citizen application is provided alongside a link for a demo repository.

8.2 Functional requirements of the citizen awareness application

Requirements and use cases, elaborated by end-users have been expressed in various events within the project lifetime. The final version of these requirements is reported in D6.2 – "Final User Requirements". Table 12 presents the *system-related requirements* that are taken into account by the citizen awareness app, while Table 13 the *case specific information* requirements that are addressed by the citizen awareness application.

Req ID	Name	Description
SYS-2	End-user interface	An HCI that allows end-users to easily communicate with the system
SYS-12	Mobile application	An application that allows for operating the system in and from the field
SYS-13	Citizen application	An application that allows citizens to send video, images and audio messages, reporting flooding emergencies (PUC1 only)
SYS-14	Remote access to Level 1 situation awareness	The capacity of the system to grant remote users (e.g. location scout) access to a Level 1 situation awareness representation (partly or in total) via the mobile

Req ID	Name	Description
		application. Citizens (PUC 1 only) should receive useful information such as alerts, risk zone warnings about areas at risk, position of safe areas, sand-bag distribution, shelters.
SYS-15	Information ingest	A functionality that allows the location scout to update information about a specific location and to add videos, images, text as well as data from other sensors

Table 12 System related requirements addressed by the citizen awareness application

Infor-ID	Category	Name	Description
PUC1-03	General information	Areas of attention, safe waiting places, shelters	Information on the presence of areas of attention, safe waiting/parking places, shelters, sand-bag distribution areas
PUC1-06	Flood risk management	Flood reports	Information about flood reports localised by audio analysis and categorised according to the problem issue
PUC1-07	Flood risk management	Flooded elements	Information on flooded elements (e.g. cars and people inside the river)
PUC1-09	Flood risk management	Elements at risk	Information on the presence of elements at risk and the degree of emergency
PUC1-12	Human factors	Physiological parameters	Physiological parameters of first responders in the field
PUC1-14	Accessibility	Navigation routes	Possibility to define an appropriate escape route or a suitable way to reach an intervention area
PUC1-16	Flood risk management	Population potentially in danger	Information on the potential presence of people in areas at risk

Table 13 Use case specific requirements addressed by the citizen awareness application

After examining the end user requirements, a list of functionalities to be supported by the citizen application has been derived. This process contributed to the overall design of the application and the list of the main functionalities that need to be supported by the citizen application are summarized below:

- Citizen text report creation and submission to the xR4DRAMA platform.
- Citizen audio report creation and submission to the xR4DRAMA platform.
- Citizen video report creation and submission to the xR4DRAMA platform.
- Automatic attachment of geo location of the user to the submitted reports.

- Situation aware notification system (text and map alerts) to inform the user regarding the event current status.
- Inclusion of a first responder mode that will connect and organize the physiological signals to the xR4DRAMA database.
- Authentication for first responders.

Parts of the objectives also include communication with the rest of the xR4DRAMA front end tools and backend APIs for the proper integration of the application and its outputs in the system architecture as well as the development of the appropriate application that will support all the aforementioned functionalities.

8.3 Functional requirements that are supported in the prototype version

The prototype version of the citizen application was developed by CERTH. The prototype version will not support all the functional requirements that have been outlined by the end users, mainly due to the lack of time in the development pipeline. However, it is expected that all of the above mentioned requirements will be supported by the final version. This version supports two modes, one for citizens and one for first responders. Each mode will be referred by the target user it is intended for in the following subsections, namely: citizen mode and first responder mode. The list of the functionalities which are supported by the prototype version for both the citizen and the first responder modes are summarized below.

Citizen Mode supported functionalities:

- Citizen text report creation and submission to the xR4DRAMA platform.
- Citizen audio report creation and submission to the xR4DRAMA platform.
- Automatic attachment of geo location of the user to the submitted reports.
- Situation aware notification system to inform the user regarding the event current status.

First Responder Mode supported functionalities:

- Bluetooth connection with SMARTEX RUSA device.
- Inclusion of a first responder mode that will connect and organize the physiological signals to the xR4DRAMA database.
- Authentication for first responders.

8.4 Hardware and software requirements

The prototype version of the citizen application has been developed using the Java programming language and utilizing the Android Studio for the development process. Thus, the only OS for mobile phones that is supported is Android. The minimum hardware and software requirements for the application to run optimally are listed in Table 14.

	Requirements
Operating System	Android 6.0 and newer
CPU power	1,8 GHz or higher

	Requirements
CPU model	Snapdragon 632 or higher
RAM	3 GB or higher
Disk storage	64 GB or more
Battery storage	4000 mAh
Ability to connect to internet with or without WIFI connection	YES, 4G connection at least
Bluetooth connection	YES

Table 14. Minimum mobile phone system requirements for the prototype version of the citizen application.

8.5 Integration architecture

The prototype version of the citizen application can take input from the citizens and the first responders. The citizens can produce text and audio reports. The first responders can record their physiological signals by wearing the garment equippped with sonsors provided by SMARTEX. The text and audio reports are sent to the backend and/or the frontend tools. The physiological signals are provided to the stress detection module of the xR4DRAMA platform.

Regarding the citizen mode, the citizens will be able to use the mobile phone onscreen keyboard and the mobile phone microphone to produce their reports (text or audio) and then will submit these reports through the backend. The connection between the backend and the mobile application is done by posting a JSON file to a specific endpoint. An example of the JSON file that is send from the mobile application is being described below:

{"type": "text", "latitude": 40.599359, "longitude": 22.9756621, "textContent": "test report"}

The geolocation of the citizen is being automatically attached to the JSON file. In case the type of the report is audio the “textContent” field is being replaced with “audioUrl” which includes a URL that downloads the audio file when visited. The URL has been prepared by the backend by uploading the audio file that has been sent by the citizen application.

Regarding the notification system from the professionals in the control room to the citizens, the mobile app listens to a specific endpoint which will respond with an appropriate text alert when the professionals choose to produce it. If available, it will pop up as a message at any place within the application. The complete high-level architecture of the citizen mode system architecture integration is presented in Figure 19.

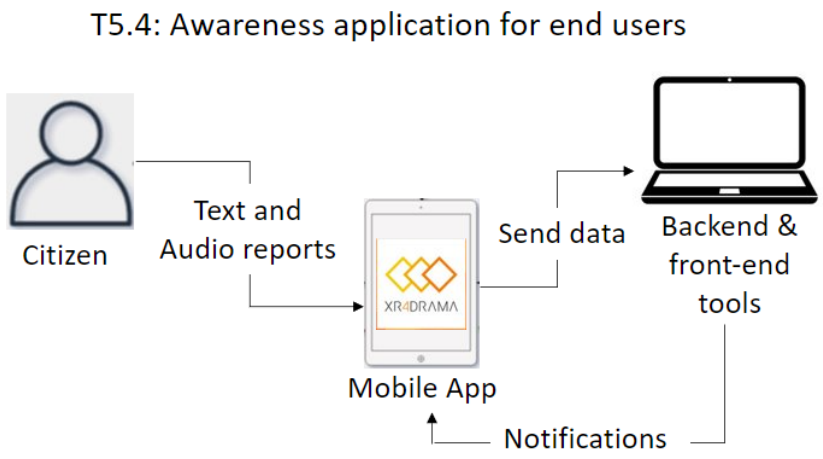


Figure 19. Citizen mode system architecture.

In the first responder mode, the RUSA device transmits the physiological measurements via a Bluetooth connection. The Bluetooth connection takes place within the mobile app which runs on first responders' mobile devices. As soon as the mobile app receives the data from the RUSA device it transmits them to the physiological signals database (DB) via the internet. The physiological signals database is developed using the MongoDB software. MongoDB is a source-available cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas.

The physiological signals database is connected via an API that can receive requests and can control the DB in order to provide the corresponding data to specific endpoints. These requests are performed by the Physiological Signals Stress Detection Module of the xR4DRAMA system which in turn will predict the first responder's stress level at a specific timestamp. The backend API and frontend tools can also gain access to the physiological signals through the same endpoints. The technical details of the integration of the RUSA device with the mobile application and the mobile application with the physiological signals database have been described in detail in subsection 3.2.2 of D3.1 – "Sensor data analysis for situation awareness – v1". The complete high-level architecture of the first responder system architecture integration is presented in Figure 20.

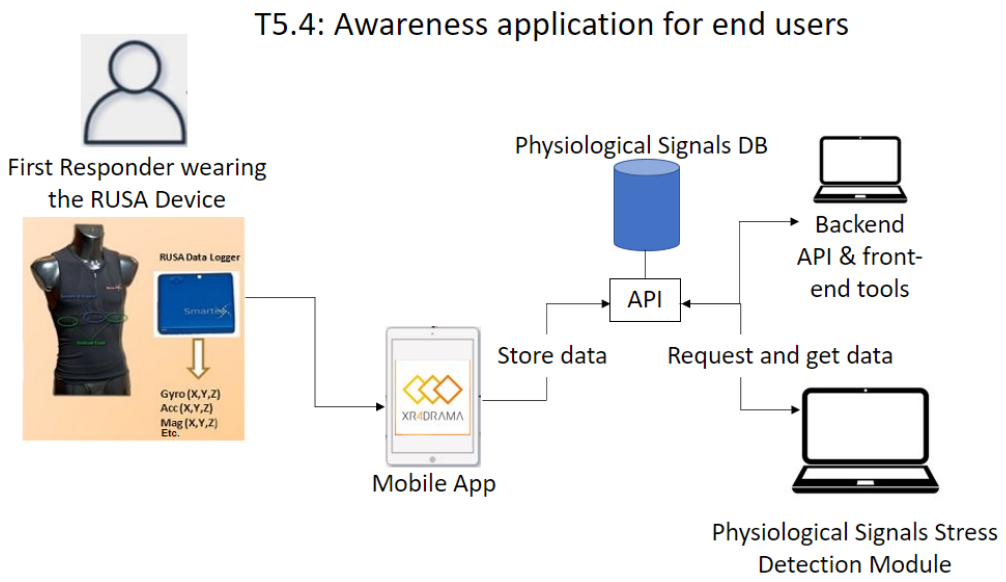


Figure 20. First responder mode system architecture.

8.6 Prototype version of citizen awareness application

8.6.1 Initial screen

The user can start the application by selecting the xR4DRAMA icon in their phone (see Figure 21 left side). The welcoming screen of the application presents the user with two options which differentiate which of the two supported modes will be selected to continue (see Figure 21 right side). Both citizen and first responder modes will be described in detail in the following subsections.

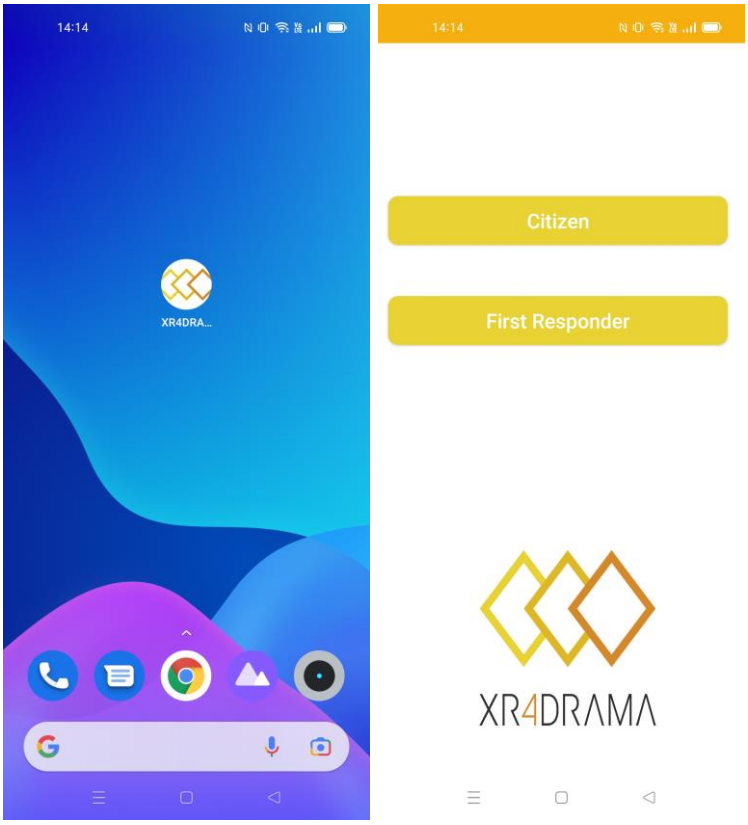


Figure 21. Citizen application icon (on the left). Initial screen of the app (on the right).

8.7 Citizen Mode

By selecting the "Citizen" button of the initial screen (Figure 21 right side) the user enters the citizen mode of the app. The citizen mode of the app offers the user the ability to submit a text and/or an audio report to the xR4DRAMA platform so that the professionals can interact with the information provided by the wider public regarding the ongoing situation.

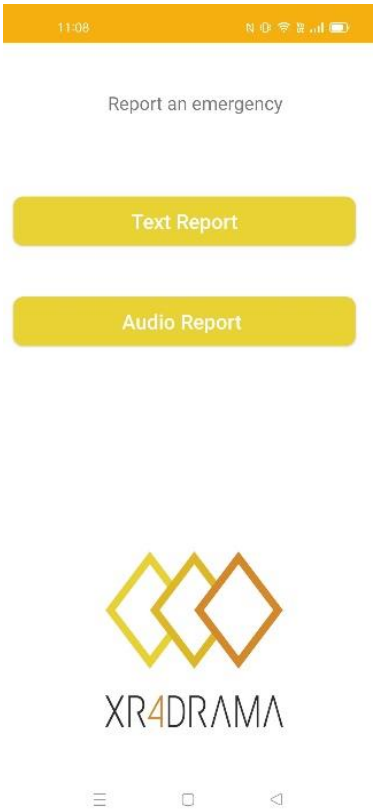


Figure 22. Citizen application: Citizen mode main screen.

8.7.1 Citizen text report creation and submission to the xR4DRAMA platform

By selecting the “Text Report” button of Figure 22 the user enters the text report screen which can be seen in the left side of Figure 23. The user can now type their report and then press the “Send” button to submit the report to the xR4DRAMA platform. An example of typing the text report is shown in the right side of Figure 23.

The citizen text report is automatically being geotagged meaning that the location of the user (latitude and longitude) will be given to the xR4DRAMA platform. The citizen text report is being forwarded to the rest of the xR4DRAMA frontend tools and backend APIs for further processing (e.g., WP3 services, KB server for raw data storage and/or sharing with the xR4DRAMA authoring tool).

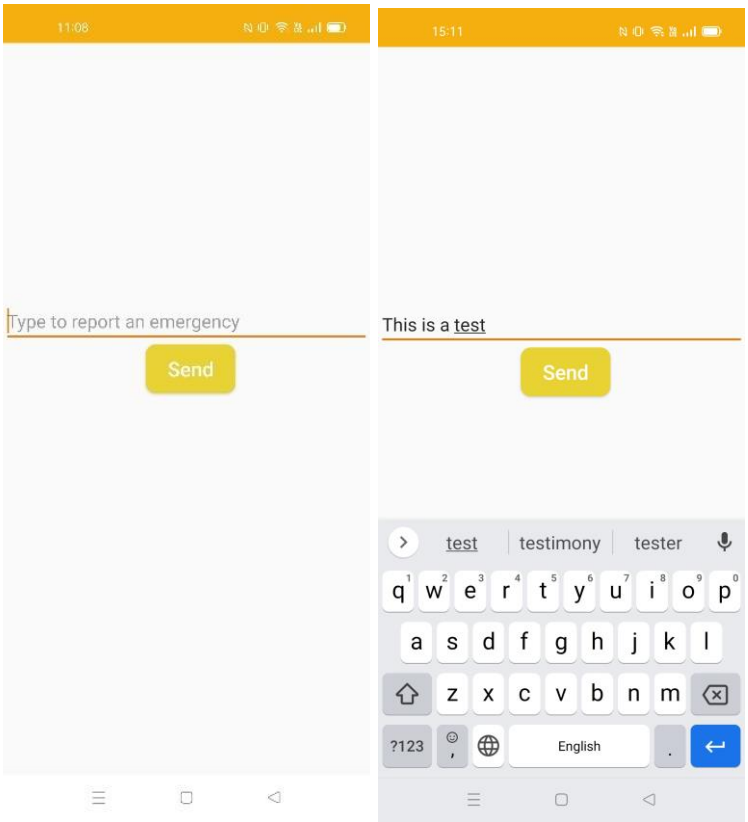


Figure 23. Text report main screen (left side). Text report creation example (right side).

8.7.2 Citizen audio report creation and submission to the xR4DRAMA platform

By selecting the “Audio Report” button of Figure 22 the user enters the audio report screen which can be seen in the left side of Figure 24. The user can now record theirself talking by pressing the centred microphone button. When the microphone button is pressed it turns blue to indicate that the audio recording functionality has started and the timer shows how long the recording already lasts. In order to stop the recording, the user need to press on the microphone button again when they are finished. An example of an audio recording taking place is shown in the middle of Figure 24. The microphone button is blue which indicates a live recording and the timer is working.

In order to select and submit the audio report to the xR4DRAMA platform the user needs to press the “File List” button next to the microphone button. This will move to the audio list file viewer and media player (see right side of Figure 24) where the user can select which audio file, they want to submit. The user can listen to his recording before deciding which to submit by selecting the play button on the media player and can submit the audio report by pressing the “SEND” button on the media player.

The citizen audio report is automatically being geotagged meaning that the location of the user (Latitude and Longitude) will be given to the xR4DRAMA platform. The citizen audio report is being forwarded to rest of the xR4DRAMA frontend tools and backend APIs for further processing (e.g., WP3 services, KB server for raw data storage and/or sharing with authoring tool).

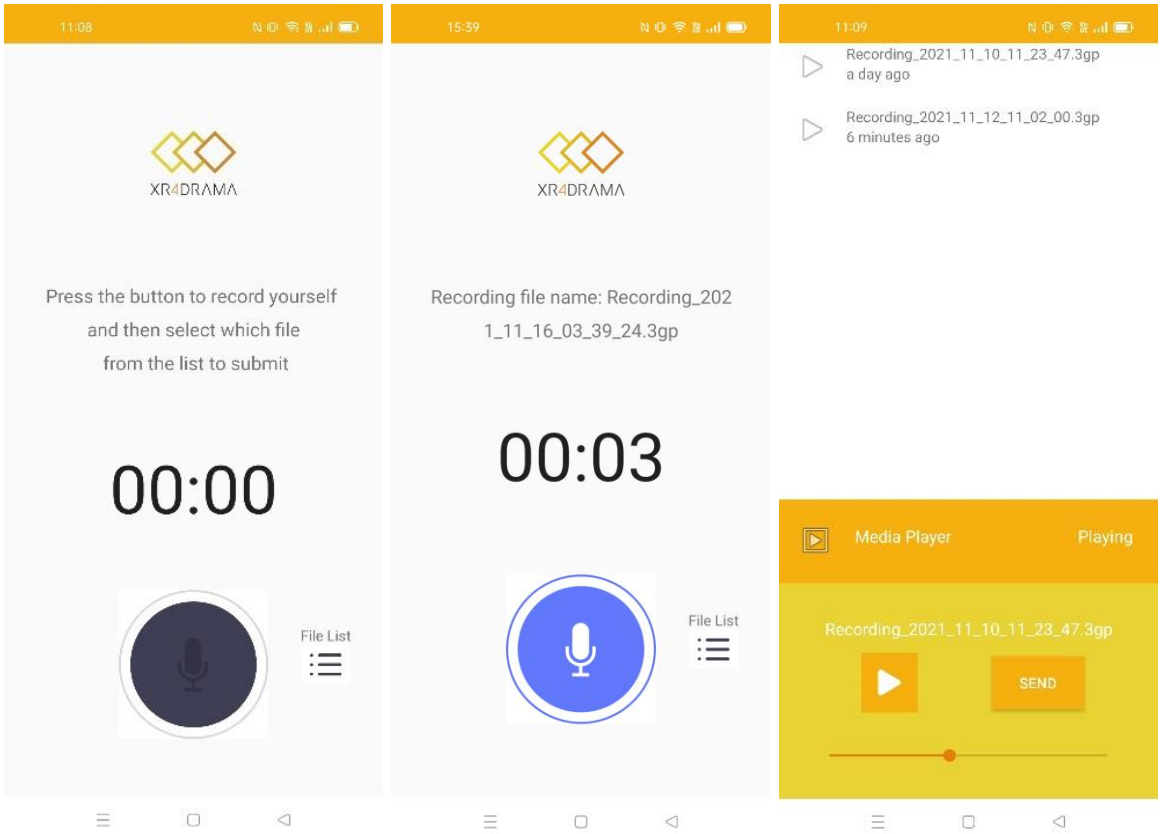


Figure 24. Audio report main screen (left side). Audio recording example (middle). File list and media player (right side).

8.7.3 Situation aware notification system

When in citizen mode the user can receive at any time a text notification by the professionals with directions or general updates over the on-going situation. The text notification will appear in black frame box and with white colour letters at the bottom part of the screen and will last a few seconds before disappearing from the application screen. An example of a text notification received when browsing on the citizen mode is presented in Figure 25. The text notification system will be upgraded in the final version to also notify the user about the reports from professionals when the application is closed.

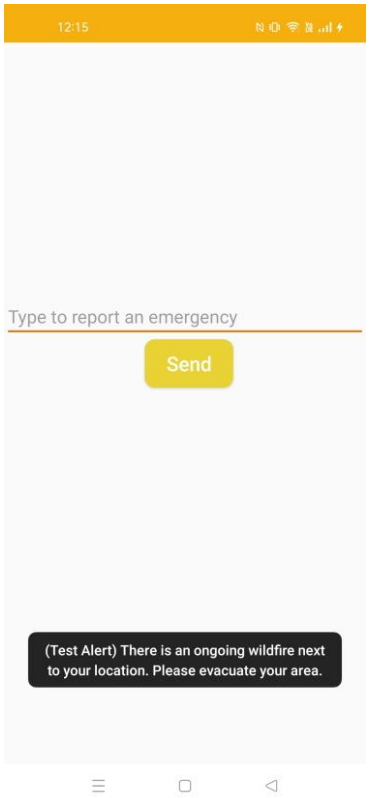


Figure 25. Notification text alert example.

8.7.4 First Responder Mode

By selecting the “First Responder” button of the initial screen (Figure 21 right side) the user enters the first responder mode of the app (see Figure 26). The first responder mode is offered exclusively for the first responders who wear the SMARTEX (STX) garment equipped with sensors and provides the functionality of a Bluetooth connection between the phone and the RUSA device (processing unit of the sensorised garment) as well as sharing of the physiological signals recorded from the first responder to the xR4DRAMA platform. When the user presses the “First Responder” button of the initial screen (Figure 21 right side), they will be prompted to provide authentication credentials to continue using the first responder mode of the app. The authentication is being cross checked with the rest of the xR4DRAMA tools (e.g., AR app, authoring tool) and the user can access all applications with the same credentials. Once the authentication is complete, the user can see the main screen of the first responder mode (middle of Figure 26). Here the user can connect via Bluetooth to the RUSA device and start streaming the physiological signals to the xR4DRAMA platform. In order to connect with the RUSA device, the user needs to press the “Start Streaming” button which will pop up a new window that lists all of the available nearby devices with Bluetooth connection enabled (see right side of Figure 26). By selecting the “RUSA WAW 00000081” option the application connects to the garment equipped with sensors and the streaming of the physiological signals begins. An example of physiological signals streaming via the application is presented in Figure 27. The channel name for each signal that is being transferred appears on the logger below the “Start recording” and “Stop streaming” buttons. The user can pause the streaming by pressing the “Stop streaming” button and can resume by pressing the “Start recording button”. The physiological signals are being organised to a

DB and are being utilized by the stress detection tools of WP3. The integration and implementation of the DB is being described in D3.1 – “Sensor data analysis for situational awareness”.

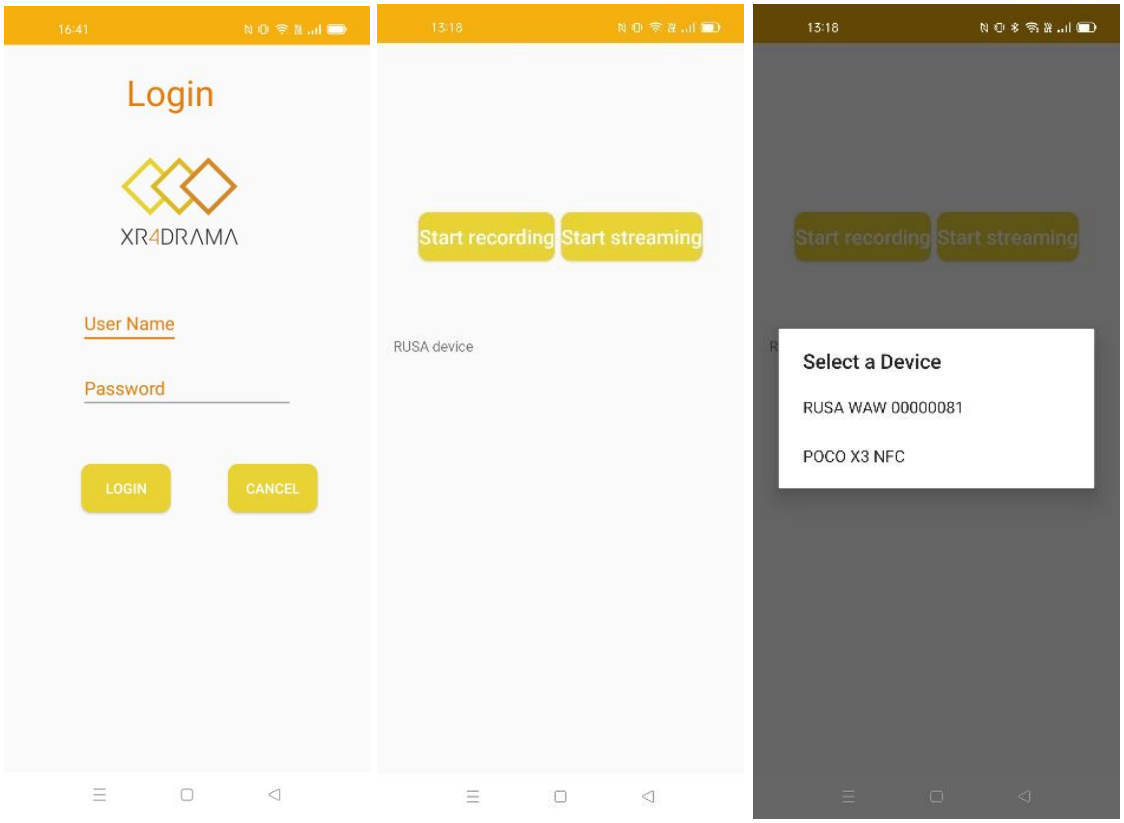


Figure 26. First responder mode login screen (left side). First responder mode main screen (middle). Bluetooth connection with RUSA device (right side).

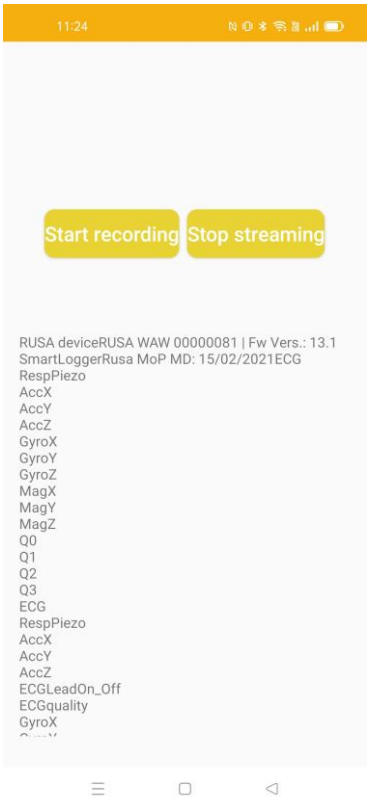


Figure 27. Physiological signals streaming to the xR4DRAMA platform.

9 Conclusions and next steps

The backend of the system in T5.2 has progressed extensively in the past few months to help deploy the first versions of all the tools and provide and absorb data coming from various modules for the entire platform to run in coherence. The backend also provides user and project management capabilities which acts as a foundation to the entire system. The next versions of the backend will provide much more capabilities with abilities of real-time communication and notification between various tools and users. The next version will be the pre-final version of the backend.

The work progress achieved in the T5.3 ("3D GIS for navigation and data geo-localization") has contributed to the first prototype as expected in the project timeline. Most of the 2D screens of the AR app have been developed, whereas an initial version of the AR view has also been developed. The communication with the frontend tools, the platform services and selected available online data services has been streamlined, as well as the data views and formulation for efficient streaming and interaction with the GIS data. The AR app is at a point that it can be tested and evaluated by the users, while continuing the improvements and the features of enhanced AR navigation in the real world, which is the end goal of the AR app. Hence, the GIS Services that support the AR app, while be evaluated. Any remaining issues regarding the integration of the GIS Services with the rest of the platform will also be tackled with during the following months.

The work carried out within T5.4 ("awareness application for end users") has produced the prototype version of the citizen application which provides a tool for the wider public to increase awareness during an emergency but also allow for direct communication between the citizens and the professionals. Furthermore, the application enables sharing of the physiological signals of the end users (first responders) with the xR4DRAMA platform. In the following months, the focus will shift on the following objectives towards the improvement of the citizen app:

- Video report creation and submission to the xR4DRAMA platform.
- Improvement of alert and notification system.
- Quality of life upgrades to existing functionalities and general optimization.
- Revision of the design elements and functionalities after the first prototype is delivered based on the lessons learnt from the PUC1.
- Collaboration with the relevant xR4DRAMA partners regarding any open integration issues.