

Type of the presentation Research contribution

Title of the presentation SUNSHINE: *Smart Urban Services for Higher Energy Efficiency*

Abstract SUNSHINE is a EU funded project, started in 2013. It delivers a smart-service platform, accessible from a web-based client that allows access to three services: energy map management, energy consumption management and public lighting management

1. Energy map management allows automatic large-scale assessment of building energy behaviour based on public data;
2. Energy performance information, with localised weather forecasts available through interoperable web-services and energy consumption data from smart-meters, are used to optimize the energy consumption of heating/cooling systems
3. For public lighting management, a middleware, based on OGC standards, for Advanced Metering Infrastructure and Automatic Meter Reading, is provided.

Extended Abstract SUNSHINE is a EU funded project, started in 2013. It delivers innovative digital services, interoperable with existing geographic web-service infrastructures, supporting improved energy efficiency at the urban and building level. Specifically, SUNSHINE delivers a smart service platform, accessible from both, a web-based client, and an App for smartphones and tablets that allows access to three services: energy map management, energy consumption management and public lighting management. Energy map management allows automatic large-scale assessment of building energy behaviour based on data available from public services (e.g. cadastre, planning data etc.). The information on energy performances are used to automatically create urban-scale “ecomaps” that will serve for planning activities and large-scale energy pre-certification purposes. More specifically, the smart web services are deployed according to standard protocols from Open Geospatial Consortium (OGC). The service retrieves data from existing geographical web services from public agencies such as cadastre, urban planning, environmental agencies and further repositories exposing data as web service in line with the EU Directive 2007/2/EC for Infrastructure for Spatial Information in the European Community (INSPIRE). The information retrieved (including type of building, use category, geometry, size and shape, age and climatic zone, etc.) are used to create interoperable 3D urban models according to the CityGML standard by OGC with the ADE (Application Development Extension). Starting from the urban model the service will produce two maps: an “ecomap” with estimated energy performances of buildings, and a map showing the comparison, for each building, between the predicted energy behaviour and the energy performance of the corresponding “reference building”.

Furthermore, for a set of pilot buildings, the energy performance information, together with localised weather forecasts data available through interoperable web-services and energy consumption data from smart-meters, are then used to ensure optimisation of energy consumption of heating/cooling systems through automatic alerts that are going to be sent to the SUNSHINE App installed on the smartphone of the final users. More specifically, the smart web service will access localised meteorological forecasts (via OGC Standards) and compare them against current weather conditions. Whenever variations are foreseen within a given area, the service identifies the potentially affected buildings and, according to their energy performance, sends notifications to building managers or dwellers informing them how to set heating/cooling, and at which time of the day. The information within the message (which is delivered via the OGC – standard Sensor Alert/Event Service – SOS/SES) is calculated, according to the estimated thermal inertia of each single building, to allow optimised (in terms of comfort/cost) transition to new weather conditions. Notifications are sent by the smart service via email, SMS or to the SUNSHINE App users. This service allows the user to get information about outdoor and indoor temperatures, forecast for the next days and suggestions. Every time when the weather suddenly changes, the program will send an automatic alert where will be posted information about changes and suggestions or references what actions to take to minimize energy wasting.

In order to offer the service of public lighting management, SUNSHINE develops a middleware, based on OGC standards, for Advanced Metering Infrastructure (AMI) for Automatic Meter Reading (AMR). This will allow to access data from smart meters, based on EN5001 protocols, and from illumination units, based on EN 50065-1 protocol, on a geographical basis via smart service, allowing geographical searches, for instance identification of all illumination units along a given street or within a certain area. The web service

will be coupled to a desktop-based user-friendly 3D geobrowser, which functions as control dashboard, and to a mobile App, which will allow onsite surveying and control of lighting units of public buildings or public lighting systems. The service allows in house ESCO operators to check the functioning of the various parameters of the entire public lighting system through an interactive mapping environment, identifying for instance damages, power losses or simply inefficient use (for instance lights being turned on when unnecessary). Similarly onsite ESCO operators will be able to survey, manage and control, directly from the site, the lighting system.

The project aims at providing a real control over consumption of managed facilities. The target users are planners and public administration officers, building managers and citizens.

The SUNSHINE technology is the result of the customisation and integration of existing software components developed by other EC-funded projects focusing on *smart city* technologies, such as the i-SCOPE project.

SUNSHINE project will be piloted for the duration of 12 months, and will targeted at energy and emission savings ranging, within the various pilots, from 10% to 30%, with higher savings being foreseen for pilots relying on older buildings, or equipped with older heating, cooling or lighting technologies. Energy savings will be compared to a one-year baseline data acquired, during the first stages of the project prior to the deployment of the pilots.

Website:

1. <http://www.sunshineproject.eu>

Video:

1. https://www.youtube.com/watch?feature=player_embedded&v=YAE0hvDM2Q
2. https://www.youtube.com/watch?feature=player_embedded&v=IiNy0UGd-7s
3. https://www.youtube.com/watch?feature=player_embedded&v=do3AJ6RvP5Q

Brochures & Flyers:

1. http://www.sunshineproject.eu/jsmallfib_top/SUNSHINE/Multimedia/Brochure/brochure.pdf
2. http://www.sunshineproject.eu/jsmallfib_top/SUNSHINE/Multimedia/Flyer/flyer.pdf
3. http://www.sunshineproject.eu/jsmallfib_top/SUNSHINE/Multimedia/Flyer/Flyer_building%20managers.pdf
4. http://www.sunshineproject.eu/jsmallfib_top/SUNSHINE/Multimedia/Flyer/Flyer_Citizens.pdf
5. http://www.sunshineproject.eu/jsmallfib_top/SUNSHINE/Multimedia/Flyer/Flyer_PA%20and%20planners.pdf

SUNSHINE Web Portal Demo:

1. <http://sunshine.graphitech-projects.com>

Social Profile:

1. <https://www.facebook.com/SunshineProjectEu>

Publications:

1. Dörrzapf, L., Mušič, B., Schrenk, M., and Wasserburger, W. W. "SUNSHINE – Smart Urban Services for Higher eNergy Efficiency". Real Corp 2013.
2. Schrenk, M., Wasserburger, W. W., Mušič, B., and Dörrzapf, L. "SUNSHINE: Smart Urban Services for Higher eNergy Efficiency". GI_Forum 2013: pages 18-24.
3. Giovannini, L., Pezzi, S., Di Staso, U., Prandi, F., and De Amicis, R. "Large-scale Assessment and Visualization of the Energy Performance of Buildings with Ecomaps". 3rd International Conference on Data Management Technologies and Applications (DATA 2014), Vienna, Austria, August 2014.

4. Giovannini, L., Di Staso, U., Cipriano, P., Prandi, F., and De Amicis, R. Poster presentation:
"Progetto SUNSHINE: servizi smart, open ed estendibili, per stimare la performance energetica degli edifici residenziali alla scala urbana". 18th National conference ASITA, Florence, Italy, 14-16 October 2014.

Dr Raffaele De Amicis is Director of Fondazione Graphitech, he holds a MEng in Mechanical Engineering, a Ph.D. on Surface Modelling in Virtual Environments. He has been research fellow at the Industrial Applications Department of Fraunhofer Institute, Darmstadt and senior researcher at the Interactive Graphics Systems Group, University of Darmstadt. He has been involved in several EU and Industrial projects. His research interests are in CAD, virtual reality, computer supported cooperative work in engineering.

Affiliation and official address: Fondazione Graphitech - Center for Advanced Computer Graphics Technologies, Via Alla Cascata 56C, Povo (TN) 38123- Italy

Nationality: ITALIAN

Education (*degrees , universities, dates*)

- Doctorate in Design and Methods of Industrial Engineering, Faculty of Engineering University of Bologna, , Italy, 2001
- Laurea in Mechanical Engineering, specialised on Mechanics of Materials, Faculty of Engineering University of Calabria, Italy, 1996

Career/Employment (*employers, positions and dates*)

- 2006- : INI-GraphicsNet Foundation, Darmstadt, Germany, Chairman of the Steering Committee
- 2004-06: INI-GraphicsNet Foundation, Darmstadt, Germany, Vice-Chairman of the Steering Committee
- 2004- : INI-GraphicsNet Foundation, Darmstadt, Germany, Members of the Board of Trustees
- 2003- : Foundation Graphitech - Center for Advanced Computer Graphics Technologies, Trento, Italy, Director
- 2003- : Department of Information and Communication Technology, University of Trento, Italy, Consulting Professor
- 2000-02: Interactive Graphics Systems Group, Department of Computer Science University of Darmstadt, Germany, Senior Researcher
- 1999-00: Fraunhofer Institute for Computer Graphics, Darmstadt, Germany, Researcher
- 1997-99: Mechanical Engineering Dept., Faculty of Engineering, University of Calabria, Researcher
- 1996-99: Molecular Biology Dept., Faculty of Science, University of Calabria, Research Assistant, Researcher
- 1994-96: Mathematics Dept., Faculty of Science, University of Calabria, Research Assistant, Researcher Assistant

Specialization

- i. **main field:** Design and Methods of Industrial Engineering, Computer Graphics, Technology Transfer, Science and Technology Policy,
- ii. **other fields:** Computer Aided Design, Geometrical Modelling, Interactive Graphics Systems, Human Computer Interaction, CAD-CAE process integration, Virtual/Augmented and Mixed Reality, CAD/VR Interfaces Virtual Product Development Process, Simulation-Optimisation and Interactive Visualisation, Computer Supported Co-operative Work, Management Control in Non Profit Organizations
- iii. **current research interest:** Advanced 3D Interaction Techniques, Shape Semantics, Visual Analytics, Augmented Engineering, Real-time Visualization of Geo-referenced Data, Multimedia Content Engineering, Collaborative Architectural Design, Virtual Reconstruction Assessment and Restoration, Scientific Management, Innovation Management

Honours, Awards, Fellowships, Membership of Professional Societies

1. Coordinator of BRISEIDE project – Bridging services, information and data for Europe (www.briseide.eu)
2. Director of NATO-ARW on NATO-ARW on Geographical Information Processing and Visual Analytics for Environmental Security, Trento (Italy) 13-17 Oct. 2008.
3. Invited Talks

- a. NATO Ecoter Final Project Meeting Development of a Prototype System for Sharing Information related to Acts of Terrorism to the Environment, Agriculture and Water systems (Ecoterrorism) - Venice, 2007,
 - b. Workshop on Collaboration@Work by the European Commission New Working Environment Unit. Brussels, 2006, Workshop – From CAD to Virtual Reality, University of Naples Federico II, Napoli 2006 ,
 - c. Workshop COMSON - Coupled Multiscale Simulation and Optimisation in Nanoelectronics, Cosenza, 2006, Workshop Topics in Automatic 3D Modelling and Processing, Verona, 2006.,
 - d. Workshop on the Virtual Reality in the Vehicle Engineering – Virtual Reality Laboratory - FIREMA Trasporti S.p.A. - Caserta, 2005,
 - e. Workshop “ECOTER”, development of a prototype system for sharing information related to acts of terrorism to the environment, agriculture and water systems NATO Headquarter, Brussels, 2005,
 - f. Conference "Mathematics , Arts and Industry, Cetraro, 2005.
4. Computer Graphics Best Paper Award 2003, “Spacedesign: A Mixed Reality Workspace for Aesthetic Industrial Design”.
 5. EC Culture 2000 programme, Net-Connect: Connecting European Culture through New Technology, grant holder 2006-2009
 6. EU FP6-STREP, IMPROVE: Improving Display and Rendering Technology for Virtual Environments, grant holder 2004-2007
 7. EU FP6-Craft , AMI-SME: Analysis of Marketing Information for Small- and Medium sized Enterprises, grant holder 2004-2007
 8. Autonomous Province of Trent, MoSeS: Modeling Semantic Shapes, grant holder 2004-2006
 9. Autonomous Province of Trent, SpaceDesign Pro: Ubiquitous Shape Design, grant holder 2004-2006
 10. Autonomous Province of Trent, InSIDE: Intelligent Styling system for Industrial Design, grant holder 2004-2006
 11. Autonomous Province of Trent, SIMI-Pro: Semantic Information Management system for Innovative Product design, grant holder 2004-2006
 12. Chairman of the Eurographics Italian Chapter Conference, Trento 2007
 13. Chairman of the group WG2 “System prototype definition ”at the workshop “ECOTER” Development of a prototype system for sharing information related to acts of terrorism to the environment, 2005
 14. Scientific Committee member of the: Conference Eurographics Italian Chapter, 2007- Conference Contexts and Ontologies: Theory, Practice and Applications, 2006. Conference Eurographics Italian Chapter, 2006, IEEE International Conference on Image Processing, 2005, AICA 2005, Conference "Matematica, Arte e Industria Arte e Industria, Cetraro, 2005,
 15. Member of European Association for Computer Graphics. EuroGraphics, since 2004
 16. Member of Italian Charter of Engineers, since 1997

Dr. Federico Prandi has been working in Fondazione Graphitech since 2009. He received a master degree in environmental Engineering, a PhD degree in Politecnico of Milan. He has been involved in several EU and research project in the area of 3D geo-visualization and application and 3D reconstruction and image based modelling.

Education and training

Dates 01/01/2006 - 31/12/2009

Title of qualification awarded PhD in Geodesy and Geomatic

Principal subjects / occupational skills covered Final thesis topic: 3D Object recognition and reconstruction for digital mapping and 3D GIS

Name and type of organisation providing education and training Politecnico di Milano (University)
P.zza Leonardo da Vinci 32, 20133 Milan (Italy)

Dates 01/09/1994 - 21/12/2001

Title of qualification awarded Master Degree in Environmental and Land Planning Engineering

Principal subjects / occupational skills covered Energetic and Thermodynamic planning

Name and type of organisation providing education and training Politecnico di Milano (University)
P.zza Leonardo da Vinci 32, 20133 Milan (Italy)

Dates 01/09/1989 - 01/07/1994

Title of qualification awarded High school Degree in electro technic

Name and type of organisation providing education and training Alessandro Volta (ITIS) Lodi (Italy)

PUBLICATIONS

- F. Prandi, R. de Amicis, G. Conti, S. Piffer, A. Debiassi and M. Calderan. "BRISEIDE a spatio-temporal framework to support environmental analysis and emergency management". In proceeding of EnviroInfo 2011.
- R. de Amicis, F. Prandi, G. Conti, D. Taglioni, S. Piffer, M. Calderan and A. Debiassi. "Landslides and spatio-temporal processing of geographical information". The second world landslide Forum. 2011.
- O. Melnikova, F. Prandi (2011). 3D Buildings Extraction from Aerial Images. In proceedings of High-Resolution Earth Imaging for Geospatial Information ISPRS Workshop. Hannover, Germany June 14 - 17, 2011
- R. de Amicis, G. Conti, S. Piffer and F. Prandi (2011). "Service Oriented Computing For Ambient Intelligence To Support Management Of Transport Infrastructures", Journal of Ambient Intelligence and Humanized Computing, DOI: 10.1007/s12652-011-0057-z
- M. P. Riggio, F. Prandi, R. de Amicis and M. Piazza (2011). "Use of High Resolution Digital Images and NDT Imaging Techniques for the Characterization of Timber Structural elements". Proceedings of the NDTMS-2011 International Symposium on Non-destructive Testing of Materials and Structures.
- R. de Amicis, F. Prandi, G. Conti, D. Taglioni, S. Piffer, M. Calderan and A. Debiassi (2011). "Landslides and spatio-temporal processing of geographical information". The second world landslide Forum.

Mr. Umberto Di Staso has been working in Fondazione Graphitech since 2012. He received a master degree in Computer Science from the University of Trento, Italy. Since 2012 he has been involved in a number of projects in the field of GeoVisual Analytics and Spatial Data Infrastructure, including among others, 3D Geobrowser for Smart Cities - 3D visualization of geo-referenced data.

EU Projects Involvement

- **SUNSHINE - "Smart Urban Services for Higher eNergy Efficiency"**
SUNSHINE delivers an extensible open toolkit featuring three smart services for: energy assessment of buildings at urban scale for the creation of "ecomaps" and their energy pre-certification; optimisation of energy consumption of heating/cooling systems based on localised weather forecasts and energy modelling of buildings; optimisation of power consumption through remote control of public illumination levels. The toolkit will be delivered as interoperable open middleware ensuring, in an interoperable manner: access to geospatial features; access to Automatic Meter Reading (AMR) functions; definition of alerts.
- **SmeSpire - "A European Community of SMEs built on Environmental Digital Content and Languages"**
The INSPIRE Directive 2007/2/EC, establishes an Infrastructure for Spatial Information in Europe, requiring large amounts of environmental digital content to be made accessible across Europe, resulting in a data pool that is expected to be of huge value for a myriad of value-added applications. The INSPIRE Implementing Rules Legal Acts outlines these data pools, but more work is needed. Making data available according to the INSPIRE standards in 30 countries using 22 languages requires specific skill sets that few public authorities have. The management of this content represents an opportunity for SMEs active in this sector. SMEs can enable countries to fulfil the Directive, creating new market opportunities with increased potential for innovation and new jobs. Due to the legal requirements, the INSPIRE implementation becomes the entry-point for crucial business opportunities, opening new, or reinforcing existing perspectives (including Linked Open Data, Sensor Web, cloud computing and other e-environment application domains). SmeSpire's purpose is to encourage and enable the participation of SMEs in the mechanisms of harmonising and making large scale environmental content available.
- **eENVplus - "eEnvironmental services for advanced applications within INSPIRE"**
The aim of this European Commission funded project is to integrate a large amount of environmental data provided by the National/Regional Environmental Agencies and other public and private environmental stakeholders involved. This is necessary to answer to the requests for environmental monitoring and reporting requested by the European, national and local policies. This will be achieved through the harmonisation and integration, within an operational framework, of existing services resulting from previous European initiatives (funded projects, good practices, EU/national/local experiences) and it will allow overcoming of cross-border/languages barriers. eENVplus provides not only the ICT infrastructure but also the documentation and support to ensure delivery of an operational infrastructure and which can become profitable, based on a well-defined organisational model and a tutored training framework.
- **LIFE+IMAGINE - "Integrated coastal area Management Application implementing GMES, INSPIRE"**
LIFE+IMAGINE is a project co-funded by the LIFE+ Programme Environmental Policy and Governance in the framework of the objective "strategic approaches". LIFE+IMAGINE deals with the integrated management of coastal zone and the implementation of environmental policies in the sector. The project in fact, through methodologies for the environmental analysis, provides information to support the coastal planning and decision making, with particular reference to two application scenarios: - Landslides in coastal zones. - Soil consumption in coastal zones. LIFE+IMAGINE implements an infrastructure based on web services for environmental analysis, integrating in its own architecture specifications and results from INSPIRE, SEIS and GMES/Copernicus.

Publications

- **Large-Scale Assessment and Visualization of the Energy Performance of Buildings with Ecomaps**

This paper illustrates the preliminary results of a research project focused on the development of a Web 2.0 system designed to compute and visualize large-scale building energy performance maps, so called "ecomaps", using: emerging platform-independent technologies such as WebGL for data presentation, an extended version of the EU-Founded project TABULA/EPISCOPE for automatic calculation of building energy parameters and CityGML OGC standard as data container. The proposed architecture will allow citizens, public administrations and government agencies to perform city-wide analyses on the energy performance of building stocks.

- **Barriers Survey: A Tool to Support Data Collection for Inclusive Mobility**

In this paper we describe the potential for using the Volunteered Geographic Information (VGI), and large crowd-sourced survey, in disable people mobility computing applications. The challenge is to make these two concepts talking together exploiting the technologies in order to increase the public participation, and to move towards sustainable development. Our goal is to investigate how participative and people-centric data collection can be used to create a low-cost, open platform to survey, annotate and localise pedestrian mobility features and architectural barriers as it is perceived by the citizen themselves. The core of the project consists into the development and deployment of a mobile application and a web platform, which allow the users to collect and manage the information surveyed.

- **Engaging Outdoor User Experience Based on High Fidelity 3D Terrain Representation on Mobile Apps**

In recent years, several mobile devices with excellent performances have become accessible to people at affordable prices. The availability of this equipment, especially in the mobile sector, has encouraged research and development of increasingly complex applications ("Apps") for the visualization of large-scale scenes. However, 3D maps typically available through mobile version of so-called "spinning globes" do not allow the use of high definition data, due to their hardware limitations compared to desktop devices. As a result it often happens that a final user is navigating a real life familiar area, without being able to recognize its orography or specific features that are typical of the real world due to the poor resolution of the underlying 3D geometry. This is particularly amplified within mountain areas where crests, ridges and valleys are not adequately represented, due to the low resolution of the underlying digital terrain model, severely limiting the user's experience. The main contribution of the work presented by this paper is the enhanced user experience through high fidelity terrain representation, which is provided by an App that addresses the two aforementioned items.

- **Pervasive touristic location based service mobile app with a social perspective**

In recent years, world markets have made devices with excellent performances accessible to people at affordable prices. The introduction of this type of equipment, especially in the mobile sector, combined with low cost "flat" Internet connections has created a new type of market, the so-called market of mobile applications or Apps Market, whose expansion goes in parallel with the diffusion of smartphones and tablets. The need and possibility for the final user to have ubiquitous access to any kind of information on any topic, is constantly increasing, and a sector that has particularly benefited from this kind of technology is the tourism domain where users are mostly looking for in place information about their surroundings. The youth of this market is likely to provide geo applications in a primordial state of development. Our experiment has been conducted by focusing on the design of a flexible architecture offering geographical information through a Game Engine that has been used to create the entire structure of the client. The main aim of this document is to provide specifications required to develop software that will inspire a new generation of software dealing with the visualization of real time geo-referenced information on three-dimensional models.