International Innovation

Disseminating science, research and technology

Lenvis

Localised ENVironmental and health Information Services for all

| November 2011 |

Quality counts

As environmental monitoring efforts grow, so too does the need for coordinated and easy to interpret data. The **Lenvis** project helps citizens and organisations access real-time information on air and water quality, as well as informing them of risks as they emerge

NO LONGER JUST the preserve of campaign groups and academics, the issue of pollution is now at the forefront of public and political consciousness across Europe and beyond. The purpose of using real-time monitors ranges from government agencies monitoring the effects of pollution to users interested in knowing air and water quality in a specific location. Organised as part of the EU's Seventh Framework Programme (FP7), the Lenvis project has drawn together a range of different organisations and individuals to develop an online collaborative platform, designed to provide information on local environmental pollution and its associated health risks.

Using the Lenvis platform, individuals can access up-to-date information on local water or air quality to inform activities such as swimming or surfing, whilst organisations such as doctors' surgeries and hospitals can use the same information to provide better treatment for any patients that arrive with possible pollution-related illnesses.

The Lenvis portal (http://portal.lenvis.eu) is not just a one directional information resource however. As a collaborative platform, end-users themselves can use the system to report on conditions in their local area, in order to ensure that the system is kept as up-to-date as possible. In addition to this user-generated content, Lenvis is also integrated with more traditional automatic environmental monitoring facilities such as water-level monitoring stations.

In keeping with this philosophy of collaboration and user generated content, Lenvis is more than a stand alone platform. Instead, it has been integrated with popular social networking platforms such as Facebook, Twitter and LinkedIn, ensuring that its information can be accessed seamlessly during a user's regular Internet browsing activities.

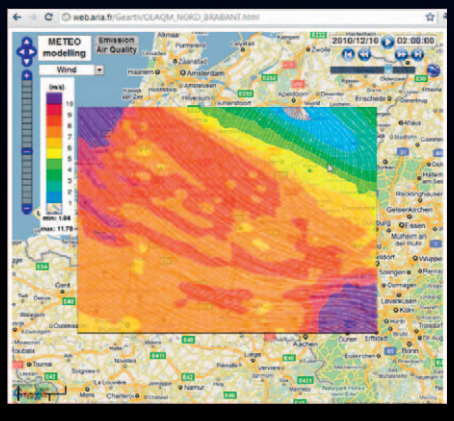

Figure 1. METEO, Air Quality and EMISSION 2D maps of model forecast application.

GENERATION Y

Lenvis is open to anyone who has a need for information on air and water quality, but has been targeted specifically at 'Generation Y' – a category of young people under 30. This has not been done to exclude people, but rather as a clever means of bringing other groups on board: "Some services provided by Lenvis are aimed at young people, for example providing information for surfing groups who are already using social networks to meet up online," As Professor Francesco Archetti of the University of Milano-Bicocca explains: "Grabbing the interest of the younger generation will hopefully encourage 'not-so-young' people to use the Lenvis service too."

As an EU-funded pilot project, Lenvis has to date primarily been trialled in three areas across Europe; Italy, Portugal and The Netherlands. In these case study areas, as well as gaining feedback on the more functional elements of the web-based platform, a lot of useful information has been gathered on the different ways in which different communities interact with health and environmental data. By allowing the sites own users to upload and share information with others directly, the Lenvis project has provided the ability to 'bring data to life'. Rather than just collating and presenting statistical data on issues such as air and water quality, users across Europe have been able to share photographs and personal experiences of pollution-based health risks as soon as they have occurred.

A EUROPEAN PILOT WITH GLOBAL REACH

One unexpected opportunity for testing the principles behind Lenvis arose through the tragic events that unfolded in Japan this year, as the result of a large earthquake and subsequent tsunami. In the aftermath of these events, Lenvis was used to integrate modelling of radioactive pollution with meteorological information; in order to track the cloud-borne movement of radioactive elements and to predict their movement up to one week in the future, on both a regional and global scale. These forecasts were useful for the planning of emergency procedures, specifically around the reallocation of people working in public services.

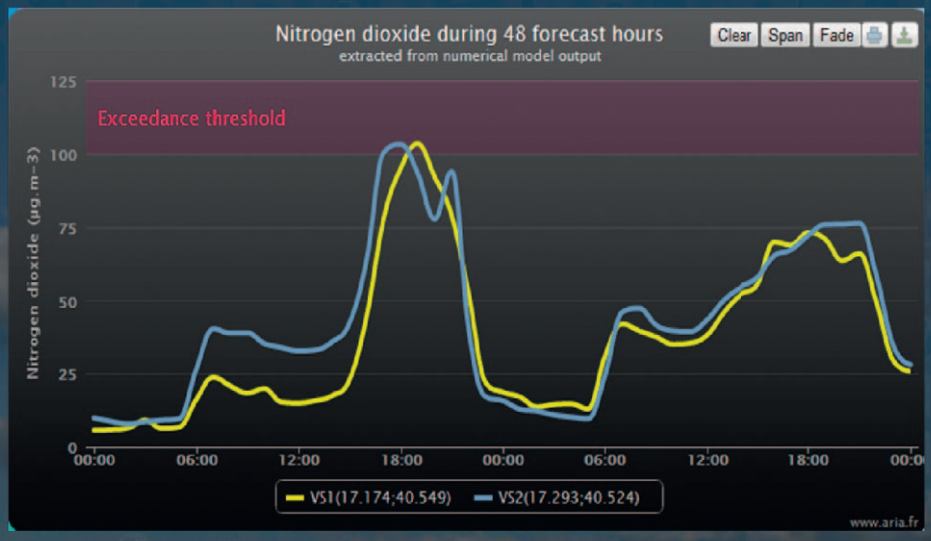

FIGURE 2. Forecasted pollutant time-series visualisation highlighting the Exceedance threshold.

In Europe, the system allowed users in the Portugese case study to simulate pollution discharges on the Estoril Coast, allowing bathers and water authorities to study the possible impact of discharge on this coast, or to study the potential origins of unexpected discharges.

Part of the success of Lenvis has arisen through the structure of the project itself. Whilst the Lenvis platform provides a loose structure through which individuals can collaborate and learn quickly and simply, this model has also been applied to the development of the platform itself.

At its heart, the project has involved four SME companies: ESAProjekt from Poland, Hydromod from Portugal, ARIA from France and Hydrologic from The Netherlands. As well as providing specialist knowledge in both platform development and water modelling concepts, these companies have also played a role in the development of Lenvis business model, bringing with them a stable network of contacts from institutions and professional groups working in environment-related activities: "The most important thing about collaboration with SMEs is their flexibility and easy communication. Unlike larger corporations, SMEs usually do not have complicated corporate procedures for every single move," Archetti notes.

As with any large project across geographically dispersed groups, Lenvis has been presented with a number of challenges. The research team had to overcome technical difficulties early on, caused by data being held in different formats and models, as well as having to deal with a wide range of existing legacy software applications. A more significant obstacle was to overcome differences in information needs and the perceived value of environmental and health information. To surmount this, Lenvis has focused on connecting all stakeholders in the environmental arena according to their informational needs. It also allows specific groups to be targeted, such as people at risk from respiratory diseases or frail elderly people, in order to provide them with selective warnings as soon as a specified pollutant reaches a threshold specified by recent European regulation.

A BROADER USER BASE

Having proven its worth in Europe and beyond, the Lenvis project is now looking to disseminate its findings and bring the platform to an even wider audience. From a science and technology perspective, lessons learned are primarily being disseminated through the project team participating in conferences and publishing papers in international journals. As is typical of this project however, this is not just a one way process: "Several meetings with end-users have taken place during the project and more are now planned, in part to disseminate the potential of Lenvis amongst different stakeholders, but also to acquire yet more feedback to improve the platform even further," Archetti highlights.

Looking to the future, the Lenvis team are aiming to ensure the project's sustainability through further networking with interested parties, as well as offering further system customisation on the open market, to meet the needs of yet more user cases. Some of these are anticipated to contain elements of mobile technology, such as providing 'gadgets' for use on mobile internet devices and tablets. More broadly however, Lenvis provides an opportunity for different stakeholders, such as those from health services, local government, water companies, bathers and surfers, to meet and discuss different viewpoints about bathing water quality and health. This process is helping to define the main issues and information gaps that still exist, and will inform the selection and development of appropriate solutions collaboratively.

For a project still in its early stages, Lenvis has already achieved a great deal, and with ever-increasing numbers of people now turning to the Internet for up-to-date news and advice, it's an approach that only looks set to grow over the coming years.

INTELLIGENCE

Lenvis

LOCALISED ENVIRONMENTAL AND HEALTH INFORMATION SERVICES FOR ALL: USER-CENTRIC COLLABORATIVE DECISION SUPPORT NETWORK FOR WATER AND AIR QUALITY MANAGEMENT

OBJECTIVES

To develop an innovative collaborative decision support network for exchange of location-based environmental and health services between all stakeholders, for enhanced capacity to assess population exposure and health risks and better management of the concerned ecosystems.

PARTNERS

University of Milano Bicocca (Coordinator), Italy • **GMV Skysoft**, Portugal • **ARIA Technologies**, France • **Provincie Noord- Brabant**, The Netherlands • **Hydrologic**, The Netherlands • **Hidromod**, Portugal • **Istituto Superior Technico (IST)**, Portugal • **UNESCO-IHE**, The Netherlands • **Esaproject**, Poland • **Comune di Bari**, Italy

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CONTACT

Francesco Archetti
Project Coordinator

University of Milano Bicocca
Viale Sarca 336
20126 Milan, Italy

T +39 02 6448 2186
E francesco.archetti@unimib.it

www.lenvis.eu

FRANCESCO ARCHETTI is Professor at the University of Milano Bicocca. He teaches decision support systems and is the author of more than 60 papers in statistical learning, ambient intelligence and systems biology. Beyond the activity in several European projects, he has extensive experience in industrial research acting as advisor to government and financial institutions.

ILARIA GIORDANI has been working in national and European research projects about ambient intelligence and statistical learning since completing her PhD in computer science in 2010.

Bridging the communication gap in environmental information

Pollution has a huge impact on human health and a myriad of environmental sytems worldwide. **Professor Francesco Archetti** and **Dr Ilaria Giordani** of the University of Milano-Bicocca outline the challenges faced in engaging a pan European audience with up-to-date environmental information

Could you provide an overview of the objectives and long-term goals of the Lenvis project?

FA: The main goal of Lenvis is to develop an online collaborative decision making and support network for the exchange of localised environmental and health services between stakeholders, with a focus on air and water quality issues.

In the Lenvis project, all end-users are an integral part of the system. This enables collaboration between different stakeholders, such as environmental protection agencies, health institutions, general practitioners, service providers, policy makers, citizens in general and environmental communities across Europe.

What challenges have you faced during the development and testing of your system?

IG: The main challenges have been scientific and technical in nature because Lenvis is one of the first projects to test a network of web services in a 'big data' environment. One relevant challenge here was to develop a uniform data model to support the acquisition and fusion of environmental data, improving its quality whilst guaranteeing individual privacy. User-driven testing has required us to make amendments, in particular with respect to the possibility of setting and modifying the composition of services for each user.

Another major challenge was found in 'fusing' sensor data from automated monitoring networks and simulation models, as mandated by the most recent European directives. The biggest issue here was adapting our numerical models and data management platforms to the real needs of stakeholders. In many instances, the most interactive and complex approach was not actually the stakeholders' first choice. Efficiency and simplicity proved to be very important requirements. For example, in the case of beach water quality, a simple SMS alert about a potential problem was more highly valued than a complex web or smartphone interface.

Developing cross-platform implementation of web services was also tricky. It was not easy to build a network of web services, and define the interfaces between them so that platforms developed under different technologies could use them. Considering the importance of bathing water quality to tourists, businesses and the general public during the summer, it was important to define a responsibility chain for the alert system, in a way that avoided issuing potentially costly false alerts.

In light of the pressing matter of climate change, is the study of air and water quality more relevant than ever? What applicable knowledge can be gleaned which might help mitigate, adapt to, or manage the effects of climate change?

FA: Climate change and air pollution have, to a large extent, a common cause in emissions from burning fossil fuel. Particles of pollutants influence the climate by scattering, reflecting and absorbing solar radiation. At the same time, concentration of particles and ozone are directly influenced by climate and meteorology. Even if they are treated separately, strategies for energy efficiency must provide a reduction in emissions that contribute to multiple air quality concerns. Policy integration requires a mix of end-of-pipe improvements and structural measures that meet pollution and climate change targets at the lowest possible cost. So the knowledge gleaned by Lenvis – in particular time and space particles concentration – can help to shape a strategy that will provide improvements in air quality, while at the same time reducing the adverse risks and impacts associated with climate changes.

How will Lenvis direct its focus in the future? What areas have you identified as critical for future development?

FA: Technology is evolving at an amazing rate. For millions of people the web is now a fully mobile experience. Lenvis will have to be developed to take full advantage of this opportunity to connect with people in order to reduce environmental and health risks for all activities.

We will also direct our focus towards other goals, aimed at improving both citizens' quality of life and the management of resources. Forecasting models will be improved in order to provide government and non government stakeholders, who are involved in the emergency management, with more accurate predictions about air and water quality. Models for predicting hospitalisation risks with respect to climate changes, pollution and their interplay will also be improved. For example, we want to enable a general practitioner to understand local risks in order to adopt a prompt treatment strategy for patients and prevent hospitalisation. At the same time, a hospital may use global predictions to implement a more evidence-based approach to resource planning. The usability of Lenvis must also be further improved to accommodate selected time-stressed users (eg. general practitioners) and elderly people.