ITEA 3

Project Results

CitiSim

An end to urban information silos

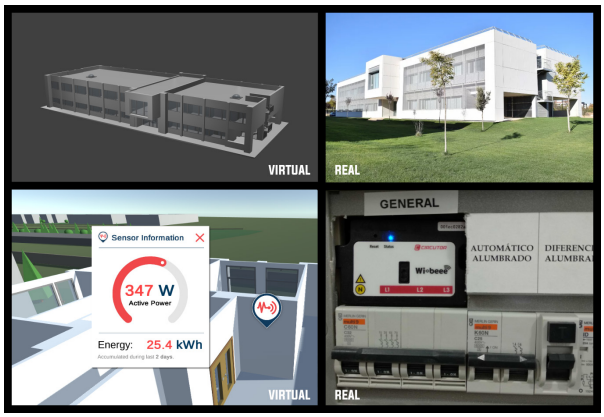
EXECUTIVE SUMMARY

The ITEA project CitiSim provides an open platform for collecting and visualising data while allowing interactions on various aspects of smart cities, such as energy, mobility and air quality. This lets businesses and Public Authorities understand and control these spaces effectively, opening up new services and engaging citizens in making the city a better place to live.

PROJECT ORIGINS

Information silos are the bane of smart cities: non-interoperable management systems for areas such as water and electricity make it difficult to respond to disasters efficiently, while developers must deal with various heterogeneous data formats and sources. Additionally, applications lack a suitable testing environment. These factors make it difficult to develop services in an affordable, time-effective manner. A fully integrated platform is the way forward.

The CitiSim (Smart City 3D Simulation and Monitoring Platform) project aims to counteract these silos and improve the way information is perceived. As a flexible Internet of Things (IoT) platform for smart cities, it allows third parties to integrate multiple types of devices, other IoT platforms and data sources in a plug-and-play manner and creates information dashboards and actions using a rule engine. In addition to the core platform, it provides 3D data simulation and augmented reality for interacting with the environment. CitiSim can then be used by businesses to create verticals in various fields and generate links between these. The project ultimately aims to be as open as possible, welcoming new collaborations via its unique Smart Platform Alliance.



3D modelling for a better perception of the information and interaction with the environment.

TECHNOLOGY APPLIED

As a transversal architecture, CitiSim's core platform combines data distribution and persistence, IoT event distribution and service discovery. Third parties can access these services via Libcitisim (the CitiSim library) or multiprotocol adapters like those for MQTT or Kafka, where events can be forwarded to a broker and made available to other tools. A 3D viewer is integrated alongside a Complex Event Processor (CEP) with notification capabilities, offering both BIM and GIS support for the automatic generation and real-time monitoring of smart 3D models. This utilises IndoorGML and is available as a scalable web and desktop solution. Additionally, Microsoft's HoloLens can be used to interact with 3D simulations in mixed reality. For Public Authorities and businesses, this is a means to accurately test applications and monitor the condition of the city.

Security is guaranteed through components that provide several mechanisms for future deployments, as well as access policies. As basic communication security procedures, for example, CitiSim allows the use of Public Key Infrastructure (PKI) and a Secure Socket Layer (SSL) through a ZeroC Ice IceSSL plugin to establish the de facto standard software stack on secure network communications. For low-cost sensors/communications technologies that cannot run SSL infrastructure, a welcome service creates a private channel for each sensor/actuator. These mechanisms imply no change in the source code of services.

CitiSim has also generated vertical use-cases that highlight its technical successes. In Smart Energy, for example, a Business Intelligence Tool and two Platforms for Energy Management were created. In Smart Mobility, three functional solutions have been deployed: A web-based Environmental Motion Assistant (EMA), an EMA mobile app and a

portable prototype with IoT sensors and a fixed IoT solution for data acquisition. This won Best Smart Environment Project at the Smart City Industry Awards Gala for its potential air quality benefits.

MAKING THE DIFFERENCE

A major advantage of the CitiSim platform is the integration of over 30 data sources (e.g. streetlamps, cams, gas and energy-related sensors), as well as commercial IoT products from companies like Siemens and Libelium and devices developed using platforms like Raspberry Pi, Pycom and Arduino. The technological results have been tested extensively in a laboratory setting, with the core architecture having processed 100 million events during the last year of the development phase. Under these conditions, a 50% saving has been achieved in services deployment time while architecture deployment has dropped from over an hour to 30 minutes. Additionally, 100% of tested smart city areas have been successfully modelled and made accessible through a service API. CitiSim has now been deployed in several cities and is working to validate these figures in practice.

Commercially, CitiSim participation has shown positive results. Answare, for example, saw a 17.44% increase in turnover, a 42.86% increase in FTE for R&D and a 20% increase in R&D expenditures as a percentage of turnover between 2016 and 2018. For Beia, these figures were 66.85%, 60% and 125.67% respectively. This highlights how CitiSim allows SMEs to enter the smart cities market, which was previously inaccessible due to proprietary solutions yet had an estimated value of USD 1135 billion in 2019. Dissemination is ongoing and the results have been shared in over 35 conferences and more than 40 publications. In conjunction with the ITEA project ESTABLISH, CitiSim is now working on a Smart Platform Alliance to maximise its impact. This will be a global community of smart platform knowledge and technology providers, offering support and a reference framework for cities that wish to implement these solutions. This spirit of collaboration is the best way to realise smart city innovations and promises to speed up their implementation enormously.

MAJOR PROJECT OUTCOMES

Dissemination

- More than 40 publications (e.g. Journal Technological Forecasting & Social Change).
- Multiple presentations/demos at conferences/fairs (e.g. Cities of Tomorrow ’18 & ’19, V Intelligent Buildings Congress Spain, RSEEC’18, GWS’18, IEEE ISGT Europe ’19, SCEWC ’19).
- 6 presentations to municipalities (e.g. Rivas Vaciamadrid, Aldea del Rey, Camas, Fieni, Bistrita and Pitesti).

Exploitation (so far)

New products:

- Real time 3D Viewer with notifications, using information from sensors regardless brand/model.
- HoloLens mixed reality application, to manage emergencies in e.g. a smart building.

New services:

- Deployment of a Platform for smart Energy management in intelligent buildings and campus.
- Citizen Reporting Service, focused on accidents or irregularities related to the city in general.
- Deployment of a Smart Environment service for air quality monitoring and awareness.

New systems:

- Business Intelligence platform, with KPIs simulation, for Energy management and optimisation.
- Platform for near-real time monitoring of Energy production and consumption.
- Multimedia platform with mixed reality, offering sensor data monitoring, controlling of actuators, visualisation of multimedia content and representation of scenarios.
- Environmental Motion Assistant, combining environmental data and motion data.
- 2 multiprotocol adapters, e.g. Kafka and MQTT, for easy integration with third party IoT solutions.
- Libcitisim - a python library to easily produce/consume CitiSim IoT events.
- IoT infrastructure with platform and devices, acting as the CitiSim core, for smart buildings.
- Semantic Searching Platform exploitable by other platforms.

Standardisation & Patents

- Creation of the Smart Platform Alliance, involving multiple European companies/research centers.
- 1 patent application submitted and pending on acceptance.

ITEA is a transnational and industry-driven R&D&I programme in the domain of software innovation. ITEA is a EUREKA Cluster programme, enabling a global and knowledgeable community of large industry, SMEs, start-ups, academia and customer organisations, to collaborate in funded projects that turn innovative ideas into new businesses, jobs, economic growth and benefits for society.

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CitiSim
15018

Partners

Romania

Altfactor

Beia Consult International

Spain

Abalia

Answare

Prodevelop

Taiger

Project start

December 2016

Project end

December 2019

Project leader

Carlos Jiménez, Abalia

Project email

info@citisim.org

Project website

http://www.citisim.org/