Matteo Orlando

Hi, I'm Matteo

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What I studied

I received B.Sc Degree in Physics Engineering in 2015 and a M.Sc. degree in ICT for Smart Societies in 2018 with a thesis focused on designing and development of a self-configuring IoT smart-meter for monitoring the power grids and enabling novel services. Since October 2018, I joined the EDA group as a research assistant. I started my PhD in November 2019 focusing my research in the optimization of the placement of PV modules in the context of Renewable Energy Community.

Technical skills

Main

Python | REST API | MQTT | Microservices | IoT | Smart-Grid

Other

Javascript | Astro | Vue | HTML & CSS | MongoDB | Docker | Git

My career

2012-2015
Politecnico di Torino

Bachelor degree in Physisc Engineering

2015-2018
Politecnico di Torino

Master degree in ICT for Smart Societies with the thesis "Desing and development of a novel smart-meter for improved Smart Grid management"

2018-2019
Politecnico di Torino

Assistant researcher for EDA group

2019-ongoing
Politecnico di Torino

PhD student in Computer and Control Engineering

My Publications

A novel Internet-of-Things infrastructure to support self-healing distribution systems
2018 International Conference on Smart Energy Systems and Technologies (SEST)
Read the full paper here Abstract In this paper, we present a novel distributed software infrastructure to foster new services in smart grids with particular emphasis on supporting self-healing distribution systems. This infrastructure exploits the rising Internet-of-Things paradigms to build and manage an interoperable peer-to-peer network of our prototype smart meters, also presented in this paper. The proposed three-phase smart meter, called 3-SMA, is a low cost and open-source Internet-connected device that provides features for self-configuration. In addition, it selectively run on-board-algorithms for smart grid management depending on its deployment on the distribution network. Finally, we present the experimental results of Hardware-In-the-Loop simulations we performed.

Engaging Users in Resource Ecosystem Building for Local Heritage-Led Knowledge
Sustainability-MDPI
Read the full paper here Abstract The aim of this paper is to form an analytical and critical framework to consider the uses of digital platforms in heritage field and practices and to provide methodologies for user profiling

based on the identification of local stakeholders and their needs. Within the context of the EU H2020 research project RURITAGE, a resource ecosystem (RRE) of various integrated tools was created for shaping and addressing heritage-led knowledge and bottom-up strategies of local regeneration. More specifically, the RRE was conceived to provide local stakeholders with new methodologies and user-friendly tools based on bottom-up processes for identifying and actioning heritage and territorial features and turning these cultural natural values—as well as the gaps—into opportunities. This paper undertakes a comparative analysis of the integration of tools in other digital platforms for heritage practices and/or regeneration processes to explore the holistic approach to heritage knowledge and the effectiveness in engaging local stakeholders. In addition, it frames methodologies for local stakeholder and related needs identification. Through this comparative analysis among digital heritage platforms and through user profiling to target the needs of users by using the RRE as a case study, the paper explores the challenge of helping communities to shape a local heritage-led collaborative knowledge supported by integrated and user-friendly digital tools and to activate them in preserving and exploiting their territories and building shared and plural cultural heritage understandings, considering cultural heritage as a social need.

Optimal configuration and placement of PV systems in building roofs with cost analysis novel Internet-of-Things infrastructure to support self-healing distribution systems

2020 IEEE 44th Annual Computers, Software, and Applications Conference (COMPSAC)018 International Conference on Smart Energy Systems and Technologies (SEST)

Read the full paper here Abstract Following the Smart Grid view, current energy generation systems based on fossil fuels will be replaced with renewable energy sources. Photovoltaic (PV) is currently considered the most promising technology, due to decreasing costs of the devices and to the limited invasiveness in existing infrastructures, that make PV installations quite common urban buildings' roofs. To maximise both power production and Return Of Investment (ROI) of PV installations, new techniques and methodologies should be applied to limit sources of inefficiencies, like shading and power losses due to an incorrect installation. In this paper, we propose a novel solution for an optimal configuration and placement of PV systems in buildings' roofs. Given a number of alternative configurations and a roof of interest, it combines detailed geographic and irradiance information to determine the optimal PV installation, by maximizing both power production and ROI. Our simulation results on two real-world roofs demonstrate an improvement on power generation up to 23% w.r.t. standard compact installations. These results also highlight that a cost analysis, often ignored by standard installation strategies, is nonetheless necessary to guarantee optimal results in terms of PV production and revenue.

Design of District-level Photovoltaic Installations for Optimal Power Production and Economic Benefit

2021 IEEE 45th Annual Computers, Software, and Applications Conference (COMPSAC)

Read the full paper here Abstract PhotoVoltaic (PV) installations are a widespread source of renewable energy, and are quite common urban

buildings' roofs. To soften both the initial investment and the recurrent maintenance costs, the current market trends delegate the construction of PV installations to Energy Aggregators, i.e., grouping of consumers and producers that act as a single entity to satisfy local energy demand and to sell the surplus energy to the grid. In this perspective, PV installations can be designed with a larger perspective, i.e., at district level, to maximize power production not of a single building but rather of a number of blocks of a city. This implies new challenges, including efficient data management (the covered area can be squared kilometers wide) and optimal PV installation (the number of PV modules can be in the order of hundreds or even thousands). This paper proposes a framework to combine detailed geographic and irradiance information to determine an optimal PV installation over a district, by maximizing both power production and economic convenience. Our simulation results run on a real-world district prove that the framework allows an advanced evaluation of costs and benefit, that can be used by Energy Aggregators to design a new PV installation, and demonstrate an improvement on power generation up to 20% w.r.t. standard installations.

A Smart Meter Infrastructure for Smart Grid IoT Applications

IEEE Internet of Things Journal

Read the full paper here Abstract Electric infrastructures have been pushed forward to handle tasks they were not originally designed to perform. To improve reliability and efficiency, state-of-the-art power grids include improved security, reduced peak loads, increased integration of renewable sources, and lower operational costs. In this framework", smart grids" are built around bidirectional communication technologies, where "smart meters" communicate with all other entities and collect data from the power grid, offering specific features to each actor playing in the energy marketplace. In this paper, to overcome some of the challenges raised by smart grids and smart meters, we propose a distributed metering infrastructure which provides bidirectional communication, self-configuration, and auto-update capabilities. Our 3-phase smart meters follow the basics Internet-of-Things principles and have the ability to run, either on-board or distributed on the network, multiple algorithms for smart grid management. These algorithms can be freely added, updated, or removed on-the-fly thanks to the auto-update feature of the system. Moreover, to reduce costs and improve scalability, we prove that it is possible to implement our smart meters using only off-the-shelf and inexpensive hardware devices. A digital real-time simulator (i.e., Opal-RT) has been used to assess the capabilities of both the infrastructure and the meter. Our experimental analysis shows that the latency introduced by the data transmission over the Internet is compliant with the limits imposed by the IEC 61850 standard. As a consequence, our architecture does not affect the operational status of the smart grid, making it a viable solution to support the deployment of novel services.

A Resources Ecosystem for digital and heritage-led holistic knowledge in rural regeneration

Journal of Cultural Heritage

Read the full paper here Abstract This paper presents a digital resources ecosystem prototype of integrated tools and resources to support heritage-led regeneration of rural regions, thanks to a deeper understanding of the

complexity of cultural natural landscapes throughout their historical and current development. The ecosystem is conceived as a distributed software platform establishing data ecosystem and open standards for the management of information, aimed at providing different services and applications to address the needs of the various end-users identified. The platform has been conceived and realised in the framework of a Horizon 2020 research project, with a view to building a set of holistic knowledge about rural regions and their cultural and natural heritage and making it available for long-lasting heritage-led territorial processes of change. It is the product of a multidisciplinary collaboration among heritage, digital humanities and ICTs experts, and combines data and methodologies from a range of approaches to humanities together with the customisation of effective digital tools. It has been designed for deployment also in cloud systems compliant with the Infrastructure-as-a-Service paradigm. All data is Findable, Accessible, Interoperable, Reusable (FAIR data). It hosts and integrates different tools, making the data gathered with/for local stakeholders usable and making the same data re-usable within the tools' functions, generating integrated heritage knowledge. It comprises data on 19 rural pilot territories, where the tools and their integration have been developed and tested, while 62 more are partially included as additional territories which participate in certain activities within the project. The main testers for this platform and its functions are the local stakeholders of these territories. The paper describes and analyses the platform and its impact, discussing the integration of tools as an innovative approach that goes beyond the use of individual tools in shaping a multidimensional vision. It also offers an analysis of the potential of an integrated digital ecosystem in evidence-based and place-based regeneration strategies. Some reflections for developments and cooperation during the pandemic are also presented.

Other projects I worked on

Ruritage

2018-2021

The RURITAGE project turns rural areas into laboratories to demonstrate natural and cultural heritage as an engine for regeneration. I was in charge of the development of the first version of the Ruritage Resource Ecosystem. This tool consisted in a full stack application that stored geographical data and metadata about the partecipants of the project and make it available to the public for visualization.
More info at ruritage-ecosystem.eu

Development of a wearable IoT device for Covid-19 early diagnosis.

2021

Cotutor of the thesis.
More info at here

Development of a wearable device for monitoring vital parameters:

SpO2, heart rate and temperature.

2021

Cotutor of the thesis.
More info at here

Design and development of distributed software platform to gather, manage and visualize multimedia clinical files

2021

Cotutor of the thesis.
More info at here