

“RESilience management guidelines and Operationalization appLied to Urban Transport Environment”

Tools & methods for resilience operationalization

A VA Platform for Personalized Crowd, Fleet & Resources Management

Presenter:

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HELLAS

Project funded by the Horizon'2020 in topic 7 of “DRS-07-2014”

Grant Agreement #653460



- **eDDS** (Evacuation Decision Support System), part of a larger entity, the Collaborative Resilience Assessment & Management Support System
- **ESSMA** (Emergency Support Smart Mobile App)
- **ESSTA** (Emergency Support Smart Training App)

...taking into account the:

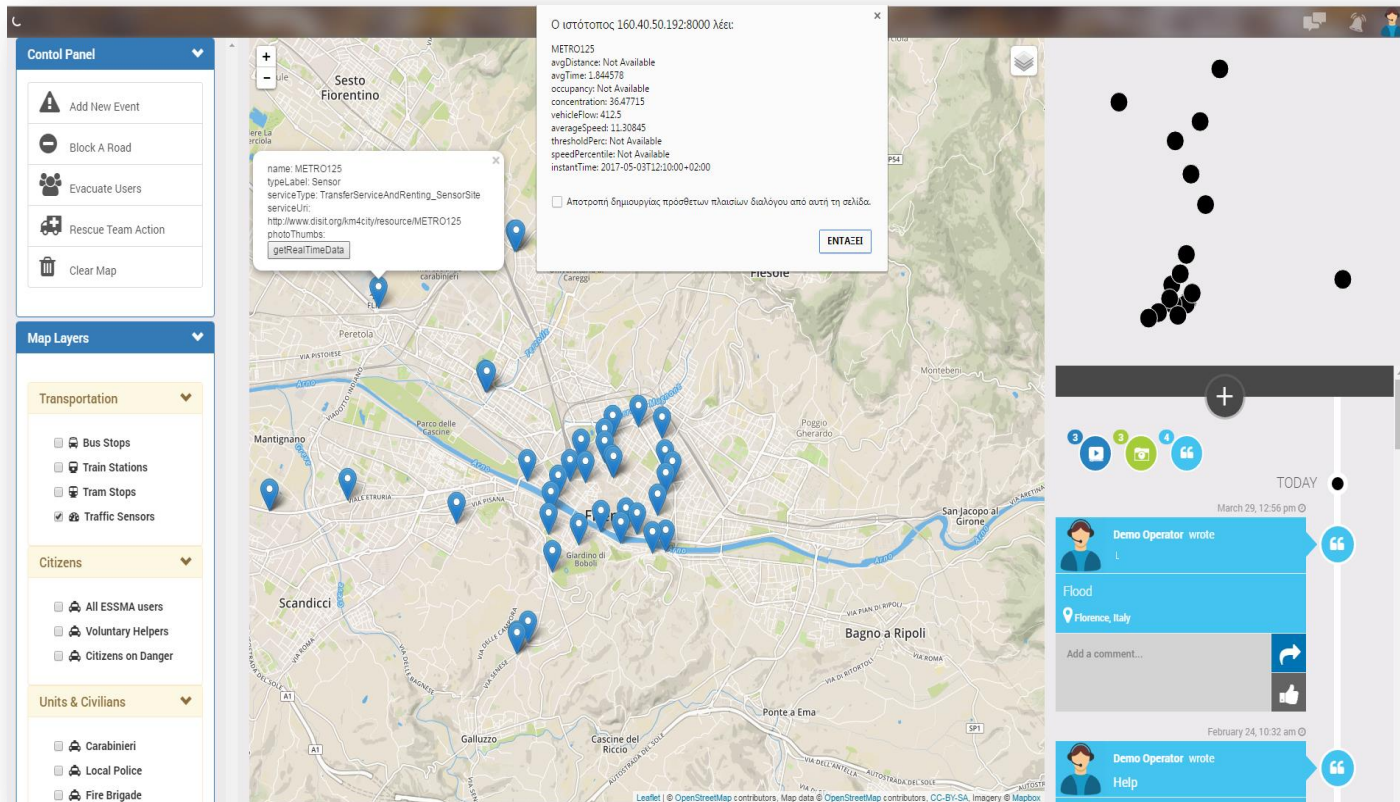
1. European Resilience Management Guide (**ERMG**) for UTS
2. User **requirements** (focus groups)
3. 1st **usability testing** & 1st refinement (eDSS, ESSMA) after prototyping
4. 2nd usability testing, 2nd **refinement** (eDSS, ESSMA)

Scope: *to support the resilience of the UTS in situation of emergency by*

- providing **Decision Support Services** to the UTS authorities
 - evacuation planning
 - collaborative rescue planning
- providing information to the UTS authorities through bidirectional communication with the ESSMA users
 - real-time location of the citizens & tracking
 - reports regarding the citizens' condition (e.g. trapped, injured, etc.)
 - real-time feedback information from the emergency scene

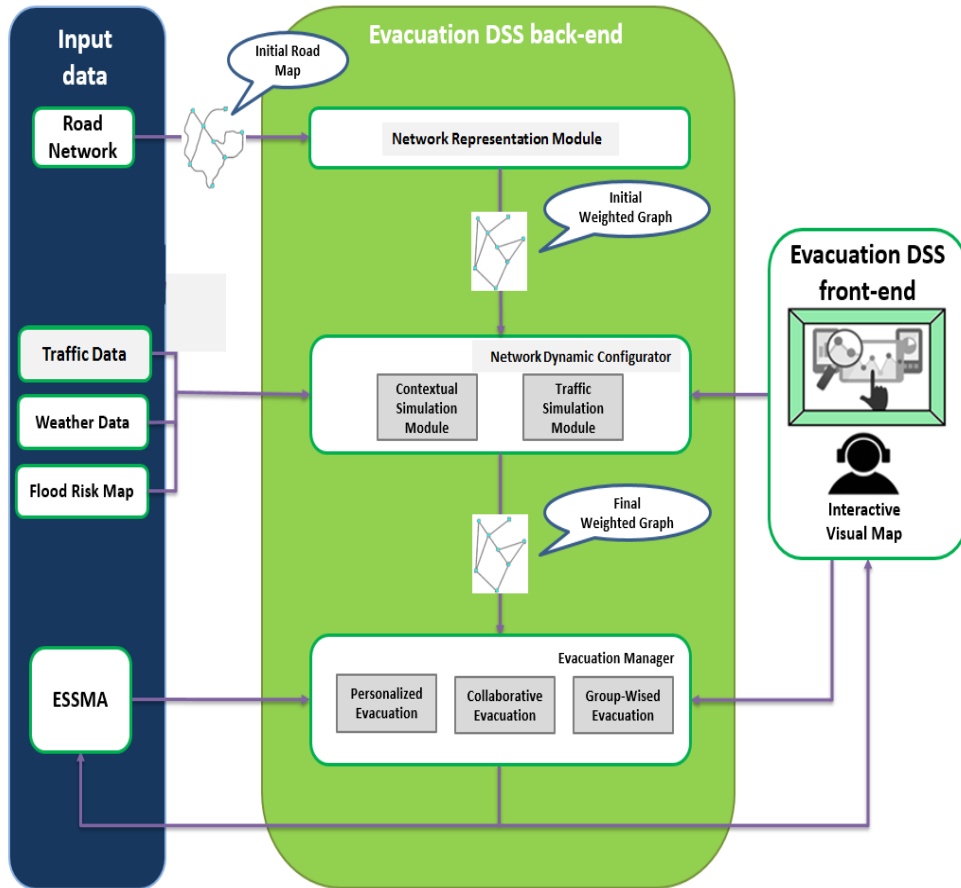
Target users

- Civil protection professionals



- Control Panel
- Map Layers
- Map View with detailed pop-ups

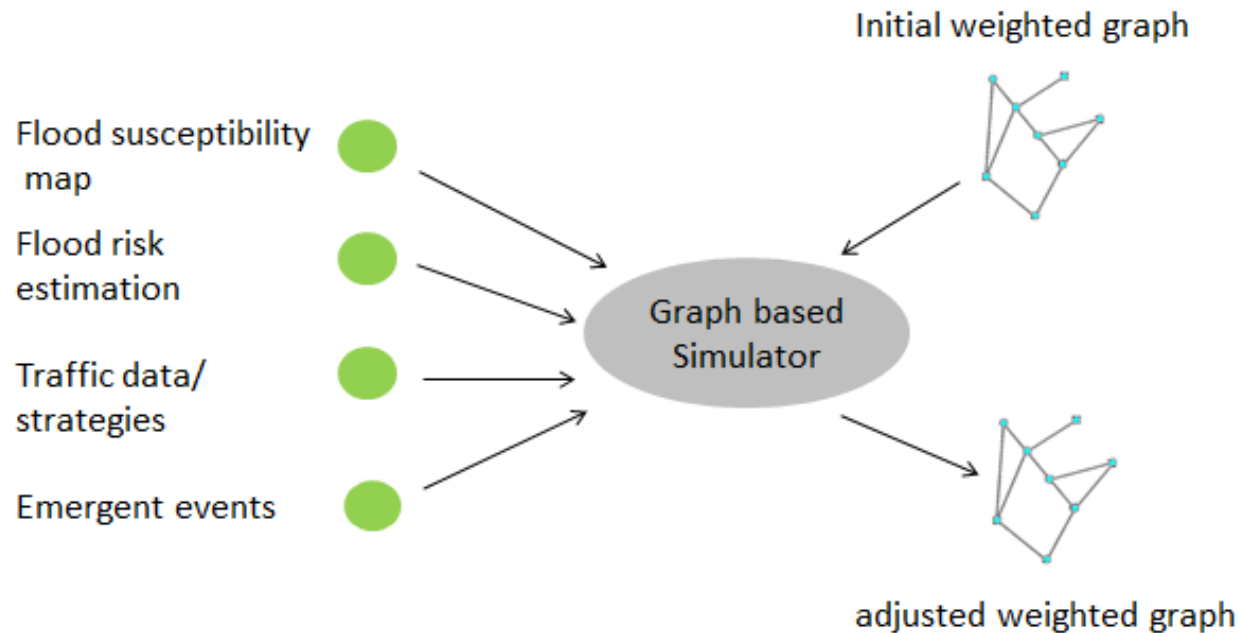
- Behavioural Analysis
- Live news feed
- Chat functionality



3 modes for evacuation routing planning supported:

1. **Group-wise** evacuation (regards big groups of people)
 Vehicles evacuation (respects the direction of the roads)
 General public (pedestrians)
2. **Personalized** evacuation (regards the vulnerable people)
 Route selection according to the type of the road and the disabilities of the user
3. **Collaborative** rescue action planning
 Role assignment (rescuers, to-be-rescued)
 Guidance of rescuers to the trapped/injured citizens

- **Dynamic update** of the network edges (i.e. roads & road segments) properties (i.e. travel costs). e.g.:
 1. Marking hazardous areas on the map
 2. Weather risk estimation & flood susceptibility maps
 3. Adaptation to real-time traffic data
 4. Real-time traffic strategies (e.g. close/open a road)



- The proposed algorithm is **based on the CCRP* algorithm**:
 - each road segment should be accompanied by a “**travel cost**” value
*the upper bound of the **weight** of the road, affected by the graph-based simulator, over the average speed of each user*

$$Travel_{Cost}(e) = \left\lceil \frac{w_g(e)}{s} \right\rceil$$

- The proposed algorithm **extends the CCRP* algorithm** by:
 - dynamic estimation of the s variable according to environmental & contextual information in real time
 - introducing personalized profiles for its users (e.g. pedestrian types, cars, etc.)
 - Matching between the profile of the user and the network’s properties

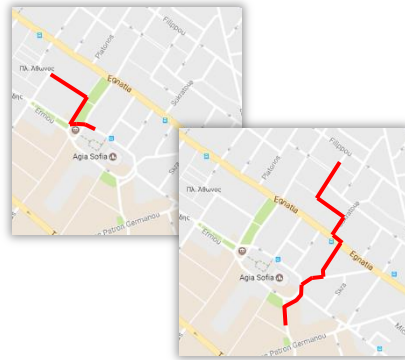
* Lu, Q., George, B., and Shekhar, S, *Capacity Constrained Routing Algorithms for Evacuations Planning: A summary of Results, SSTD’ 2005*, pp. 291-307, 2005.

- Goal: To visualize and cluster agents based on their mobility behaviors.

- Mobility behavior features are extracted for each agent, using the coordinates of paths that they have taken in their history.

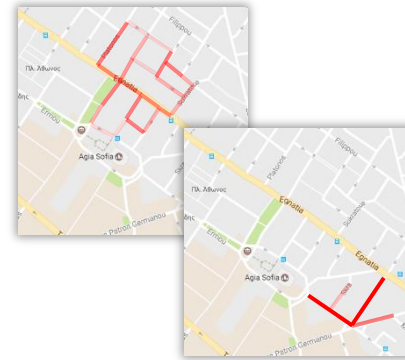
Average path length

Discriminates between agents taking short paths vs agents taking long paths.



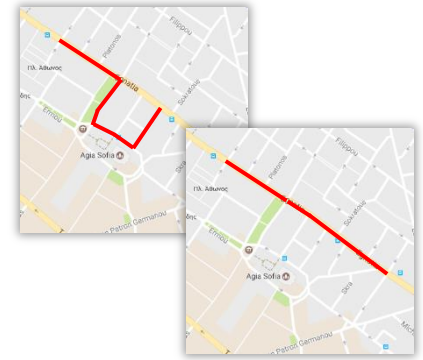
Average path entropy

Discriminates between agents taking random paths vs agents taking specific limited paths.

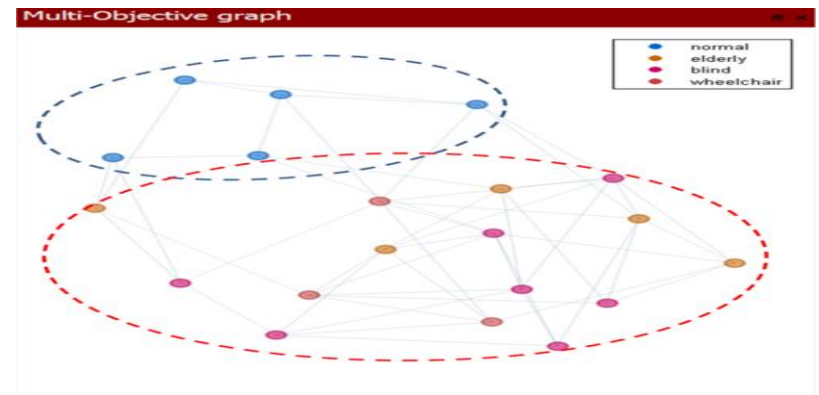


Frechet feature

Discriminates between agents taking paths of different geometric shapes.



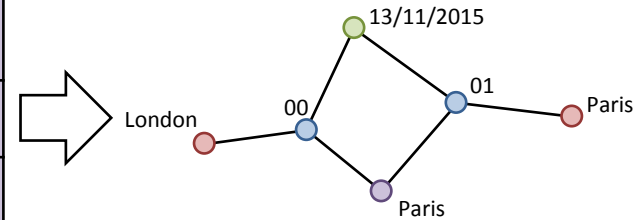
- Each point corresponds to an agent.
- Colors denote ground truth (blue: no mobility problems, redish: mobility problems.)
- Agents with 1st behavioural pattern are visually clustered from agents with behavioural pattern 2.



- **Goal:** Detect emergency events from social media, using visual analytics methods.

- **Raw data:** Twitter posts
Attributes:

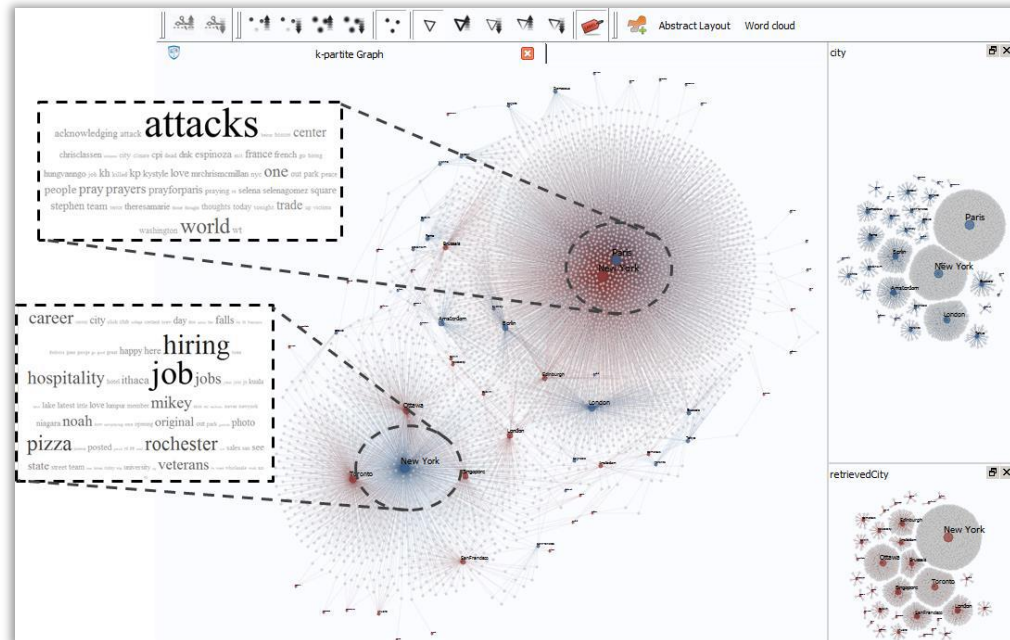
Tweet ID	Post location	Date	Text location
00	London	13/11/2015	Paris
01	Paris	13/11/2015	Paris



- Location from which they were posted
- Date/time
- Location mentioned in text
- Emergency-related keywords
- Metadata (original/retweeted, author, etc.)

- Multimodal k-partite visualization
 - Reveals groups of posts with common attributes

Example of k-partite visualization using tweet posts sent during the week of Paris attacks on 13/11/2015

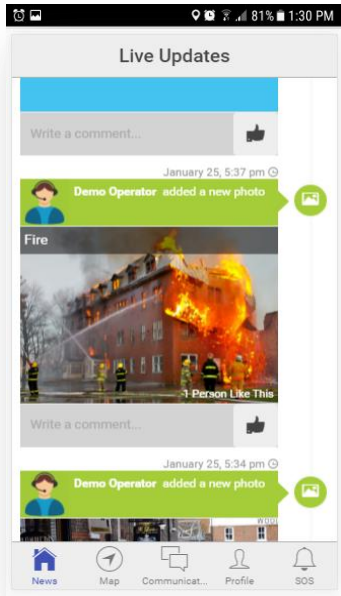


- **Scope:**

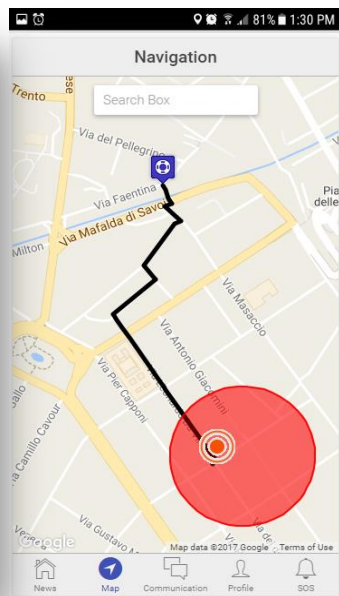
- to **track users'** movement & behaviour and thus, provide the eDSS with data on a level of detail
- to provide users with personalized information, aiming to **support self-rescue** or to **divert passenger flow** in the UTS in case of a disruption, or to **provide guidance** to other citizens **in need of help**

- **Target users:**

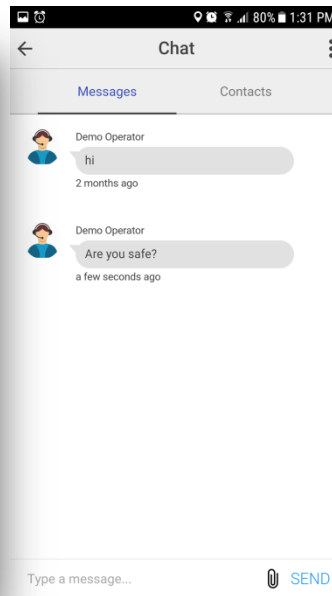
- **civilians** (owners of a smartphone, Android/iOS)
- **rescue professionals** (professionally trained in rescue activities between 18 years of age to retirement)
**the app distinguishes between helpers and non-helpers*
- A key role is the **operator's one** responsible for informing & guiding the ESSMA users (through the eDSS control interface)



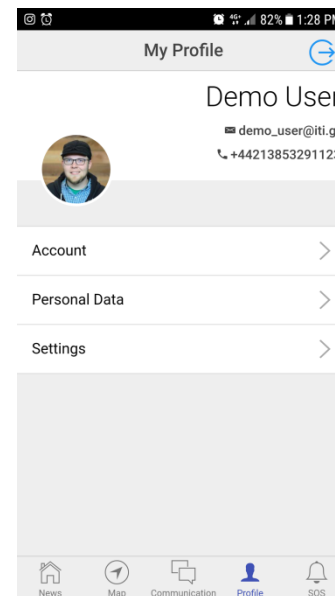
News Feed



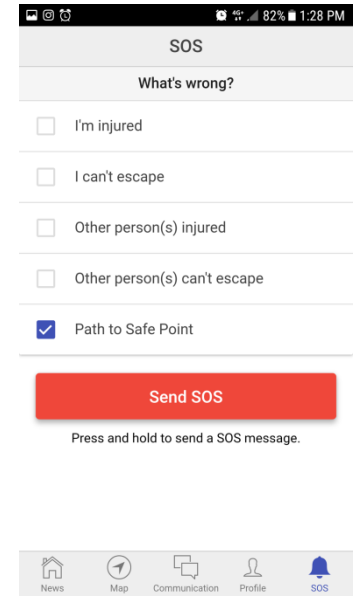
Map



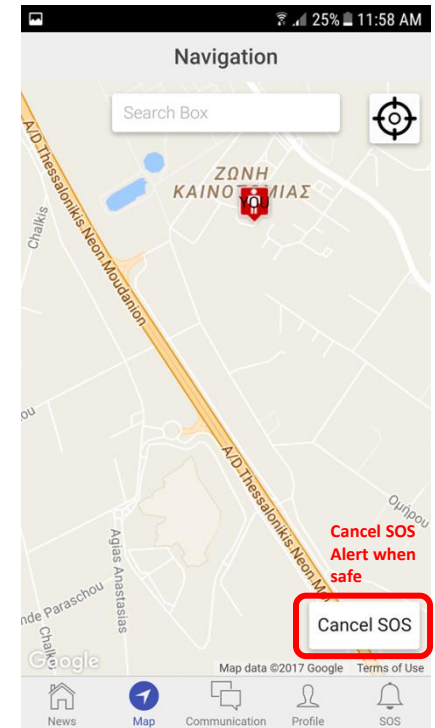
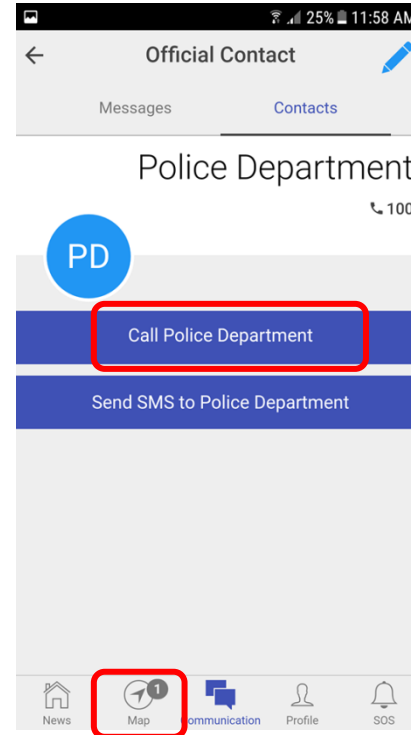
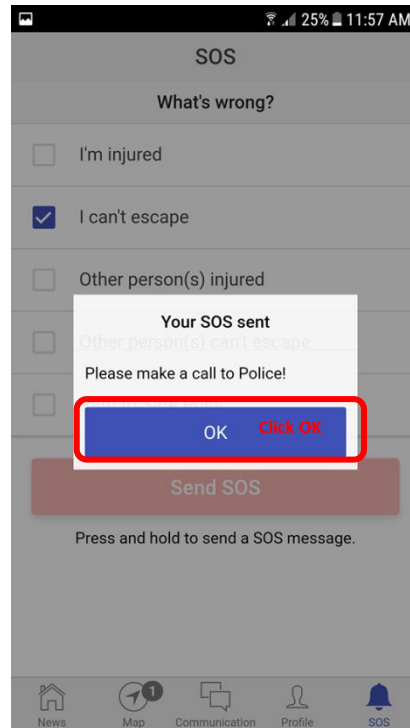
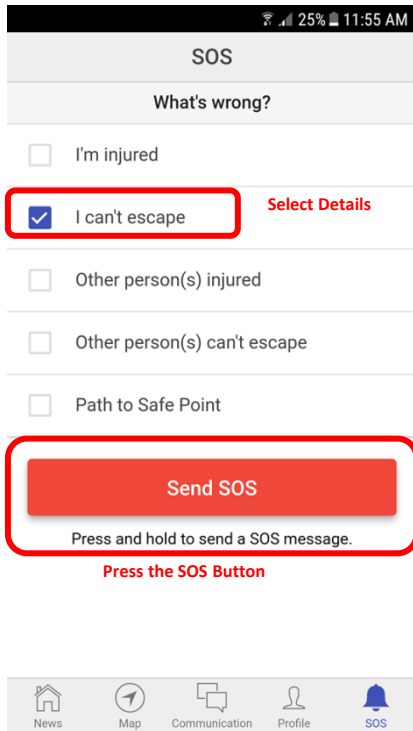
Chat



Profile



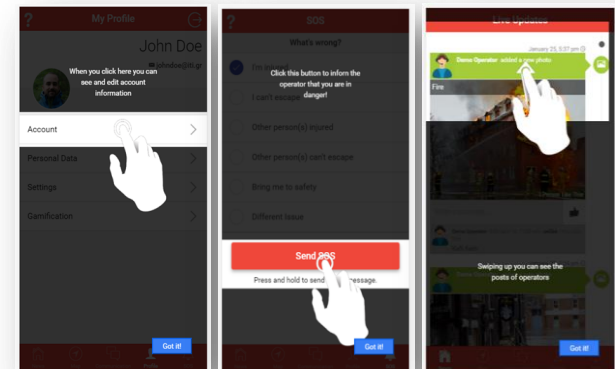
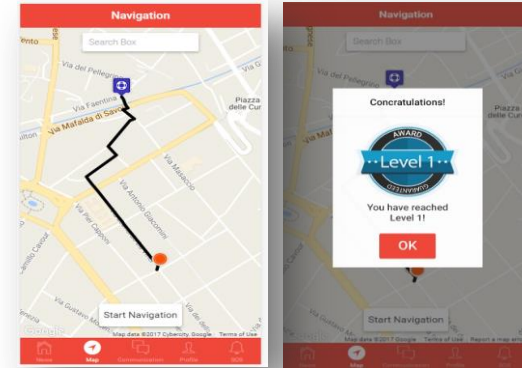
SOS



Scope: *To offline familiarize the ESSMA users (rescuers & rescuees) with the usage of ESSMA*

ESSMA training mobile app development (front-end):

- Based on the same concept as the ESSMA app
- **Random generation of evacuation & rescue paths** for training purpose
- **Gamification** functionalities, with **points & levels** collection by using the app
- Web services supporting:
 - experience based simulation of random paths
 - for the CRUD functions of the Gamification points
 - Updates in the database tables of the Gamification records



[RESOLUTE] 1st Evacuation Scenario (single user)

- <https://www.youtube.com/watch?v=CxWs2OXgUgk>

[RESOLUTE] 2nd Evacuation Scenario (group rescue)

- <https://www.youtube.com/watch?v=MeA2JcieUQk>

[RESOLUTE] 3rd Evacuation Scenario (collaborative rescue)

- <https://www.youtube.com/watch?v=4ZhkMzlygIM>

Questions & Answers



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