A mobile crowdsensing app for improved maritime security and awareness

Davide Moroni, Gabriele Pieri, Marco Reggiannini, Marco Tampucci

S4E

NAUTILOS

PerCom – DEMO SESSION

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Outline

- S4E project: Safety & security systems for sea environment

- The role of crowd sensing in the marine-maritime domain

- App
  - Scope and design
  - Demo
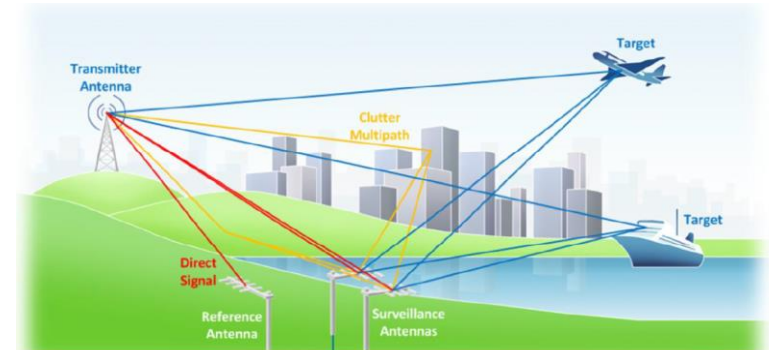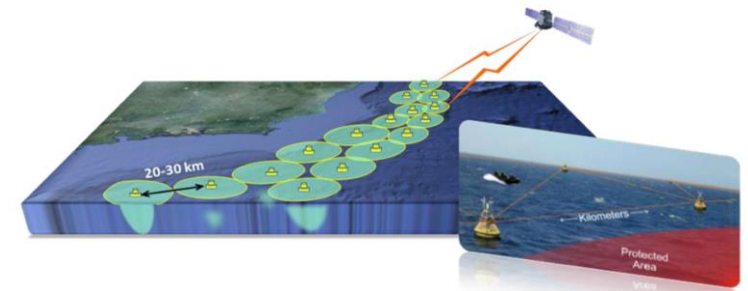
- Future plans and conclusions

Safety & Security Systems for Sea Environment (S4E) project

An intelligent integrated systems for:

- pervasive and continuous monitoring
  - In ports, protected marine areas, remote coasts, river mouths, oil platforms, or waste water discharges
- simplified surveillance & increased safety in marine protected areas
- supporting navigation and simplifying surveillance in coastal marine areas
  - using active sensors, both with fixed and mobile
  - through passive sensors, based on the intelligent use of opportunistic sources
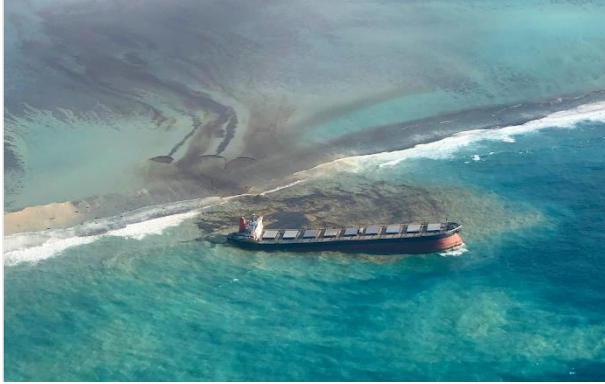
- **Advanced early warning systems** for the protection of coastal marine areas and the protection of citizens of port cities
  - X-band radar sensors arranged along the coast and / or mounted on cooperating ships **+ available satellite assets**
  - **identify** the presence of spills at sea
  - **predict** the impact area on the coast, for risk management or, in general, the direction and speed of propagation.
  - **enable prompt response** and mitigation actions
- **Interactive app for sailors and citizens**
  - not just users but **engagement** and **awareness**

- Deploy the smartphone as a sensing and communication device
  - to collect and transmit relevant data about the status of the sea, the presence of pollutants and other hazards
  - thanks to the help of volunteers
- Convergence between citizen science, environmental monitoring and mobile sensing
- Expected benefits:
  - Extended coverage for areas of interest
  - More timely reports with respect to remote sensing
  - Awareness-raising on the themes of marine safety and marine protection

Environmental monitoring

Citizen Science

Mobile Sensing
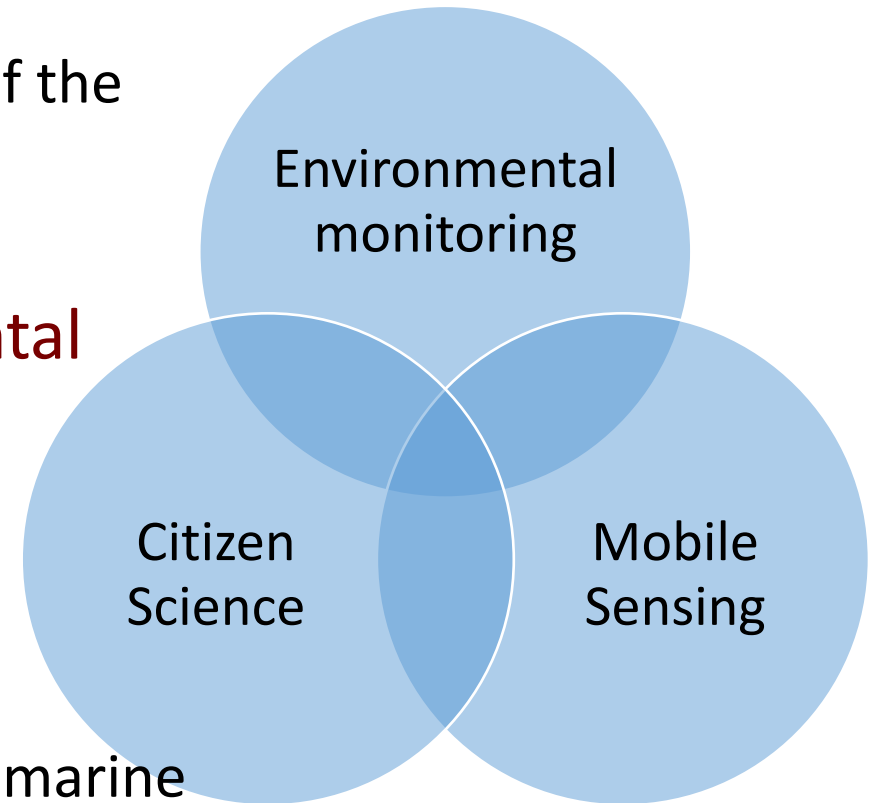
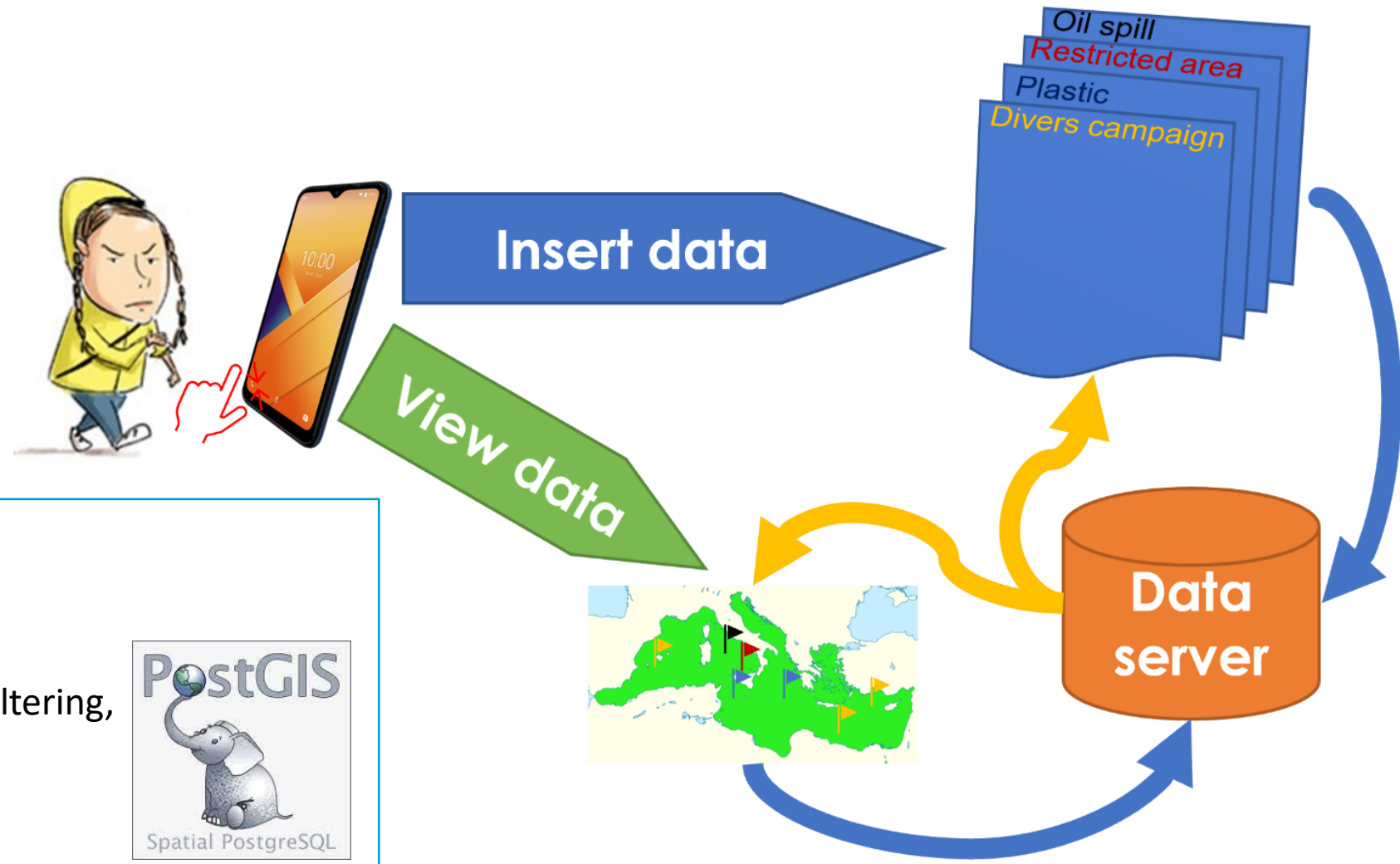**SW framework**
ReactNative
- Android, iOS

Data server
- Rest API
- postGIS DB
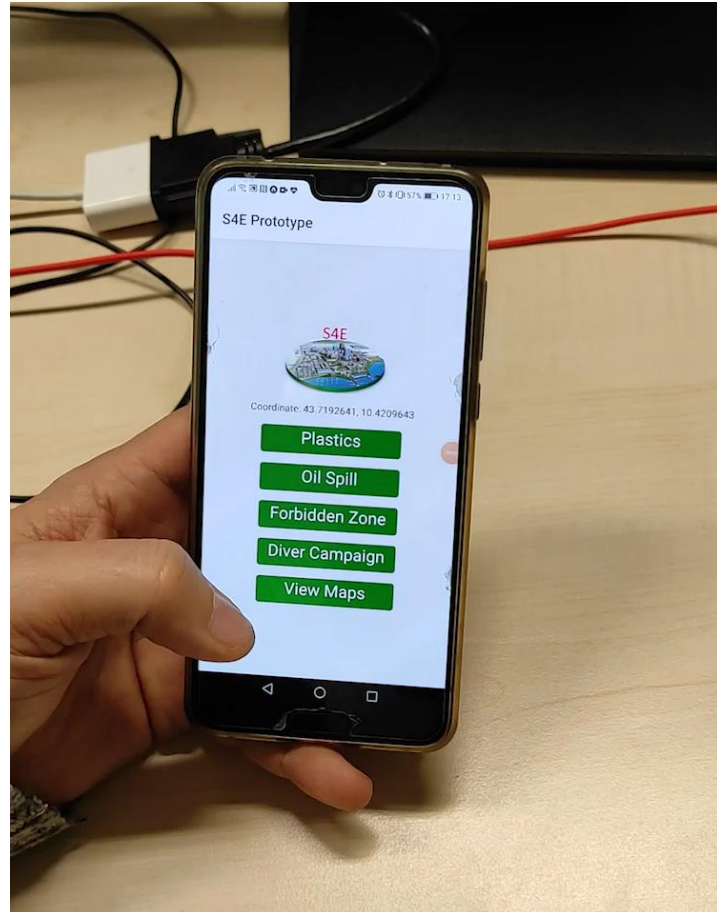 - Spatial queries support, filtering, visualization and analysis

Insert data

View data

Oil spill
Restricted area
Plastic
Divers campaign

Data server
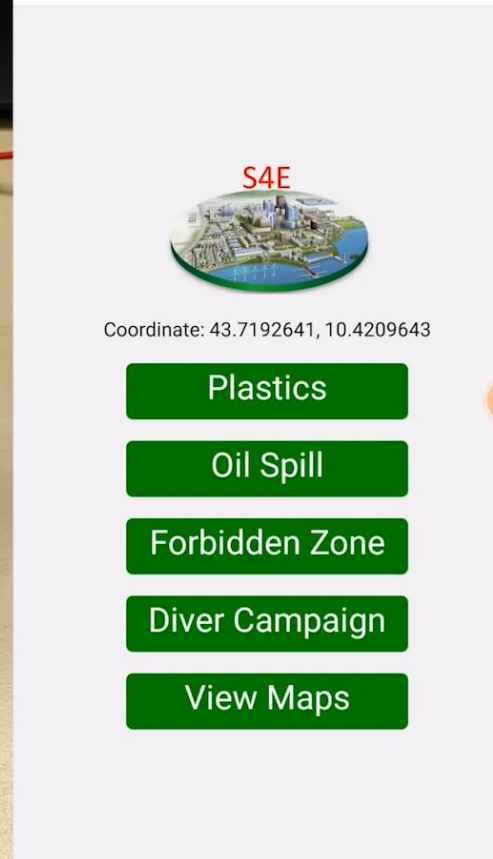
S4E Demo

Conclusions and plans for the future

- Proposal of a mobile crowd sensing app
  - Enabling citizen science
  - Providing reports for sea safeguard and citizen safety
  - In the framework of a wider integrated project for safety and security

- Forthcoming releases:
  - Inclusion of GeoServer for providing WMS according to OpenGeoSpatial consortium standards

- Future works:
  - Image acquisition through the app for additional evidence
  - Integration of computer vision and Artificial intelligence paradigms for image understanding

- Planned testing:
  - Acquisition campaigns in the framework of S4E and H2020 Nautilos project

Bibliografy

[1] D. Moroni, G. Pieri, and M. Tampucci, "Environmental decision support systems for monitoring small scale oil spills: Existing solutions, best practices and current challenges," Journal of Marine Science and Engineering, vol. 7, no. 1, p. 19, 2019.

[2] M. D'Acunto, D. Moroni, A. Puntoni, and O. Salvetti, "Optimized dislocation of mobile sensor networks on large marine environments using voronoi partitions," Journal of Marine Science and Engineering, vol. 8, no. 2, p. 132, 2020.

[3] D. Moroni, G. Pieri, O. Salvetti, M. Tampucci, C. Domenici, and A. Tonacci, "Sensorized buoy for oil spill early detection," Methods in Oceanography, vol. 17, pp. 221–231, 2016.

[4] Z. Li, F. Santi, D. Pastina, and P. Lombardo, "Multi-frame fractional fourier transform technique for moving target detection with space-based passive radar," IET Radar, Sonar & Navigation, vol. 11, no. 5, pp. 822–828, 2017.

[5] M. Goodchild, "Neogeography and the nature of geographic expertise," Journal of location based services, vol. 3, no. 2, pp. 82–96, 2009.

[6] M. Martinelli and D. Moroni, "Volunteered geographic information for enhanced marine environment monitoring," Applied Sciences, vol. 8, no. 10, p. 1743, 2018.

[7] D. Moroni, G. Pieri, M. Tampucci, and O. Salvetti, "A proactive system for maritime environment monitoring," Marine pollution bulletin, vol. 102, no. 2, pp. 316–322, 2016.

[8] Meta Platform, Inc., "React native," https://reactnative.dev/, 2021, last reviewed March 8, 2023.

[9] Open Geospatial Consortium, "PostGis," https://postgis.net/, 2021, last reviewed March 8, 2023.

[10] ——, "GeoServer," http://geoserver.org/, 2021, last reviewed March 8, 2023.

[11] C. Wilson, D. Robinson, and R. A. Simons, "Erddap: Providing easy access to remote sensing data for scientists and students," in IGARSS 2020-2020 IEEE International Geoscience and Remote Sensing Symposium. IEEE, 2020, pp. 3207–3210.