ITEA 3

Project Results

ESTABLISH

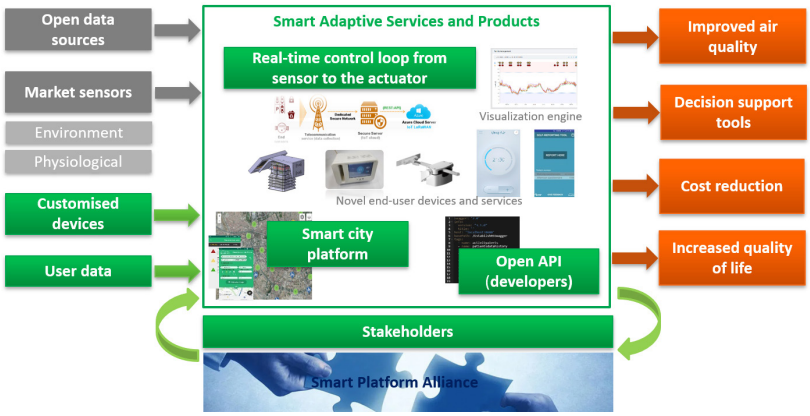
Environmental data management for a better quality of life

EXECUTIVE SUMMARY

Air quality solutions require real-time data and visualisations for the comprehensive monitoring of domains like infrastructure, health and mobility. The ITEA project ESTABLISH has thus implemented a control loop from environmental sensors to a smart platform with third-party interoperability, generating quality of life innovations at both the individual and city level.

PROJECT ORIGINS

Our environments inform our behaviours and lifestyles; together, these determine up to 90% of our health outcomes. Nonetheless, 90% of Europeans live in cities with harmful levels of air pollution; as air enters buildings via ventilation, both indoor and outdoor contaminants have an effect on indoor air quality. While smart city solutions can be used to manage health, mobility and pollution, the market is controlled by larger players with proprietary solutions. Users and cities are often stuck with one provider and must keep investing for years. For the benefit of both citizens and city authorities, the field must be made accessible to SMEs who can combine their efforts in an open, interoperable manner.



ESTABLISH solutions

The ESTABLISH (Environmental Sensing To Act for a Better quality of LIfe: Smart Health) project offers a smart city platform composed of a route optimisation mobile app for citizens, a web app for pollution and traffic predictions and simulations and a web app for real-time data visualisation. Additionally, an indoor air quality solution creates a complete control loop from sensors to actuators, combining heterogeneous data sources (environmental and personal data) and controlling devices to ensure healthy indoor air. The main focus has been on indoor and outdoor air quality sensors, but the results can easily be expanded by third parties to all kinds of consumer products and domains.

TECHNOLOGY APPLIED

ESTABLISH has utilised pre-existing open data sources regarding traffic, parking, public transport and pollution levels and commercial sensors for measuring indoor and outdoor air quality and physiological features. Data is fed to the smart platform and, in the case of smart cities, analysed by advanced machine learning algorithms developed within the project in order to make predictions. The ESTABLISH Visualisation Framework (EViF), a web-based framework for creating Internet of Things (IoT) dashboards, presents this to users based on their specific needs. The framework is protected by secure multi-user access with granular permissions.

Within the platform itself, the mobile app for citizens is the front-end of a cloud platform for data fusion and data analysis and a multi-modal route planner. This uses deep learning techniques and open data from city councils to create mobility recommendations. The pollution and traffic web app is a mobility platform decision tool for city authorities and provides seven-day predictions based on the analysis and processing of a traffic simulation platform. The final component is a city authority management dashboard, which uses a complex event detector to define time-series events. In the case of both smart city and air quality solutions, an open API collection of REST services allows for third-party implementation of new tools and services.

ITEA 3

Additionally, ESTABLISH has generated demonstrators to show these innovations in practice. For the sensor-to-actuator control loop, for instance, the platform detects e.g. the CO2 level within a building and uses a window opener to offer automatic ventilation. A self-reporting application, meanwhile, was developed to collect indoor air quality (IAQ) perceptions and possible health symptoms and to visualise these alongside objective IAQ measurement data.

MAKING THE DIFFERENCE

One of ESTABLISH's major technical achievements is data reliability: through the evaluation of 62 sensors and five wearable devices and support for five wireless standards, 36 applicable measurement variables were generated (in addition to existing open data sources). This has allowed the data analytics methods, tools and algorithms to achieve a classification accuracy of over 80%, creating business opportunities for manufacturers, software developers, health organisations, insurance companies and more.

Within the consortium, a variety of new partnerships and markets for SMEs have emerged. UniqAir, for instance, has developed a control app which is already being utilised in their commercial purifier model and has opened up export markets in Canada, Denmark, Germany, Singapore and the UAE. Prodevelop, meanwhile, was able to expand its smart services to the maritime sector and develop new R&D projects on data analytics, Industry 4.0 and green ports. Finally, Coway intends to launch their new IAQ device in 2021, having partnered with Philips to market products in China. In total, 74 new customer segments were created across the project.

Alongside the ITEA project CitiSim, ESTABLISH is a founder of the Smart Platform Alliance. This aims to be a global community of smart city knowledge and technology providers, increasing the impact of projects by providing a reference framework and support for cities that want to implement solutions. ESTABLISH's results have now been disseminated through 22 exhibitions, 26 workshops, 26 conference papers and seven scientific journal papers. This will further increase market accessibility for companies of all sizes, in turn allowing citizens and city authorities to visualise and manage their environmental conditions to an ever-higher degree – an important breakthrough that promises vast improvements to quality of life.

MAJOR PROJECT OUTCOMES

Dissemination

- Project presentations at 22 exhibitions and 26 conferences (e.g. Global IoT Summit, SCEWC, Science & Information Conference, European Conference on Software Architecture)
- 7 scientific journal papers (e.g. Mobile Solutions and Their Usefulness in Everyday Life, Pervasive and Mobile Computing, Building and Environment)
- 26 workshops with stakeholders

Exploitation (so far)

New end-user services (13), including e.g.:

- Mobile application for citizens moving around city
- Web application for city authorities for urban mobility planning
- Indoor air quality management system and novel IAQ/OAQ devices
- IoTLoRaWAN cloud application for HVAC systems
- Self-reporting application for IAQ perceptions
- Smart window opener
- Air purifier control application
- Smart tracking of athletes
- Decision support instrument

New platform services (6), including e.g.:

- Smart city platform
- Visualisation platform
- Environmental data platform

Smart Platform Alliance created with the ITEA CitiSim project

Patents

- 4 patent applications

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.

https://itea3.org

ESTABLISH
15008

Partners

Czech Republic
Charles University
DEKPROJEKT
Institute of Microelectronic Applications

Finland
CGI
Inspector Sec
UniqAir
VTT Technical Research Centre of Finland

Republic of Korea
Coway
ETRI

Romania
Beia Consult International
Siveco Romania

Spain
HI iberia
Prodevelop

Turkey
Semantik Ar-Ge
Turkgen

Project start
September 2016

Project end
December 2019

Project leader
Kaisa Vehmas, VTT

Project email
kaisa.vehmas@vtt.fi

Project website
https://www.vtt.fi/sites/ESTABLISH