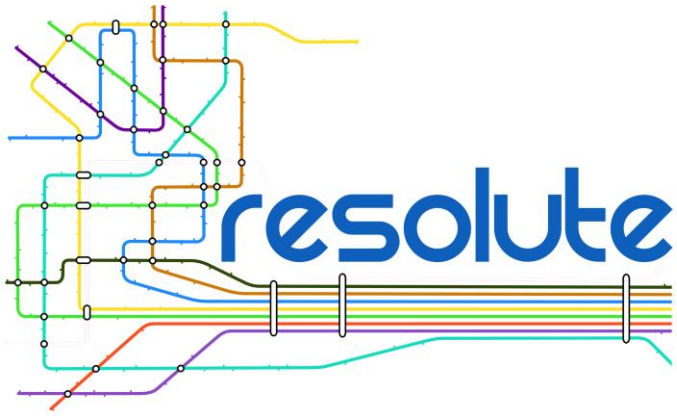

GAME BASED TRAINING APP

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Authors	Cristina Martelli, Alexandros Drosou
Email	martelli@disia.unifi.it, drosou@iti.gr
Affiliation	University of Florence, CERTH-ITI
Contributors	Emanuele Bellini (UNIFI), Jan-Paul Leuteritz (FhG)

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EXECUTIVE SUMMARY

This document reports the work done to develop the RESILIENCE STORIES app and the ESSMA training app. In particular the RESILIENCE STORIES represents the result of a co-design activities with the Italian Civil Protection to identify the relevant aspects of the emergency scenarios to be tested. The game is organized in a graph-based narration with a number of decisions points to evaluate the resilience awareness of the players against specific situations. The app foresees a flexible scoring mechanism to support different learning strategies.

The ESSMA training app is dedicated to support the learning of the ESSMA app. The idea is to guide the uses in discovering the app functionalities without reading user manual.

The result of the work are two apps that will be used during the Pilot execution (WP6) in Year 3. Moreover the RSOLICE STORIES app will be used n WP7 for dissemination and awareness rising activities.

PROJECT CONTEXT

Workpackage	WP4: Backend
Task	T5.4: Game based training app
Dependencies	D5.1 and D5.2 of UX design.

Contributors and Reviewers

Contributors	Reviewers
Emanuele Bellini (UNIFI)	Cristiano Costantini (THALIT)
Jan-Paul Leuteritz (FhG)	Manfred Dangelmaier (FhG)

Version History

Version	Date	Authors	Sections Affected
1.0	16/02/2017	Cristina Martelli	All
2.0	30/03/2017	Alexandros Drosou	Chapter 4
3.0	3/05/2017	Emanuele Bellini	All
4.0	23/05/2017	Emanuele Bellini	All
5.1	23/05/2017	Paolo Nesi	All

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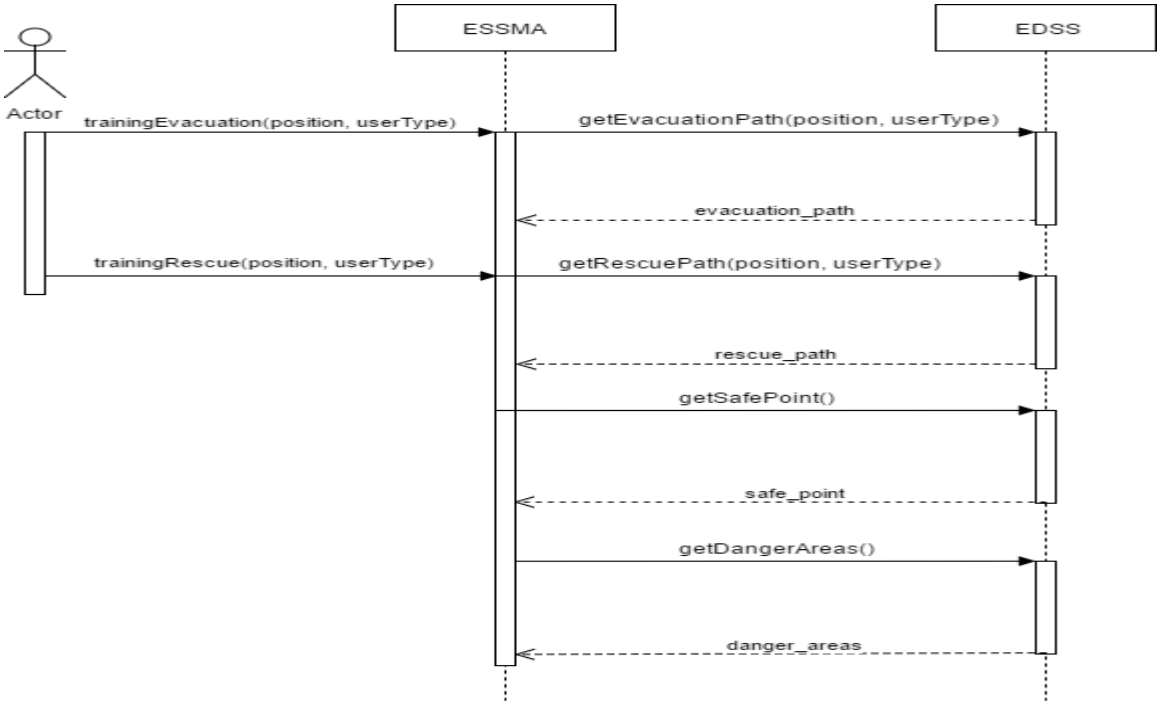

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1 INTRODUCTION

Game based applications are specific tools, for the empowerment of communities and territories to successfully deal with critical events. They may play an important role in the general framework of statistical information system, as they allow both to share information and knowledge and to act as survey questionnaires, which collect data through the game performances.

In the RESOLUTE Project framework, app-based training is functional to the full exploitation of all the phases of action, represented in the resilience cornerstones, in which is important:

- to learn from evidence and experience
- to react to a critical events
- to anticipate dangerous behaviours and events.

1.1 Structure of the document

After having introduced main characteristics and potentialities of app based trainings and games, the document presents two different applications developed in Resolute framework: (i) *RESILIENCE STORIES* and (ii)ESSMA.

In the specific, *RESILIENCE STORIES* is a general purpose instrument which translates narratives, provided by dominion experts, describing real-life situations and key learning points into a playable game: the objective is to produce a multi-step tree narrative, focused on critical events, in which the player, providing answers and choosing solutions, tries to individuate the most correct behaviour.

The ESSMA training app is dedicated to familiarize and train users with the real application of ESSMA, as it uses the same functionalities, even if data and alerts are random generated.

Both the training apps use a gamification award system.

1.2 Relation with the project

The outcomes of the Task 5.4 are going to be exploited in the WP6 during the pilot execution (T6.4) and validation (T6.5). In fact, the training activities will be executed during the pilot execution and their effectiveness will be measured in the validation phase.

2 THE ROLE OF GAME BASED TRAINING IN RESOLUTE PROJECT

In the RESOLUTE project, game based training is motivated for its teaching potential: interactive, engaging and immersive. The presented proposals may be included in the general category of games/apps with an educational intent: they generally need to be engaging, although not necessarily fun, while the learning can be implicit or explicit. The learning outcome is dependent upon (i) an appropriate pedagogy; (ii) the underlying game mechanics and (iii) how the content is integrated into the game. The learning is happening due to intrinsic motivation to play.

Game-based learning has become an optimal training tool for soft skills development since it fulfils the following five criteria:

- Compelling content
- Clear emphasis on practical application
- Interactivity and experimentation
- Genuine skills development through practice and feedback
- Motivation for people to learn and, above all, to complete the course they begin.

In fact, these are criteria any kind of training should fulfil regardless of format. Game-learning is able to offer these five characteristics. Game-based training has been reported to offer a safe, effective method of conditioning for people that results in comparable (and, in some cases, greater) improvements in physical and cognitive performance than traditional programs. While technical instruction training has been associated with a higher volume of skill executions (i.e., more 'touches'), game-based training has been associated with greater cognitive effort - an important condition for skill learning. Indeed, studies investigating skill learning have reported comparable (and, in some cases, greater) improvements in skill execution, problem solving and decision-making following game-based training than training involving repetitious technical instruction [Gabbett, Jenkins, Abernethy, 2009].

In the general economy of the RESOLUTE project, app based training has been identified as a trade-off between (i) the exigency of a pervasive and wide dissemination of educational contents, (ii) the effectiveness and timeliness diffusion of educational and informational contents in response to critical situations and (iii) the affordability of the educational process.

Some areas have been considered in the app based training design. By way of example these are some of the points that have been considered during the app design: What is the background of the player(s) (age, language, experience, prior knowledge, preferred learning styles, etc.)? – What are the learning goals? – How does the game content, that is, the factual knowledge contained, experiences, mechanics and activities, relate to the learning goals? – How integral is the content to the game mechanics, processes, experience of playing as well as the art assets or copy, and is its acquisition required in order to progress? – Will the game engage the learners – is it immersive? – Does the game have a learning curve (i.e. do the players improve through repeated play), appropriate feedback, clear progression etc.? – What level of fidelity is appropriate? – How will learning be transferred beyond the game context? – How can the game be embedded and assessed? – What other practices will support learning, either in the game such as reflection, or externally such as discussion? – What retention rate, i.e. how long will the players remember the learning, will the game have?

In the following of this report some of these points will be presented and discussed.

2.1 App based design training vs. traditional teaching

Traditional teaching has not been banned in RESOLUTE project: the importance of conferences, workshops, classroom training actions, and taught lessons may play a strategic and effective role: nevertheless, a genuine interest toward app based training is explained by the possibility of producing activities with the following characteristics: user-centred, on-demand, engaging, technology-centric.

Often, production costs are considered a serious drawback for serious games: one area in which game based learning is surpassed by traditional classroom learning is often cost, as they requires that each student have access to computers or other gaming devices for a far greater percentage of their instructional time than is generally possible in schools.

In this project, we have adopted simple case scenarios and no expensive, immersive technology: the objective has been to create a flexible and agile environment in which easily translating, disseminating and updating the dominion expert's narrations on critical events.

To this end, in RESOLUTE we design and develop a game based meta-application for Training in order to train different user categories (people at large on risk perception or early warning interpretation, Critical Infrastructure managers on ERMG application, etc.) according to their learning objectives

In the following of this report two different proposal will be presented and discussed: (i) *RESILIENCE STORIES* and (iii) ESSMA

3 RESILIENCE STORIES

RESILIENCE STORIES is (i) a game based training and (ii) a survey tool, useful to know more about competencies and needs of the players, through their playing performances. In picture Figure 1 the 5 different dimensions that have been evaluated has been shown and dealt in the app-based design.

Figure 1 game based app "RESILIENCE STORIES" design dimensions

3.1 RESILIENCE STORIES design dimensions

The game based app *RESILIENCE STORIES* has been designed and built along several dimensions, in order to represent the critical situations' complexity. In the following, the single dimensions will be presented and discussed.

3.1.1 Exprt driven Resilience narrations

The game based training app is based on the knowledge and expertise of dominion experts who know:

- what happens on the occasion of critical events
- the most common reactions, mistakes and dangers.

On this base, they are (i) able to identify key learning points that must be addressed in the game based training; (ii) the correct behaviour that must be proposed and explained to the players.

There is a strong relationship between the knowledge of the phenomenon and the structure of the game: the different reactions and behaviours (either right and wrong) are translated into potential game paths, and their severity impact in terms of potential consequences are encoded through a score mechanism.

The experts' role is not confined to that of critical events storytellers: they can be seen also as survey designers, as while playing, app users communicate their knowledge level on the phenomenon under examination. A player's potential lack of knowledge and skills is communicated through quantitative measures evaluated on the base of their performance scores.

3.1.1.1 Narration co-production

The environments and the scenarios described in *RESILIENCE STORIES* first release, have been mainly derived from documents and advices produced through the collaboration with the Italian Civic Protection. In particular, dedicated co-design sessions with max 4 experts have been organised to produce relevant information from their experiences. The focus groups were organised around some real events that had happened recently in Florence, such as flash flooding and wind storm on 1/9/2015 and the Mugnone flooding exercise. These two events have been used to frame the discussion but the dialogue has been conducted in a unstructured way to leave the experts free to provide their inputs. Through this technique, we obtained less stereotyped answers also coming from their personal experiences.

The documents and the narrations obtained have been analysed and divided into chunks composed by small phrases. Then such chucks have been organised into a step-by-step narration.

Civil Protection experts have suggested the decision points on the base of the most common events and errors (like choosing the shortest way back to home and not the one with the lowest number of traffic lights, which during a flash flooding could be out of order).

The scores have been decided on the base of the gravity of the error and on the players' profile (e.g. an error, made by a student or by a teacher has a different gravity and thus a different score will be applied).

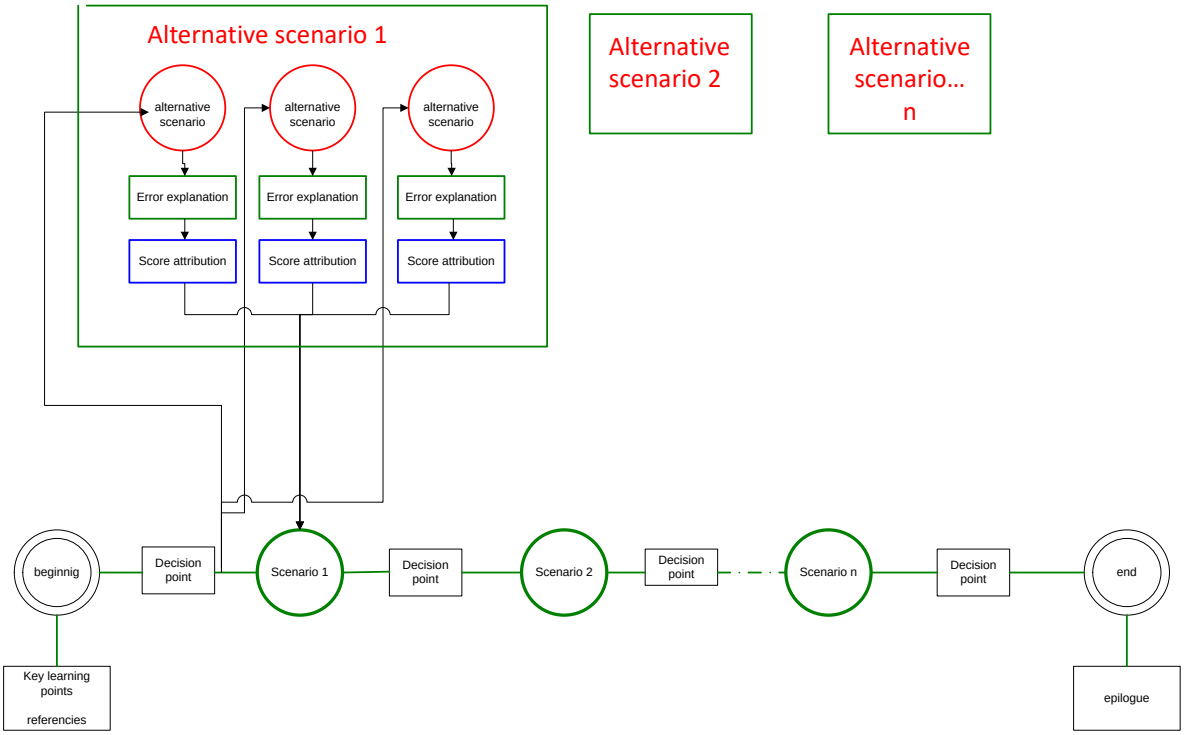
3.1.2 Game mechanism

On the base of dominion experts' knowledge, the educational elements were constructed. The educational contents are organized along two different axes: scenarios and insights. Both scenarios and insights are referred to the key learning points individuated by dominion experts.

- ***Scenarios***- short narratives which describe the situation that must be addressed by the player adopting a specific decision;
- ***Insights*** –deepening and specific information on the situation described in the scenario. The insights may be videos, texts, audios.

Further objects are:

- ***Decision points***, where the player is called to choose between different alternatives to move ahead from the situation described in the scenario.
- ***Epilogue***, in which all the contents distributed in the different steps of the game are proposed as an integrated narration. The epilogue is provided at the end of the game and is intended to provide the player with a structured information resource.



In Figure 2 the general structure of the train-based app *RESILIENCE STORIES* is depicted:

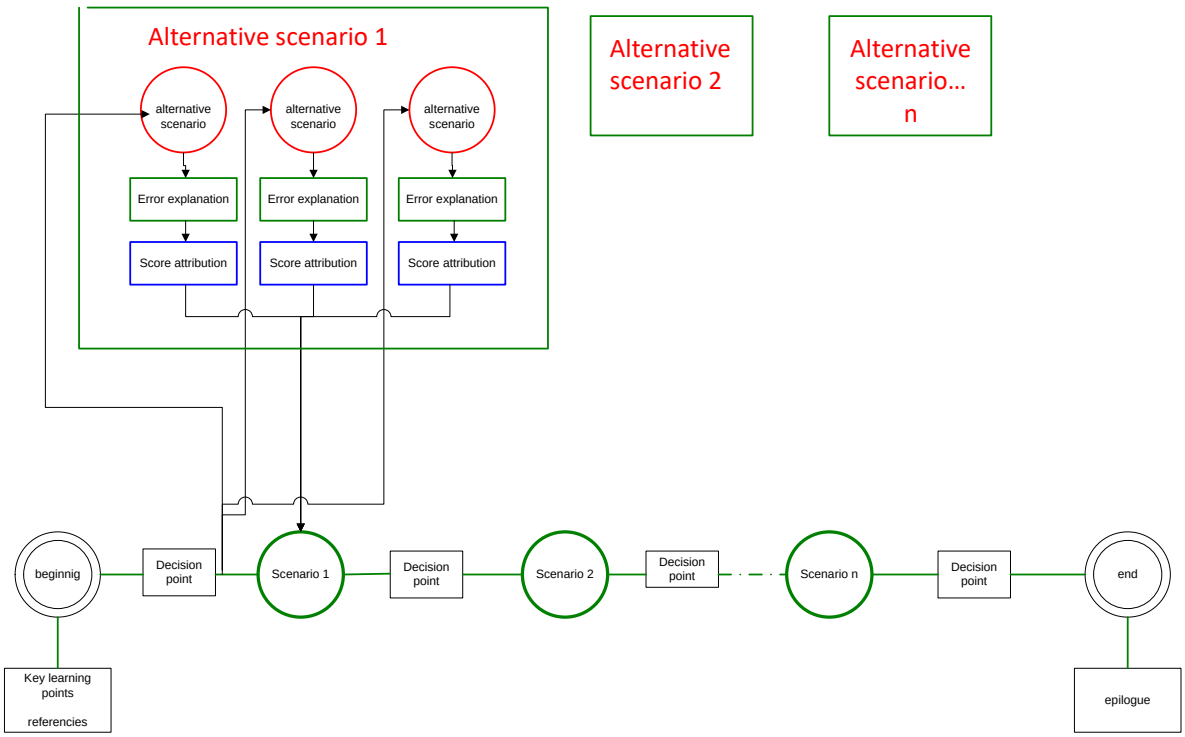


Figure 2 the train based app structure

Starting from the *beginning* in which the key learning points highlighted by the experts are listed, a narration made by a sequence of different *scenarios* is modelled. After every scenario, a *decision point* object engages the player with a question: What next? What is your choice?

Only one is considered a fully safe choice; the others lead to wrong and dangerous situations individuated as frequent and common by dominion experts; these situations are linked to the key learning points listed at the beginning of the game.

It is important to notice that a "wrong" choice does not result in a defeat in the game because the scope of the app is educational and oriented to build adaptation capacity and awareness in the users. To this end, a "recovery path" after a wrong choice, is always proposed in the story with some explanations and warnings.

Insights are provided both in scenarios and in decision points and recovery paths: in all these situations, the player may use additional contents and documents to take more informed decisions.

The game score depends on:

- the number of correct paths that have been chosen
- the severity of the mistakes
- on the deepening contents accessed

3.1.3 Fun and storytelling

As previously described, the game base app *RESILIENCE STORIES* is an interactive narration that the player progressively builds, choosing among different options.

The Figure 3 shows a typical state/event structure, in which the decisional events allow a walkthrough among the scenarios, which represent the possible states.

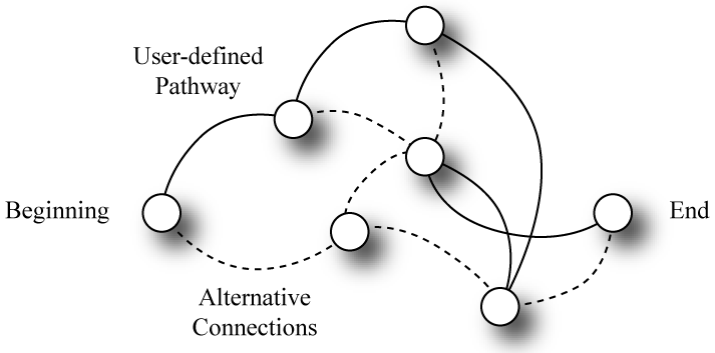


Figure 3 the train base app as a state/event system

The number of states and decisional events are not fixed and the experts are free to model the narration according to their view of the problematic area.

3.1.4 Survey and information gathering

RESILIENCE STORIES may be defined as a non-fictional narrative, in which aspects drawn from real world are presented together with an imaginary story, which the player constructs step by step, scenario after scenario.

The key learning points around which the story is designed may be object of measures, definitions, standards: in this perspective, as previously outlined, *RESILIENCE STORIES* works like a survey support, gathering and collecting the players' performances around the key learning points' figures and facts. When choosing a solution and a scenario, at decision point level, the player acts as a questionnaire respondent.

The Figure 4 shows how facts and narrative contribute to the resilience stories building.

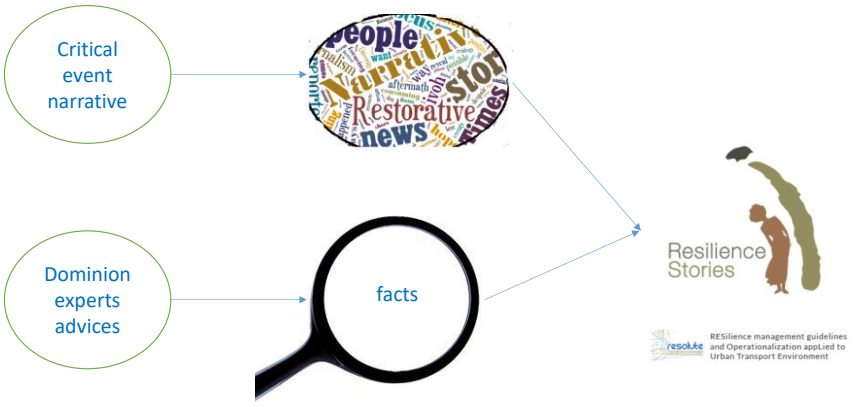


Figure 4 Resilience stories contribution

The data that we intend to collect are mainly linked to the questions proposed in the decision points: how diffused is the knowledge about the correct behaviour that must be maintained during a critical event?

In all the situations in which figures are available for the cases described in the decision points (as, how many are the persons injured for that case…), a comparison among the player sample knowledge and a more general population will be possible.

3.1.5 Just in time publishing method

RESILIENCE STORIES is a web app that supports different media: in the game framework, the player may watch to a video, listen to a recording, or answer to questions.

In critical situations, it may be important to check competences and skills in real time and to provide pertinent indications and information. *RESILIENCE STORIES* is modelled like a web container, as shown in the picture

The container structure is simple: it is enough to insert the different content object and the training game is ready to be disseminated.

3.2 Scoring flexibility approach

RESILIENCE STORIES is equipped with scoring functionalities to be used:

- in the gaming environment to provide the player with a feedback on the game performances;
- in the surveying environment to quantify the characteristics of the participant sample.

Any single event (choice selection, going backwards, opening deepening, etc.) in the game structure can be assigned to a different scoring model. The same game may have a different scoring approaches, depending on the user's profile that is supposed to play: for instance, when the game is proposed either to the general population or to a skilled subgroup, the respective scoring approach may be different.

In this way, it is possible to adjust the scoring according to the learning objectives and strategies. For instance the negative or positive reinforcement (Skinner, 1953) is a strategy that can be fully implemented with the scoring flexibility approach. According to (Forster and Skinner, 1957) the goal of reinforcement is always to *strengthen* the behaviour and increase the likelihood that it will occur again in the future. In real-world settings, behaviours are probably not going to be reinforced each and every time they occur. For situations where you are purposely trying to train and reinforce an action, such as in the classroom, in sports, or in animal training, you might opt to follow a specific reinforcement schedule. There are two types of reinforcement schedules:

Continuous Reinforcement: the desired behaviour is reinforced *every single time* it occurs (right choice). This schedule is best used during the initial stages of learning in order to create a strong association between the behaviour and the response. This can be done by immediately incrementing (+1) or decrementing (-1) the total score. Also, different weights can be associated to decision points to augment the magnitude of the reinforcement (+2, +3, +4, …). Once the response is firmly attached, the reinforcement strategy can be switched to a partial reinforcement schedule. This can be done by tracking the user performance along its learning process.

Partial Reinforcement: In partial reinforcement, the response is reinforced according to a specific schedule. Learned behaviours are acquired more slowly with partial reinforcement but the response is more resistant to extinction. Examples are:

- Fixed-ratio schedules are those where a response is reinforced only after a specified number of responses. This schedule produces a high, steady rate of responding with only a brief pause after the delivery of the reinforcement. For instance it is possible to get a score increment after 2 or 3 right choices.

- Variable-ratio schedules occur when a response is reinforced after an unpredictable number of responses. This schedule creates a high steady rate of responding. For instance it is possible to get a score increment/decrement after a random number of right/wrong choices.

Deciding when and how to reinforce an answer can depend on a number of factors. In any case the app is able to support different strategies and it is capable to switch to a partial schedule of reinforcement automatically according to the user profile.

3.3 RESILIENCE STORIES: an game for resilience enhancement

RESILIENCE STORIES is designed to play a role in all the four cornerstones (anticipate, respond learn and monitor), which characterise a resilient system. In this sense, it may be functional to resilience engineering, which is aimed to develop and manage the corresponding capabilities in the system.

The following system highlights the role of *RESILIENCE STORIES* in the framework of a Resilience Analysis Grid (RAG) based on these four capabilities, (Hollnagel ,2011)

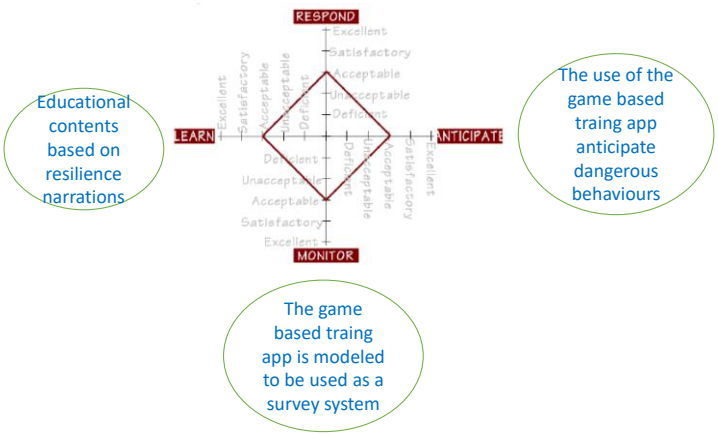


Figure 5 RAG for RESILIENCE STORIES

In the specific, *RESILIENCE STORIES* used as a survey asset, is particularly functional to Anticipate and Monitor cornerstones.

In the Anticipate cornerstone, in particular, *RESILIENCE STORIES* allows to individuate dangerous behaviours and views The knowledge on these knowledge and skills lacks allows to anticipate potential risks, improving structures and educations. These results may be attained also through a recursive use of the app, in which different releases may be distributed to address in ever fitting way to empower the players,

Moreover, the app RESILIENCE STORIES addresses the ERMG recommendations (Gaitanidou, Bellini, Ferreira, 2016). In particular the **Manage awareness & user behaviour function** recommends to shift the classical command and control relationship between authorities and the population towards a more flexible approach where the person is seen as an active participant in his/her safety, rather than a passive recipient of services. Thus, the person can enhance the resilience of the entire UTS enhancing his/her capability of self-adapting to changing conditions. To this aim it is necessary to develop new not-technical skills in the population through an effective training strategy. According to the ERMG **Manage awareness & user behaviour function,** 3 tiers of training can be identified The use of the game with the smart devices is considered a desirable enhancement of the Tier 2 that foresees the use of the scenarios for training in a controlled environment to test the participant ability. The use of a smart game approach aims at reducing the costs and time needed for the training of a large number of people. In fact, through a smart app the training program is ubiquitous, extendible with new stories and accessible for a large range of users (from children to elderlies).

3.4 Architecture and interfaces

In the following a short review of RESILIENCE STORIES main functionalities by its user perspective. The application has been developed both for smartphone and tablet, as presented in this report.

3.4.1 Identifying and profiling the users

The *RESILIENCE STORIES* app requires a login to access to the game. Such a decision has been taken to track the single player performances and; the profiling phase collects the information for players stratification.

Collecting users' profiles is strategic for RESILIENCE STORIES since they allow to stratify the different behaviours and answers according to the respondent's characteristics, along with the classical questionnaires modelling methodology. The profiling may be obtained along several approaches.

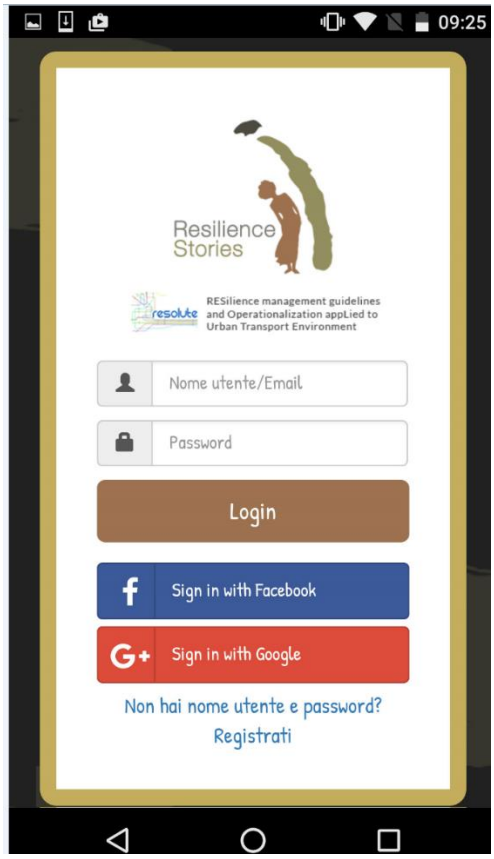


Figure 6 RESILIENCE STORIES login

In Figure 6, the user's profile may be obtained through a direct login, Facebook- or Google-account. Such methods are quite common and can speed up the registration procedures.

3.4.2 Choosing a narration

Once the user is registered, he lands to the main page where a list of the stories is presented and selectable. Each story is represented by an evocative picture that helps the players in understanding the ambience in which the scenario is placed and by a title. More titles can be visualized scrolling down the main page.

Figure 7 RESILIENCE STORIES Main page

3.4.3 Introducing narrative and objectives

According with the general app structure depicted in

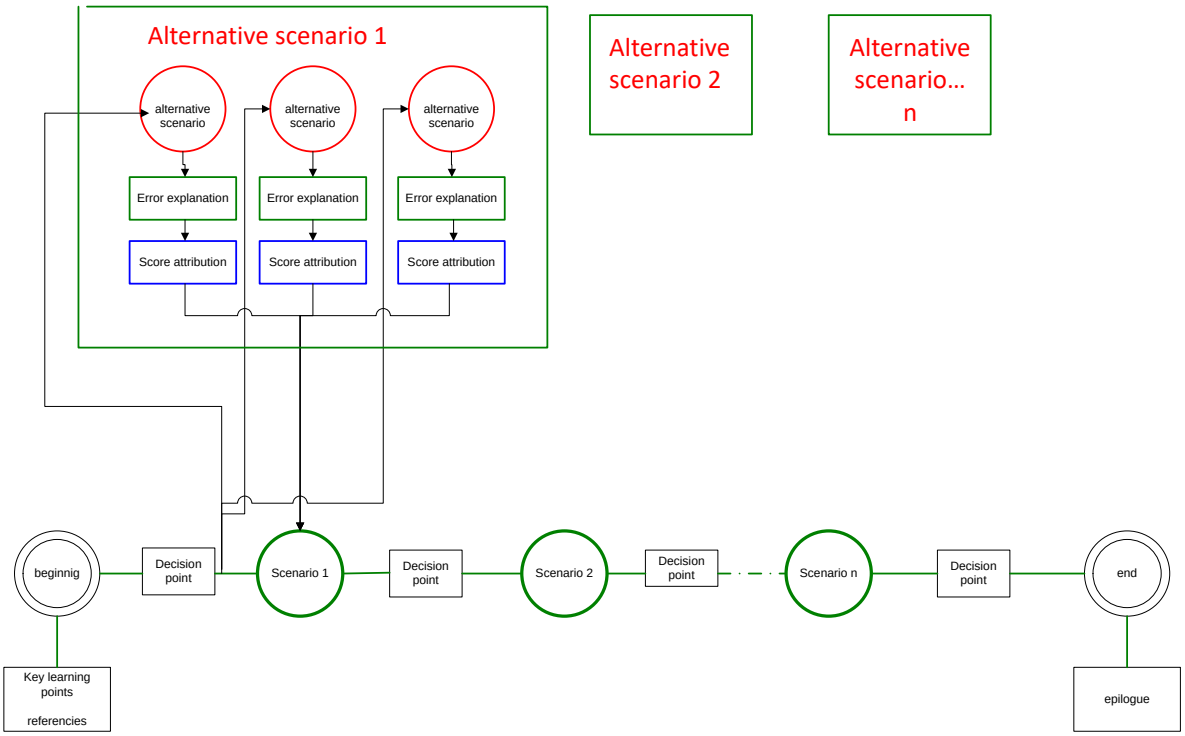


Figure 2, a first introduction is provided immediately narration selection. In this environment, the key learning points to be attained and the most relevant references are listed (Figure 8).

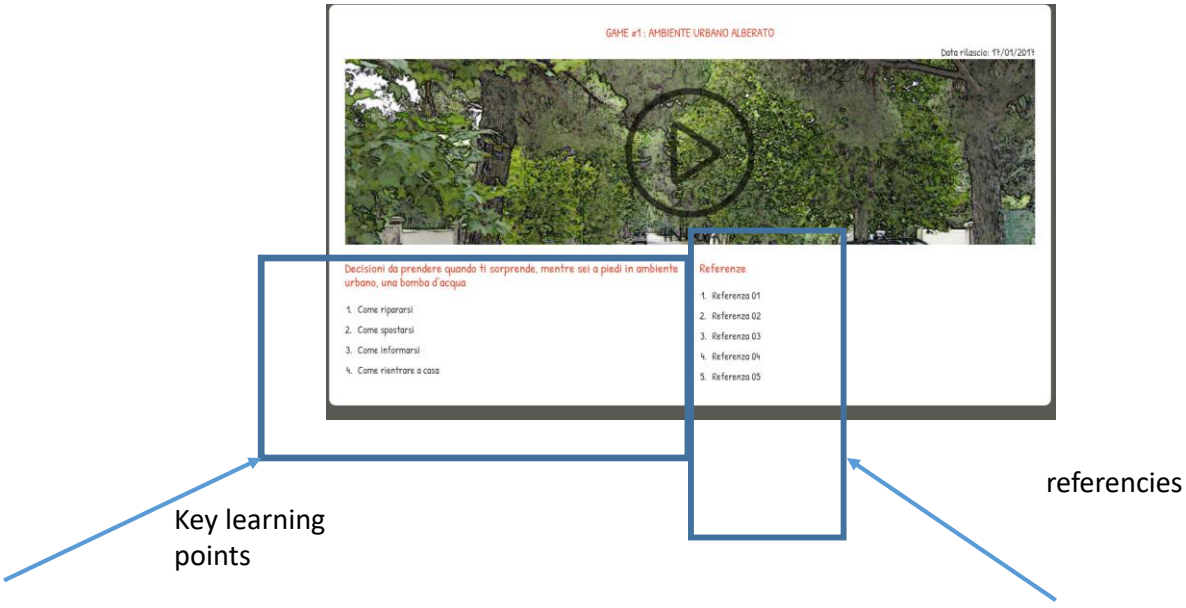


Figure 8 Learning objectives presentation (imagine obtained from the tablet version of the game)

3.4.4 The narration begins

After the presentation, the narration begins, as shown in Figure 9. The evocative at the beginning aims to act in two ways: a) framing the context better than a simple textual description (where I am, what kind of elements are there around me, etc.); b) re-creating the “similar” arousal condition during critical events leveraging the emotional inputs derived by the visual stimuli.

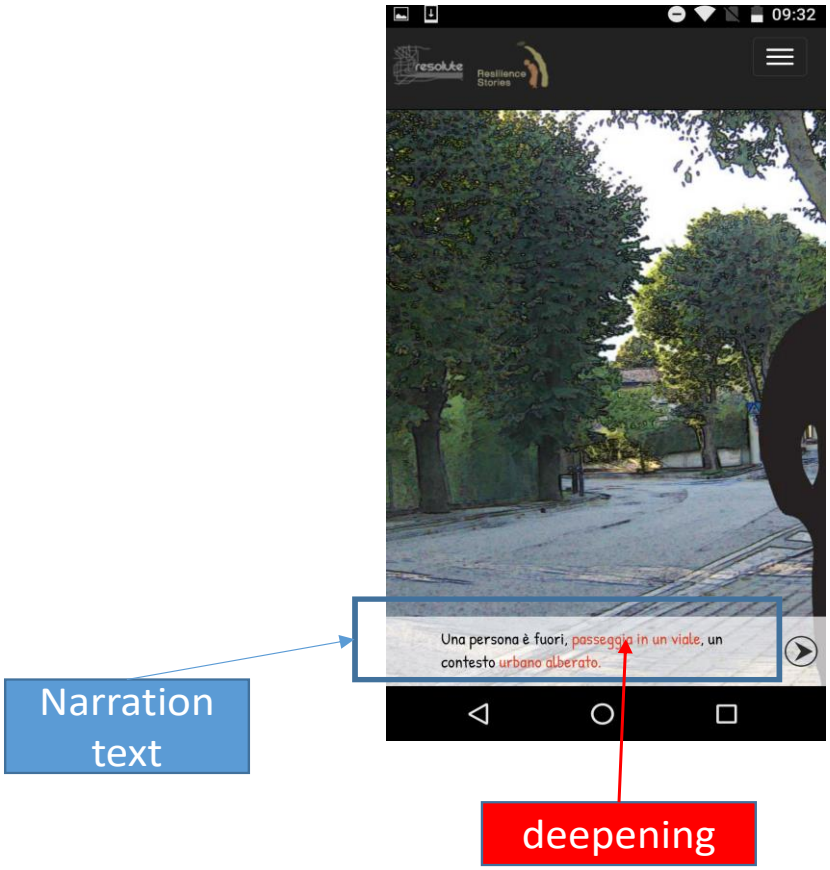


Figure 9 RESILIENCE STORIES Begins

In order to support the learning activities, *RESILIENCE STORIES* app allows to use a wide range of deepening supports such as: movies, text, audio. Such supports can be accessed through specific words in the description.

The text provided scribes the scenario in which the player is called to play. Some slides may be needed to better detail the environment and to reduce the uncertainty derived by a simple and limited description. What it is important here is to avoid that a poor representation of the context may affect the capacity of the players to respond correctly.

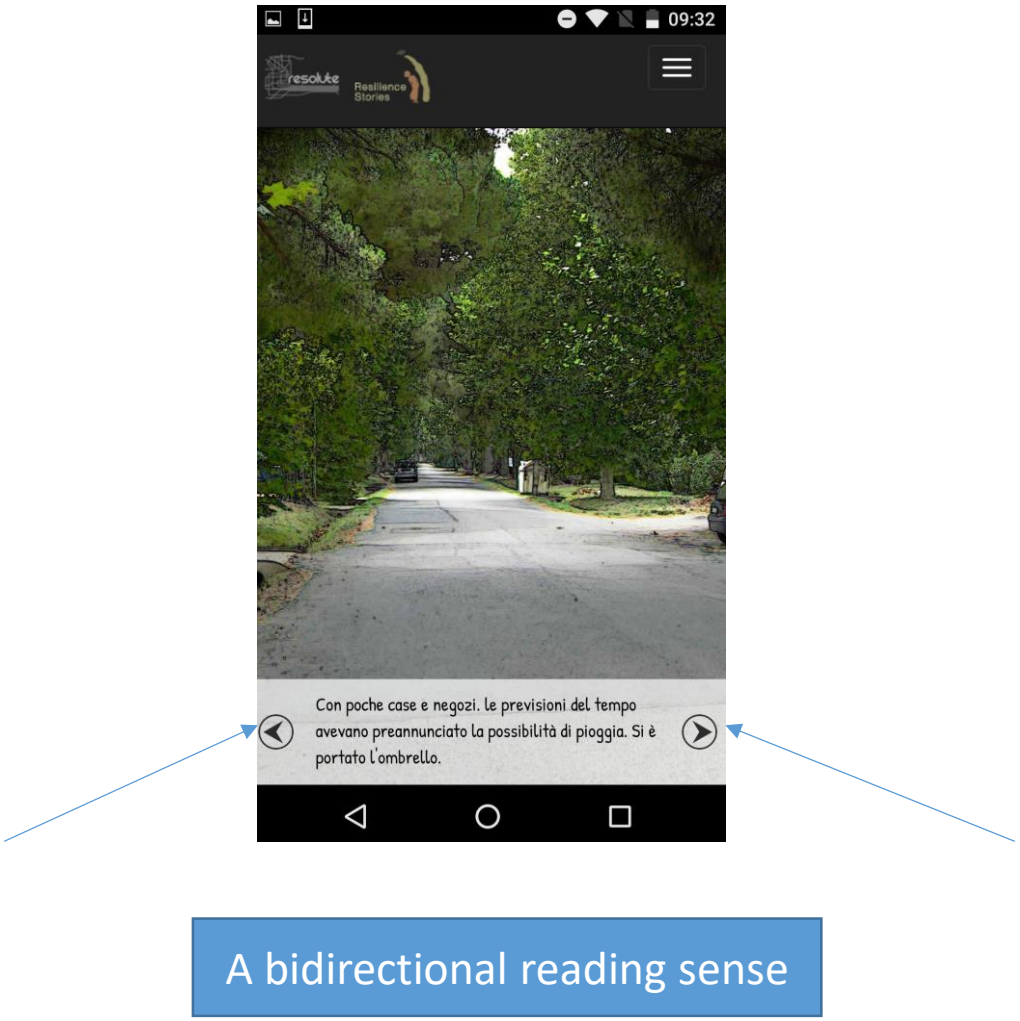


Figure 10 Bidirectional reading sense

RESILIENCE STORIES allows also a bidirectional reading sense to allow the player to reflect on the proposed case. The app developed allows enabling this functionality between two decision points or throughout the narration depending on the user's profile. In this way, it is possible to create different learning experiences according to the target users.

3.4.5 The choice

RESILIENCE STORIES communicate to the players that something is changing in the "mental environment". Specific pictures are used to increase the arousal level in the players. In this context a choice is requested to the player to respond with a safe behaviour to such a changed condition. Thus, the player is called to choose a narrative path. It is worth to notice that the number of alternative paths is not fixed. The narration author can propose a different number of choices in each decision point. One of the alternatives is correct; the others may present a different level of criticality, which justifies its scoring level.

Once a choice is taken, is not possible to go back again for changing it. Instead, if the choice is not the right one, according to the structure of the game, the player continues on a longer "educative" path where suggestions and recommendations are provided to explain the impact of the event.

3.4.6 The epilogue

RESILIENCE STORIES ends communicating to the user the final score awarded and its explanation. In the same moment, the player is invited to play again to improve the performance or to choose another narration.

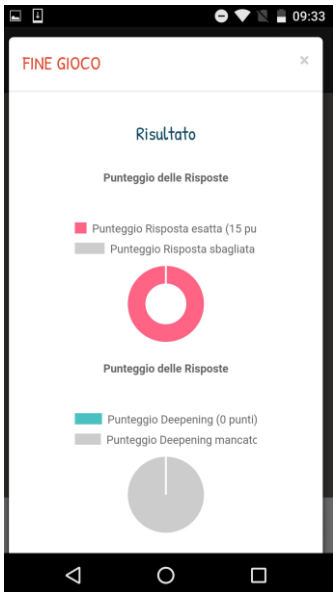


Figure 11 Epilogue screen

3.5 Database

In the Figure 12 is reported the main structure of the database for the app.

- Game: it manages the scenarios (narrations). Relevant fields are: title, img (the evocative picture)
- Player: it manages the player's data as name, email, username and password
- Player_game: it manages the scores and the paths (iter) that the player does during the play.

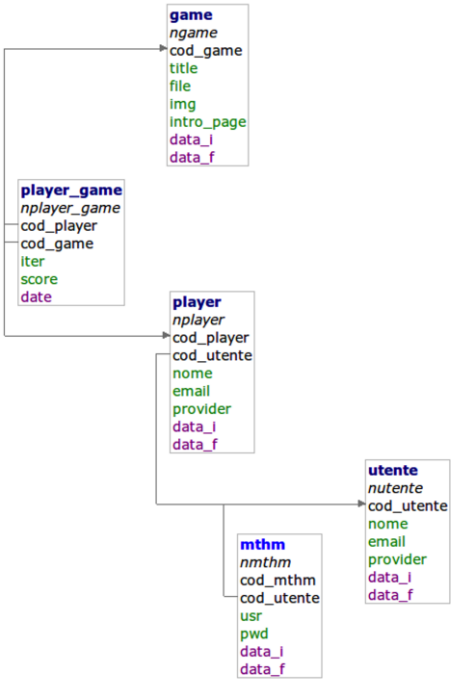


Figure 12 Database schema - main tables

3.6 Flash Flooding outside - narration paths architecture

The story told in this game is about the flash flooding/water bomb, an extreme event characterised by heavy rain and the water level on the street that rises quickly. The right behaviour is to looking for a close environment (e.g. shops) as soon as possible being careful not to approach the trees or metallic goods because of the lightning.

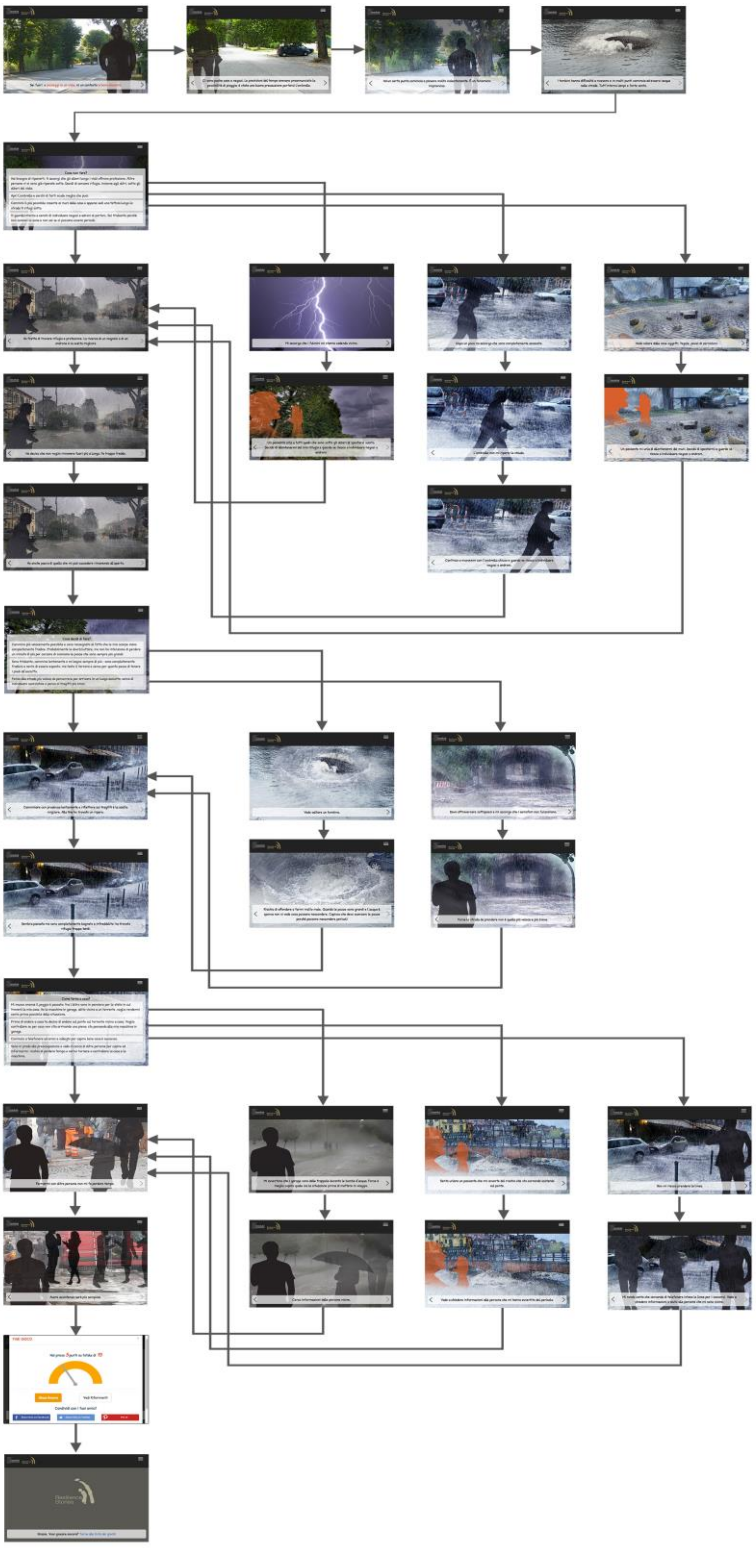


Figure 13 Narration path architecture

3.7 Flash flooding at home - narration path architecture

This story is about how to behave during a flash flooding when you are at home. Several behaviours need to be taken to reduce the risks. In particular a person needs to keep the window closed, remove or secure all the goods that can fall down on the street (gazebo, flower pots, etc.), avoid going down to the cellar or garage to check if „everything is fine“, etc.

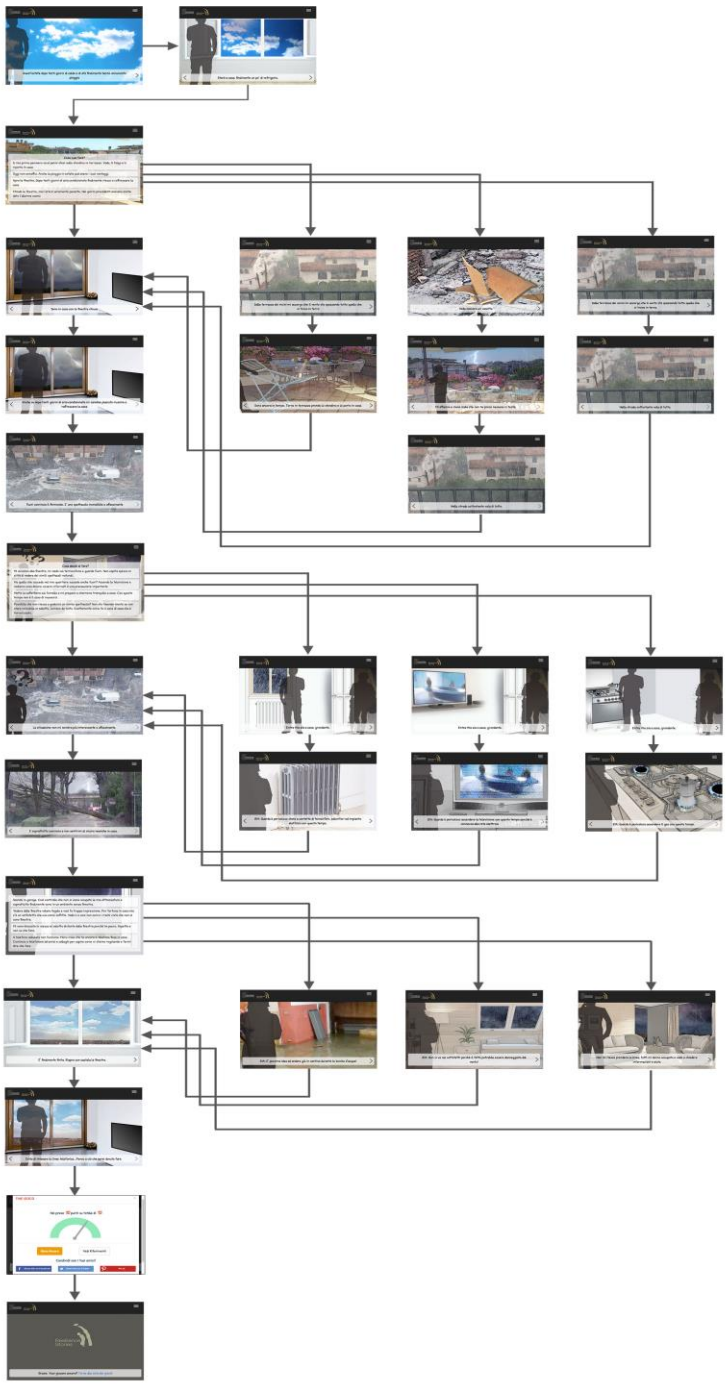


Figure 14 Narration path architecture

3.8 Conclusions

RESILIENCE STORIES have been thought not only as an app, but mainly as an evaluating instrument able to provide a community of users with an ever updated set of contents, information, and self-evaluating-tools.

Under this perspective, it has been designed to be fully functional to the resilience perspective, not constrained to a fixed model but able to follow a dynamic and complex perspective like the one expressed by the Resilience guidelines and by the FRAM paradigm. The style of the narration aims at bringing the players into reflexive experience, where the competitive aspect of the game is reduced in favour of an engaging narration.

The use of the evocative pictures has the aim of reinforcing the expressiveness of the text. New stories can be easily added to the list and can be managed different difficulties according to the target users (kids, adult,).

The app will be disseminated through the WP6 Pilot test and through the WP7 activities in order to collect a relevant dataset usable for assessing the risk perception and preparedness level of the targeted population.

4 ESSMA TRAINING APP

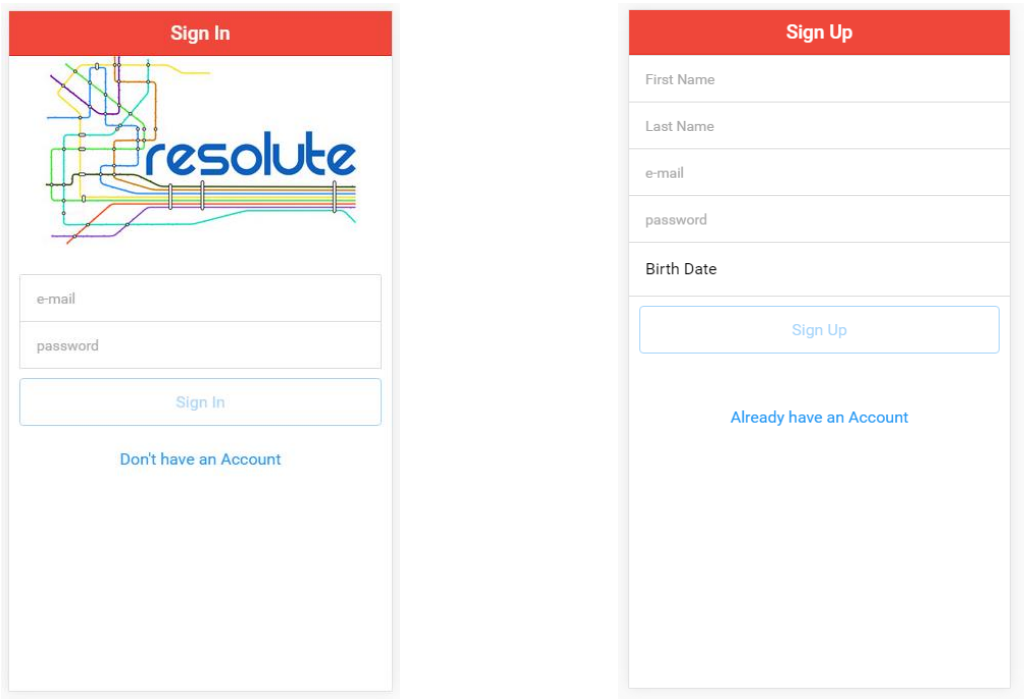
4.1 General Description

The ESSMA training app is dedicated to familiarize and train users with the real application of ESSMA. Moreover, this app uses the same functionalities with the ESSMA; however, the data and the alerts that are shown in the app are not real but random generated. Additionally, a walkthrough description, which will be illustrated in subsection 1.4, is developed in order to inform the user about several functionalities of the app. The ESSMA training app uses a gamification award system in order to keep the interest of its users at a high level. More specifically, we determined a number of tasks that award points to the user for every successful completion. When the points of a user reach a threshold of points, they receive the respective level badge.

4.2 User Interface

For the interface of the application, we use the CSS component that is provided by Ionic. This component provides all the necessary styling classes in order to design the whole interface of the application.

Figure 15. Login and Register Views



4.2.1 Walkthrough Description

In order to train users on how to use the app we created an walkthrough description that explains the major functionalities of the app these walkthrough views are shown is the following figures (Figure 16,**Errore. L'origine riferimento non è stata trovata.**. The walkthrough explanatory guide can be triggered either by users or automatically by the application. For the creation of this feature we used an angular directive that is called *ng-walkthrough*[1].

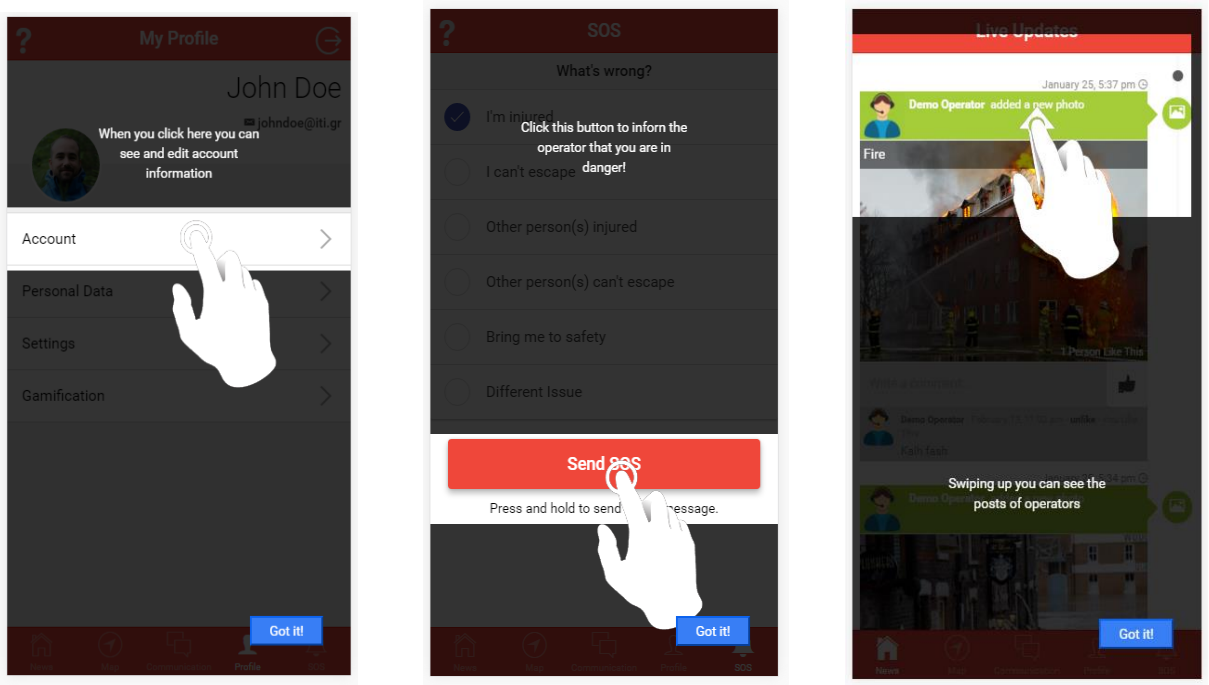


Figure 16. Walkthrough Views

A number of applications uses this kind of technology when they introduce a new feature extending their main functionalities. In our case, in which we need to familiarize users with a new application, the use a walkthrough description could be beneficial.

4.3 Gamification Description

The main goal of the introducing the concept of gamification to ESSMA training app is to increase the user's interest at this training process. The idea is to have a central gamification framework. Various functionalities can communicate with this central framework to be a part of the completely gamified environment. The goal is to motivate the user by invoking a sense of gamification to their daily usage of the app.

A number of tasks are assigned with points and the user receives these points after the successful completion of these tasks. The user is able to illustrate their point their current level in a specific view of the app. Additionally, a pop-up window is being appeared when the user reach a new level after the collection of a specific number of points.

Table 1 Table of points

Task	Points
Training Evacuation	1000

[1] https://github.com/souly1/ng-walkthrough

Training Rescue	1200
Communication Tasks	60
SOS Alert	200

The number of points is varied, the two main tasks that give to the user the most points are the training evacuation and the training rescue. These tasks are the most important ones because they train users not only how to use the application but also how to be safe in real scenarios. The number of points that users receives for these two tasks are 1000 and 1200 points, respectively. At these point, it is noteworthy that the rescue training task has two parts: the first is to reach the person that ask for help and the second to assist this person to reach a safe point; extra points are given for the second part of the task.

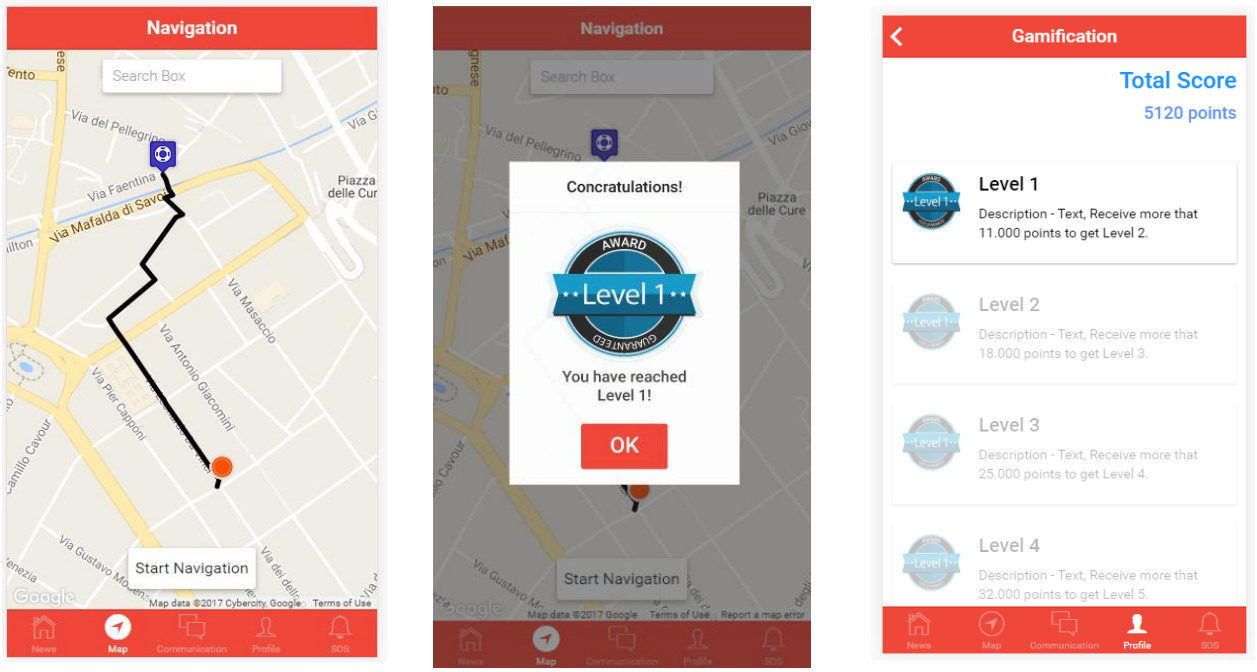


Figure 17 Gamification view

Additionally, the send SOS alert is an important task because with this task, users can be trained on the scenario that they are in danger and how to inform the operator about their condition. This task gives to the users 200 points that added to the general number of points. Finally, the message, the SMS and the phone call tasks gives to the user 60 points for each action.

During these tasks, users can use the respective communication functionalities of the application that gives to the users the opportunity to chat with local bodies and send SMS or make phone calls to them. For the training app, it is not necessary to send a real SMS of make a real call but only to navigate to the native applications of their device through the ESSMA training app. On the other hand, for the chat functionality, the messages are not sent to operators but users receive an automated reply. These tasks can be done by users only one time.

4.3.1 Gamification Scenarios

- *Training Evacuation*
  The user can ask for an evacuation, in which case the system will send to them an evacuation path. After the user has successfully followed the path, and when the user reaches their destination, the Gamification Algorithm will award to the user a number of points. During this task, the system watches the user's location and refreshes their marker on the map. The total length of the evacuation path

depends on the level of the respective user, providing to them longer path when they are higher level. The evacuation scenario is available to both simple users and volunteer helpers.

- *Training Rescue*
  A user that has accepted to be a volunteer helper can request a rescue path. Therefore, the system will show on the user's map the location and the path of a fake user that needs help. When the user reaches this destination, the system will award them a number of points. Additionally, extra points will be given to the user if the task contains also an evacuation plan for the user that needs help. This dependency is based on the condition of the user that has request for help.

- *Communication Scenarios*
  Another scenario that will give points to the user is the use of the chat functionalities of the application. This chat functionality is not a real one but the user will receive a message declaring that this is a training app. This scenario aims to familiarize the users with a new chat interface that ESSMA provides. Users are able to communicate with the local bodies. Additionally, the user will receive points every time that they use the phone call or SMS functionalities of the application.

- *Send SOS Alert*
  Finally, the user will be trained in order to learn how and when to use the SOS alert button. This will not be a real alert but it will familiarize the user with how to properly use this function. As this scenario is for training purpose and the users is not on real danger, the ESSMA training app will urge the user to send alert signals. These notifications will guide the users through the SOS call feature, including the pages describe their emergency condition.

4.4 Architecture

In this subsection, we will describe in a high level the architecture of the ESSMA training app. More specifically, the architecture of this app is almost the same with the architecture of the original ESSMA app that is developed in the Task 5.4. The architecture type that we use for this application is a client-server architecture and the communication between the mobile and the back-end is being done with a RESTful API. This API contains all the necessary functionalities in order to receive and send data between the mobile app and the server. On the server side, the data are stored to either a MySQL database or a File System. In the File System are stored the photos and videos that users are able to send through the mobile app to the server. On the other hand, the rest of the data are stored in a number of table to the MySQL database.

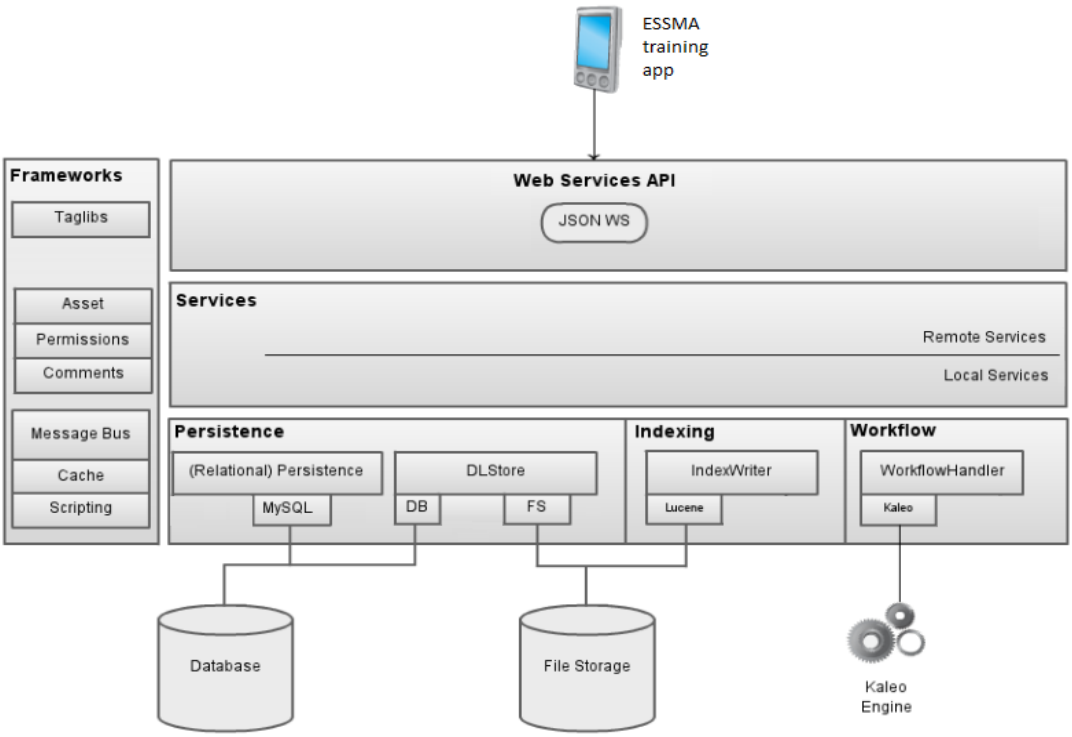


Figure 18. Back-End Architecture

4.5 Application's Interaction Diagrams

The ESSMA training app is shared the same database with the original ESSMA app. The users are able to log into the training app using the same credentials as with the ESSMA app or the can create a new account. These credentials can be used both to the training and the original app. As it is shown in the sequence diagram below there are two main functions the login and the register that the users can use in order to be authenticated or to create a new account, respectively.

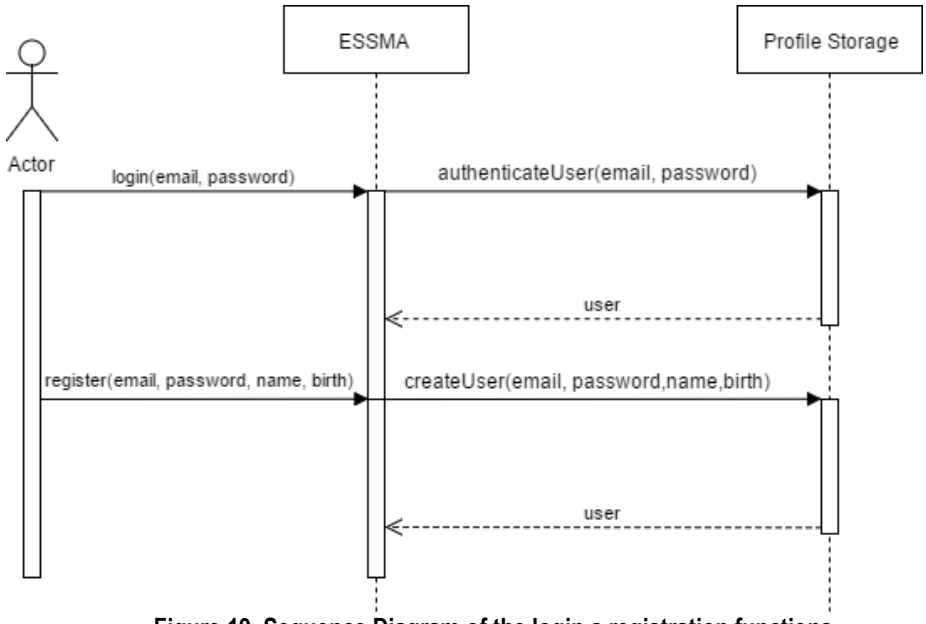


Figure 19. Sequence Diagram of the login a registration functions

The SOS functionality of the training app is a very important one. In this task, users will learn how to use the SOS button that will send to the operator a signal in order to inform them that this user is in danger. In real conditions, this information is propagated to the other ESSMA users, in order to give the volunteer helpers the opportunity to to assist this user. Nonetheless, in the training app the other users will be informed that a user uses this training app in order to motivate them to use the training app too.

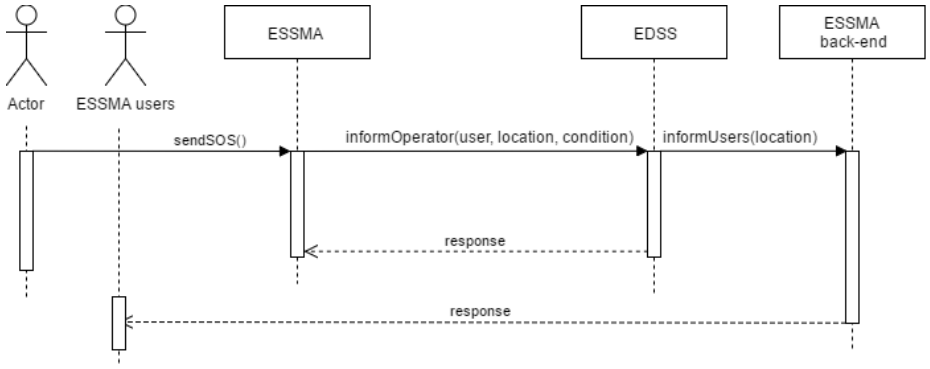


Figure 20. Sequence Diagram of SOS function

Finally, the navigation functionalities are the most important part of the ESSMA training app. In this component of the application, users will be able to simulate real scenarios of emergency. Additionally, using these two main functionalities they will be able to be evacuated and to make an imaginary rescue. After the successful completion of these tasks the will get the main number of points. In these tasks, uses will request an evacuation path in order to follow it. Moreover, for those users that have declared their willingness to be volunteer helpers, another task will be available. In this task, users could request a rescue path for iconic users and then the evacuation plan for both of them. In addition, the application will show to the user the safe points, as well as the areas in danger on the provided map.

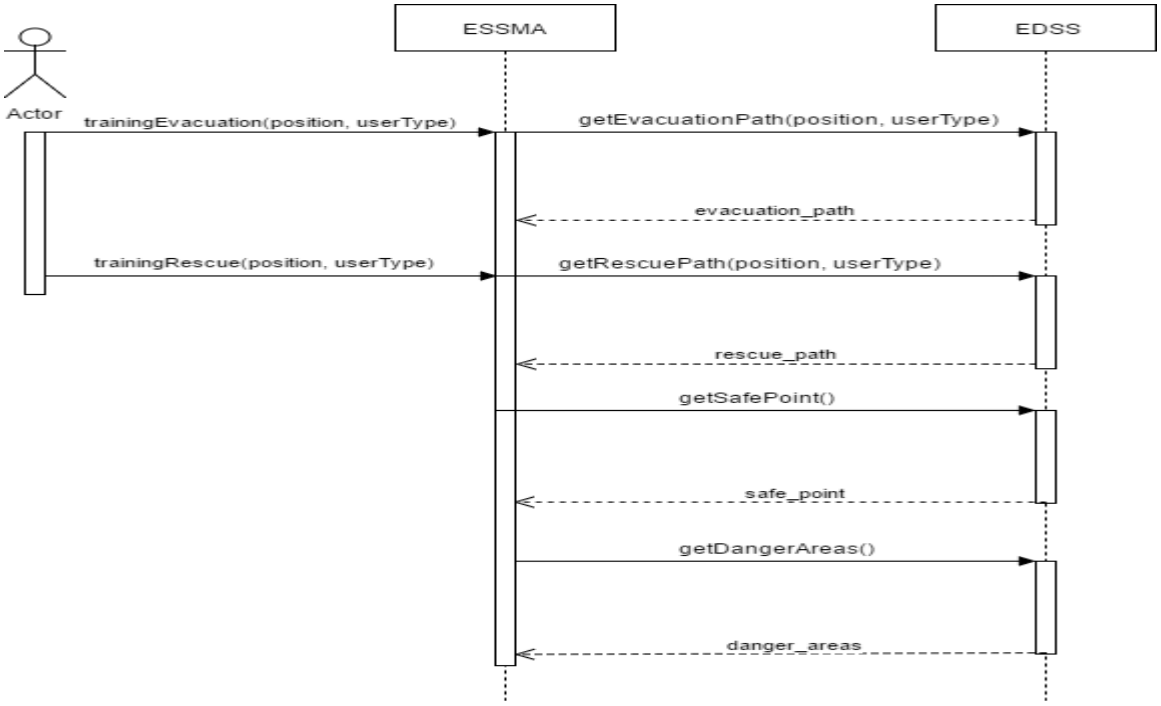


Figure 21. Sequence Diagram of Navigation functionalities

4.6 External Components[2]

The ESSMA training app is a cross-platform application, where both Android and iOS are supported. We have used the Ionic[1] which is a framework built on top of AngularJS[3] and Cordova[4].

Using AngularJS MVC architecture, we were able to develop a single page application optimized for mobile devices. Together with the CSS components all elements that a mobile application needs were offered. Additionally, using JavaScript we were able to extend these components enhancing the functionalities of the app.

Moreover, a number of Cordova plugins were used in order to use the native device functions with JavaScript code. Below, the plugins are illustrated:

1. **<plugin name="cordova-plugin-device" spec="~1.1.3"/>:** This plugin defines a global device object, which describes the device's hardware and software. Although the object is in the global scope, it is not available until after the deviceready event. This plugin is necessary in order to known when we can use the other Cordova plugins.
2. **<plugin name="cordova-plugin-console" spec="~1.0.4"/>:** This plugin is meant to ensure that console.log() is as useful as it can be. We used this plugin for debug purpose during the developing stage.
3. **<plugin name="cordova-plugin-whitelist" spec="~1.3.0"/>:** Domain whitelisting is a security model that controls access to external domains over which your application has no control. Cordova provides a configurable security policy to define which external sites may be accessed. This plugin gives the opportunity to define the cross origin policy of the application.
4. **<plugin name="cordova-plugin-splashscreen" spec="~4.0.0"/>:** This plugin is required to work with splash screens. This plugin displays and hides a splash screen during application launch.
5. **<plugin name="cordova-plugin-statusbar" spec="~2.2.0"/>:** Using this plugin, Cordova provides an object, the StatusBar object, which contains some functions to customize the iOS and Android StatusBar. It is used basically for styling purpose.
6. **<plugin name="ionic-plugin-keyboard" spec="~2.2.1"/>:** Using this plugin, Cordova provides an object, the Keyboard object, which contains some functions make interacting with the keyboard easier, and fires events to indicate that the keyboard will hide/show.
7. **<plugin name="cordova-plugin-camera" spec="~2.3.0"/>:** Using this plugin, Cordova provides an object, the Keyboard object, which contains an API for taking pictures and for choosing images from the system's image library. This plugin is used in order to capture photos that will be sent to operators through chat
8. **<plugin name="cordova-plugin-file-transfer" spec="~1.6.1"/>:** This plugin allows you to upload and download files. It is used with the coordination of the previous plugin in order to send photos to operators through chat.
9. **<plugin name="cordova-plugin-geolocation" spec="~2.4.1"/>:** This plugin provides information about the device's location, such as latitude and longitude. This information is necessary for the evacuation and the rescue path that will be provided by the EDSS that is developed in the Task 5.2.
10. **<plugin name="cordova-sms-plugin" spec="~0.1.11"/>:** This plugins is used by in order to send pre-defined SMS using the native device application for SMS.
11. **<plugin name="phonegap-plugin-push" spec="~1.9.2">:** This plugin offers support to receive and handle native push notifications with a single unified API. We use the Ionic push notification system in order to send to the ESSMA training users when either a new task is available and needs to be done or to send a number of alerts by the system to the users.

[2] https://ionicframework.com/

[3] https://angularjs.org/

[4] https://cordova.apache.org/

CONCLUSIONS

The RESOLUTE project aims at investigating the capability of games to train (prepare) with success a large number of people against a number of risk scenarios. Scope of the game is to support community resilience building through integrating other formative and informative actions usually carried out by authorities with leaflet, public meetings, media communications, lessons in the school, etc. The capability of the gamification of training to change wrong heuristics or to raise awareness has been explored with success in several contexts (Gabbett, Jenkins, Abernethy, 2009), while in the resilience domain it represents a novelty. Even if there is a solid background behind the game approach, its validation and impact will be evaluated during the Pilots execution (WP6).

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