

SPOTTED - Satellite Open Data for Smart City Services Development

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Abstract

SPOTTED aims to provide an innovative solution based on the integration and customized processing of massive Open Data collections, including Earth Observation (EO) data, to monitor and support decision makers in the field of green areas management. What do we want to do: a) Integrate: provide an innovative solution based on the integration and customized processing of massive open data collections, including Earth Observation data to monitor and support decision takers in the field of Green Areas management; Combine: combine artificial intelligence processes, cloud storage and cloud computing technologies, massive open data collection with customizable dashboards for automatically monitoring, classifying, managing, and predicting emerging land changes; Innovate: improve the current solutions and services and open new business avenues for novel applications based on Open Data libraries and enabling technologies such as EO, AI, Cloud and Big Data. Use of integrated Open Data collections through Open Data infrastructures such as EU Portal, CEF Context broker and Copernicus Hub to empower customized services that optimized the use of data processes addressing them into different monitoring services

Keywords

Smart cities, Open data, Green areas management

1. Introduction

The EO open data are becoming increasingly important, in particular integration with other non-EO data enables highly valuable commercial applications. SPOTTED aims to provide an innovative solution based on the integration and customized processing of massive open data collections, including Earth Observation data to monitor and support decision takers in the field of Green Areas management. SPOTTED is designed to combine artificial intelligence processes, cloud storage and cloud computing technologies, massive open data collection with customizable dashboards for automatically monitoring, classifying, managing, and predicting emerging land changes. The proposal targets its output on the analysis and management of urban green areas supported by the Public bodies participating in the consortium. Territorial changes, natural or man-made, can have a strong negative impact on land, buildings, critical infrastructures, natural environment both in terms of territorial sustainability and resilience dynamics. The owners or, more importantly, public entities in charge of managing massive land assets, need to


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continuously monitor what happens to the properties (cadastral parcels) under their control and possibly anticipate negative repercussions deriving from unexpected or undesirable changes. The project's overall objective is to improve the current solutions and services and open new business avenues for novel applications based on Open Data libraries and enabling technologies such as EO, AI, Cloud and Big Data. An innovative framework of high-performance data infrastructure will enable capabilities for automated collection, combination, management, processing, enrichment, securing, and privacy preserving of heterogeneous datasets aiming at supporting decision-making based on Open data. The data organization model of SPOTTED project is designed to minimize the need for redundant information storage space by favouring on-the-fly processing in most analyses. The innovative key of this model is the use of integrated Open Data collections through Open Data infrastructures such as EU Portal, CEF Context broker and Copernicus Hub to empower customized services that optimized the use of data processes addressing them into different monitoring services. To optimize resources and ensure the best performance, SPOTTED uses a "Tipping & cueing" model. The "Tipping" recognizes on a macro scale the areas most affected by territorial changes thanks to the processing of satellite, geographical and statistical information. The "cueing" phase on the other hand is the automatic tuning process of the analysis calibrated only on the areas identified in the tipping process. In this way, the use of data is reduced and optimized, real-time processing processes are lightened and a constant and updated flow of information between the Open data collections and monitoring services is guaranteed. The project will clearly demonstrate how this framework will generate innovation and large-value creation from the data assets through the implementation of three pilots in Milan, Helsinki and Naples focused on the monitoring and planning of green areas in the cities in relation to different factors (e.g. tourism impact, quality of life etc.). Applying self-developed AI algorithms to Copernicus and a combination of other non-EO open data (such as pollution data, urban and extra urban traffic data, meteorological data, land management regulation, local strategic plans, social media data, socio economic data) allows SPOTTED to mine relevant information enabling the following outputs:

- Automatic change detection and Machine Learning classification of changes (such as land cover and land use, sizing and classification of agricultural activities, presence of new buildings or fixed structures, deforestation and growth of vegetation, urbanization in the surroundings)
- Analytical insights for smart gran asset management (knowledge of socio-economic, urban and infrastructural dynamics, calculation attractors proximity in terms of time and distance and complex analyses based on EO, social networks and big data)

2. Objectives and work programme

Main Objectives	How the proposal addresses the specific objectives of the call
<p>...address the generation of cross-border and/or cross-domain services re-using information made discoverable/available through the European Data Portal, in combination with other sources of information, where applicable.</p>	<p>SPOTTED project will pilot different cross-border services, in three different cities (Milan, Helsinki and Naples) in the field of green areas management and their impact evaluation in societal and economic aspects. These services will be based on the combination of Earth Observation open data (i.e. satellite images) with open dataset provided by the cities and other sources, in particular the European Data Portal.</p>
<p>actions must address as a priority datasets belonging to one or more of the following High Value Datasets categories: geospatial, earth observation and environment, meteorological, statistics, companies and company ownership, mobility.</p>	<p>The core datasets that will be addressed and reused by SPOTTED are related to the Earth Observation open data (e.g. Copernicus satellite images) that are included in the High Value Datasets category. To support the specific project use cases these base datasets will be combined with other open data, provided by the city, mostly related to the High Value Datasets, concerning, for instance, to environmental, statistical and economical information</p>
<p>Datasets generated must be discoverable and available through one or more Member States' open data portals and through the European Data Portal</p>	<p>The SPOTTED technical framework will assure interoperability of the open dataset produced during the project and their compliance with the national and European related metadata standards (e.g. DCAT-AP, GeoDCAT-AP) and API. In this way the open data generated by the project can be easily made available through the European Data Portal and national open data portals.</p>

Conditions for the publication and re-use of datasets generated by the proposed actions must be machine readable and compatible with open standard licences

...Application Programming Interfaces (APIs) must be used as far as possible for the data re-used and/or generated...

Datasets generated must be harmonised, including the detailed description of the data... the structure of the data, the data content and the semantics of the data.

Concrete Key Performance Indicators (KPIs) must be proposed in order to evaluate the benefits of the implemented solution(s)...

The technical solution developed by SPOTTED will guarantee the interoperability and compliance with the European standard of the generated open datasets that will be made available in open machine readable formats.

All the datasets provided by SPOTTED project, during the piloting phase of the city services, will be made available through specific APIs for a simple and standard third party access. The APIs will be compliant to most relevant (de-facto) standards for open data reuse in Europe (e.g. CKAN API, SPARQL etc)

Specific capabilities of the SPOTTED framework will be devoted to the data collection and harmonisation. The reuse of specific data platforms with data semantic harmonisation capabilities (i.e. Digital Enabler platform) will ensure that the generated dataset will be harmonised also across different use case services.

A specific task has been defined in the workplan (inside Activity 1) to define, at the beginning of the project, the different KPIs to evaluate pilot serviced results and impact. Furthermore a set of initial KPIs is already included in this proposal in the Impact and Sustainability section

Use cases must be included to demonstrate the appropriateness of the proposed solutions and how they will address economic and societal challenges.

SPOTTED will implement and experiment services related to different use cases of Milan, Helsinki and Naples. The services will use the SPOTTED framework services to access data and perform specific analysis in it, demonstrating the added value of the technical solution. Moreover the use cases are focused on the evaluation of the economic and societal impact of the specific environmental policies in the field of green area management

Relevant legal aspects concerning data use, adoption, sharing... additional to those related to ensuring GDPR compliance must be addressed

The project management processes and the pilot monitoring task will be in charge of verifying the possible issues related with the data reuse (e.g. open licenses) and privacy (GDPR compliance). Anyway, at the moment of the proposal writing not specific issues are identified in relation to the selected use cases

Deployment of a Context Broker solution, i.e. as an implementation of the NGS-LD API technical specification

The SPOTTED technical framework will be fully integrated with an instance of the CEF Context Broker supporting NGS-LD API. The presence in the consortium of the FIWARE Foundation and other technical partners with an high expertise in the usage of CEF Context Broker, will guarantee a full compliance with this solution.

3. Pilots

There are three pilots:

- Data driven green and just transition (Municipality of Milano): with SPOTTED, Milano plans to develop a data platform to analyze and predict urban, social, and economic impacts of green transformation initiatives. The platform will serve as a practical policy-making asset, as it will provide machine learning tools to assess, plan, and develop sustainability programs such as ForestaMI, the Milan building regeneration plan, or the municipal de-sealing action;

- Monitoring sustainability of tourism and urban planning (Helsinki): the pilot in Helsinki focuses on identifying the green areas out of the satellite imagery at the city level. This information is used to create two data products, one for monitoring the sustainability of nature tourism and one for maintaining the green index indicator in support of urban planning;
- Monitoring urban regeneration strategies (Municipality of Napoli): the Naples pilot project focuses on the use of satellite images to create multi-temporal and multi-parameter thematic maps for a thorough analysis of the starting point of the actions and for a constant and continuous monitoring of the achievement of the identified objectives.

4. Exploitable assets

The exploitable assets are as follows:

- SPOTTED technical framework: it is an integrated environment based on mature existent assets that will be able to collect information from heterogeneous open data sources, including satellite images combine them and provide data analytics through visual dashboard and maps
- Pilot service applications: in each pilot will be developed specific applications that will reuse open data and analytics provided by SPOTTED framework to perform analysis in particular related to the green areas management
- Impact assessment: the consortium will elaborate a methodology and framework for the assessment of the impact of the solution and data provided. Such framework will include a set of indicators and guidelines for execution, and will be tested on the pilots
- Lesson learned and guidelines: based on the piloting activity and impact assessment implemented, the consortium will elaborate a set of guidelines aimed at supporting public administrations in adopting the SPOTTED solution and services and/or implementing similar ones

5. Work carried out so far

So far the consortium has elaborated a first set of requirements for the pilots. Specifically, so far it has been established:

1. Pilot objectives
2. Overarching objective and strategy
3. Main stakeholders involved
4. Liaison with specific projects and plans
5. Pilot timing and management structure
6. Pilot approach methodology
7. Indicators to assess/monitor/predict
8. Case-study areas to perform the analysis
9. Datasets to be used

6. Future plans

The project will be presented at the FIWARE Global Summit taking place in Gran Canaria (Spain), September 14-15. This event is organized by FIWARE, which is a curated framework of Open Source Platform components to accelerate the development of Smart Solutions. Specifically, FIWARE Foundation drives the definition – and the Open Source implementation – of key open standards that enable the development of portable and interoperable smart solutions in a faster, easier and affordable way, avoiding vendor lock-in scenarios, whilst also nurturing FIWARE as a sustainable and innovation-driven business ecosystem.