# TEN SUCCESS STORIES ON THE USE OF SATELLITE APPLICATIONS IN CITIES

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# TEN SUCCESS STORIES ON THE USE OF SATELLITE APPLICATIONS IN CITIES

## CLEAN CITY

## EFFICIENT CITY

## HEALTHY AND INCLUSIVE CITY

## SAFE AND RESILIENT CITY

# EXETER: A bin collection service relying on Satellite Navigation



## The Exeter City Council

Exeter is a city in South West England, with 125,000 residents and 53,000 households. The Exeter City Council has 12 lorries which collect domestic waste every day in five zones of the city. For most residents, rubbish collections take place once a fortnight.

## The challenge

Until 2010, the Exeter City Council had no coherent information system to track and plan bin collections, or to deal with missed bins. Lorry drivers often didn't have written notification of missed bins and work plans were not up-to-date.



The only means for residents to report a missed bin was to call the Council's customer advisors. The advisors would then contact the crews by radio, so it took considerable time to establish where the missed bins were, and there was no way of knowing whether they were genuinely missed. The volume of customer calls and the length of the calls meant that the phone lines would become very busy and customers could not always get through to an advisor.

## The satellite solution

In 2011, the Council equipped all its waste collection vehicles with Satellite enabled systems to develop a self service tool to report missed bins online.

Thanks to this new technology the crews can report reasons for non-collections on the satellite devices in their cabs. This information is used in real time to work out a suitable response to customers, either explaining why and what to do if the Council is not returning a bin the customer thinks has been missed, or by raising a service request instantly in the cab, where the crew has genuinely missed a bin.

## The results

Today, drivers responsible for bin collections in Exeter receive their daily work on their satellite devices in the cab, and can press a button to record when collections have been completed, or reasons for non-collections. Supervisors can monitor progress in the back office, or from a tablet when they are on the move.

All relevant information is made available to the Council's online form, so that when customers or advisors want to report a missed bin they simply need to enter their address into the form. The Council now returns for less than 30% of reported missed bins that were genuinely missed by the crew. The satellite-based system is also used by the Exeter City Council to deliver and remove waste bins. Before the adoption of the new system, it frequently took more than 10 days to fulfil bin orders. Today, the average order fulfilment time has been reduced to less than five days.

Overall, the satellite-based system enabled the service to save time, to better organise waste collection, and to do more with less, with no need to purchase new lorries or to hire new staff. For an initial investment of £240k, the Council estimates that the new system has generated £340k capital savings and £470k in revenue savings since its implementation.

www.exeter.gov.uk

# LONDON: AirTEXT, a public health advice programme



## The organisation

airTEXT is a consortium of the 33 local authorities that make up Greater London in partnership with regional & national government - the Greater London Authority, the Environment Agency and Public Health England (formerly the UK's Health Protection Agency).

## The challenge

London is often affected by peaks in air pollution. While air pollution and health advice was widely available, it was not actively disseminated. The consortium wanted to become pro-active in informing vulnerable people about air quality, allowing them to take effective prevention measures and self-manage their symptoms.



© Iuna

It was expected that this would improve the patients' quality of life and address health inequalities, while reducing costs incurred by the National Health Service.

## The satellite solution

airTEXT is an air quality information service based on satellite data, available to people vulnerable to air pollution (or those with general interest) who subscribe to it. Automated alerts are triggered on days of elevated air pollution and sent daily to subscribers via text, voice message, or email.

The service was launched across London in 2007. It is also available on Twitter and social media with a smartphone application.

Alerts across London inform subscribers of the air pollution levels expected (moderate/ high/ very high) with alerts for UV index, pollen and temperature information also becoming available to service users in 2012.

With the alerts there is a description of the likely symptoms and advice on how to handle them is also provided. The range of new environmental alerts for UV, pollen and temperature have been of particular interest to health care providers, with cold weather forecasts and alerts, targeted at sufferers of chronic obstructive pulmonary disease.

The project has been implemented by the airTEXT consortium initially under the ESA PROMOTE programme, then as part of the 7th framework EU project PASODOBLE, and finally within the INTERREG IVB project 'JOAQUIN'.

## The results

airTEXT research by the University of Brighton illustrated that 68% of those with a medical condition would alter their behaviour in response to receiving an airTEXT alert message. Survey participants were asked what action they took in response to an air pollution alert. Increased preparedness was overall the most common response with actions including remembering to keep inhalers nearby (27%) and taking an extra dose of medication to prevent symptoms (14%). Avoiding exposure was the second and third most popular answer including staying indoors (19%) and reducing strenuous exercise (15%).

Finally, 87.4% of participants stated that the airTEXT service had raised their awareness of air quality issues.

www.airtext.info

# LYON: Solar energy production monitoring using satellite information



## Grand-Lyon

The Urban Community of Lyon (Grand-Lyon) is the second largest agglomeration in France and is composed of 58 municipalities. With a population of 1,3 million inhabitants, it is the heart of the country's second economic pole.

For some years now, Grand-Lyon has been deeply involved in considerations about post-carbon cities and the implementation of procedures aiming to prepare the conditions for a change paradigm in the fields of climate and energy. They include the signature of the Covenant of Mayors, the Confluence urban project supported by the European Commission and the reinforcement of the competences of Grand-Lyon in the field of energy.



©Grand Lyon

## The challenge

Within the EU funded-CONCERTO Renaissance project coordinated by Grand-Lyon, a group of energy efficient buildings for a total floor area of 79,000 m2 have been built in the Lyon-confluence area by three real estate developers according to specific guidelines that included targets in terms of energy consumption and use of renewable energy systems.

Thus, in addition to wood chip boilers and solar thermal systems, 11 PV systems have been installed for a total power of approximately 250 kWp.

As it was difficult to ask each company in charge of the design and installation of a photovoltaic system to use the same monitoring system, a "district scale monitoring system" has been tailor-made to ensure that all PV systems operate properly on the long term.

## The satellite solution

Satellite irradiation data are used by this district scale monitoring system to assess the expected hourly output of each PV system. The estimated hourly output is compared with actual production data. In case of difference, an alert is sent to one of the project participant so that the faulty PV system can be repaired as soon as possible.

## The results

Thanks to satellite data, all PV systems of the CONCERTO Renaissance installed in the Lyon-Confluence neighbourhood are controlled each day to make sure that they operate properly and malfunction is detected very quickly.

The satellite-based solution costs 1% of the value of the energy annually produced (approx. EUR 125,000).

Operating and maintaining the installations without the satellite solution would cost the double, requiring at least one working hour per day on each installation.

Before, it would take several days to spot malfunctioning that is now instantly detected by the system.

www.hespul.org

# AMSTERDAM: Earth Observation data for bridge monitoring



## The Department of Engineering

Amsterdam has approximately 1,600 bridges and 900 km of quay walls, shores, banks, talus, inclines and slopes, 600 km of which are managed or owned by the Municipality. The Department of Engineering of the City of Amsterdam is responsible for urban planning and infrastructure maintenance, including assessing the structural integrity of bridges and quay walls.

## The challenge

Heavy traffic and frequent renovation works can threaten the stability and structural integrity of bridges, quay walls, and buildings.



To ensure the integrity of these assets and plan maintenance works accordingly, the Department needs frequent and up-to-date data on deformation of structures and soil. This information is essential to assess the traffic impact on bridges and prioritise maintenance works where they are needed.

## The satellite solution

The Department of Engineering of the City of Amsterdam decided to work with SkyGeo and use satellite-based data to measure and map deformation of the infrastructure and the buildings.

First, InSAR (Interferometric Synthetic Aperture Radar) data were acquired to map movements in the city area. InSAR data provide accurate information on deformations of structures and roads with millimetre precision. This information can be used, among other things, to predict the impact of groundwater level reduction on buildings.

Data collected through satellite observation were further validated through field measurements. The data validation process was also supported by the students of the Delft University of Technology and the University of Salerno.

## The results

So far, InSAR data allowed the Department to assess deformations of 100 bridges and nearby buildings along the quay walls.

The City will use such information to prioritise maintenance works and prevent damages to the assets' integrity during maintenance works, hence possibly saving a considerable amount of time and resources on field measurements.

The Netherlands Environmental Assessment Agency estimates that the costs for repairing the damage and the frequent maintenance of the infrastructure in urban areas can amount to € 5.2 billion up to the year 2050. Earth Observation can thus play a crucial role in the future to reduce the spending of public administrations on infrastructure monitoring and maintenance.

The Department of Engineering is exploring ways to extend the use of inSAR satellite data to also study the past and current behaviour of buildings that are close to planned construction sites. Indeed, satellite data allow the Department to foresee the sensitivity of buildings to soil movements and damages that could be caused by heavy works around the buildings.

www.amsterdam.nl/ingenieursbureau

# BOLOGNA: Satellite Navigation to smoothen public bus traffic flows



## The City of Bologna

The Italian city of Bologna, capital of the Emilia Romagna region, counts a population of about 375,000 people. The city registers about 2 million movements every day: 45% of them are internal and 28% and 27% are respectively the percentages of exchange and crossing movements in town.

The Sustainable Mobility Sector, part of the Land Management Department of the Municipality of Bologna, is responsible for carrying out planning policies and infrastructure interventions to favour sustainable mobility.



## The challenge

Considering that the city of Bologna is too small to have an underground system, finding an alternative solution to provide an efficient above-ground public transportation service was necessary to facilitate urban mobility.

## The satellite solution

In 2005, The Department of Mobility equipped buses with a satellite-based positioning system that gives green light priority to public buses. The Automatic Vehicle Location (AVL) system relies on GPS transmitters on public buses that regularly communicate their position to a central unit.

The messages received by the central unit are automatically retransmitted to communicate the expected arrival times at the bus stops.

More recently, the Municipality developed the local observer system Urban Traffic Optimisation by Integrated Automation (U.T.O.P.I.A.).

Bologna's centralised streetlight system adapts to traffic flows in real time, relying on the information provided by the AVL system and by a network of sensors placed under the street pavement, which monitor the number of cars on the street.

Two minutes before approaching the traffic lights (detected through the GPS connection), buses send a message to the sensors nearby, allowing the central control unit to adapt the street light phases in real time so as to give priority green light to buses. The priority request is generated considering the buses' predictive travel and arrival time schedule at bus stops. The priority requests are forwarded to the U.T.O.P.I.A. centre, while the updated requests are forwarded to the Local Level where the intersection controller will provide the priority.

## The results

The green bus priority system ensures the punctuality of buses arrival times while smoothing city traffic and reducing commuters' travel time. Since 2012, the travel data collected from public buses through satellite navigation are open and freely available online. The next challenge for the Municipality is to also introduce the green priority system on city centre's taxi routes.

www.comune.bologna.it

# LEMVIG: Managing pipelines and wastepipes with the support of satellites



## The Municipality of Lemvig

The Municipality of Lemvig, on the west coast of the Jutland peninsula in Denmark, has a population of 21,500. The Municipality covers an area of more than 500 km2, including the towns of Lemvig and Thyborøn-Harboøre. Lemvig is surrounded by water, with three fjords on its southern borders and a string of islands on its western perimeter.

Lemvig Vand og Spildevand (Lemvig Water and Wastewater) is the private supply company (100% owned by the Municipality of Lemvig) in charge of managing 575 km of waste-water pipeline and 580 km of drinking-water pipelines in the area.



©Benny Vejlby

## The challenge

Lemvig Vand og Spildevand noticed that while pipelines in the area had an average life of 75 years, pipes in Thyborøn would only last 30 years. Afterwards, the pipes had to be changed..

Trying to understand what caused pipes in Thyborøn to degrade faster than in the rest of the Municipality, the company noticed that soil in Thyborøn would subside more than in other areas. Hence, they started looking for a tool that would allow them to monitor soil subsidence, better place the assets and intervene promptly on damaged pipes.

## The satellite solution

In the late Nineties, Lemvig Vand og Spildevand decided to start using InSAR data to monitor soil subsidence in the area. The experience proved successful. Between 2014 and 2016, the European Union and the European Space Agency launched Sentinel 1, a constellation of two satellites with a high spatio-temporal resolution and coverage whose data are freely available. Thanks to a collaboration with the Lemvig municipality, the Danish Coastal Authority and the Danish Agency for Data Supply and Efficiency, Sentinel data were used to assess land movements in Lemvig, documenting a subsidence up to 1 cm per year in Thyborøn.

## The results

By using the soil deformation maps generated with Sentinel data, Lemvig Vand og Spildevand can precisely monitor soil subsidence in the area, in order to identify the pipes that need to be restored before they break up and with no need for regular site inspections. The company is now able to better manage its assets, and to position the pipes where they are expected to last longer.

They are so satisfied with the results obtained so far, that they are now working to launch a modelling pipe software that would use Sentinel data to visualise the position of the pipes dynamically. This system would increase pipes' lifetime of at least 10% and is expected to generate €500,000 of revenues per year.

The Danish Agency for Data Supply and Efficiency (SDFE) is currently working to identify other sectors of use of Sentinel data, both in the public and the private sectors.

www.lvs-as.dk

# FLORENCE: Satellite Navigation to better manage tourist flows



## The Economic Activities and Tourism Department

The Historic Centre of Florence, in Italy, is a UNESCO World Heritage Site since 1982. The city attracts millions of tourists from all over the world. In 2018, 10.6 million tourists visited Florence.

The Economic Activities and Tourism Department of the Municipality is responsible for promoting and managing tourism in Florence. Their main challenge is to sustain the city cultural offer, while mitigating the side effects of tourist pressure on the historic centre.



©Nives Mestrovic

## The challenge

Most tourists in Florence are concentrated in the Historic City Centre, an area of approx. five km2.  To mitigate overcrowding, the Department decided to adopt dedicated measures to guide tourists towards alternative thematic itineraries.

## The satellite solution

Among the measures implemented, the Department launched Firenze Game, a mobile app combining digital gaming and city tours. Targeting schools and kids up to 12 years old, the app aims at stimulating players to learn more about the city while supporting the need of the Municipality to delocalise tourists from major attractions.

Firenze Game relies on Satellite Navigation to guide the young players (and their families) among different itineraries, challenging them to look closely at Florence's hidden beauties and less known stories.

Players can create their avatars and get a set of cards, classified by historical periods. Cards are automatically unlocked through geo-located check-ins. While moving around, the players can gain new cards by localising themselves close to squares, monuments and museums. The more unknown or remote a location is, the more the value of the cards to be collected increases.

The location data are acquired through the mobile device and then combined with city maps retrieved from Open Street Map.

The free app was developed in Italian and English by the Municipality of Florence with Linea Comune, Muse and Digital Fun/TuoMuseo, an international collective of artists, game and sound designers, developers, and 3D animators.

## The results

The geo-localisation of the player translates the digital and gaming experience into a physical one.

The app has been developed so as to allow the Tourist Department to autonomously update and add maps. These can be redrawn from scratch with geo-referenced information.

A cross between PokemonGo and a sticker album, Firenze Game merges the digital and analogical worlds to offer dedicated tourist and educational experiences to youngsters. At the same time, the app represents an innovative way to manage tourist flows in a smart and engaging fashion.

http://app.comune.firenze.it

# TRIESTE: A mobile system to deal efficiently with daily city matters



## The Municipality of Trieste

With a population of about 200,000 people, Trieste is the capital city of the Friuli Venezia Giulia region, in north-eastern Italy.

## The challenge

Due to the large amount of work entrusted to its offices, the Municipality of Trieste struggled to be informed of and to respond to the many daily problems reported by city residents.



At the same time, it was difficult for residents to know which specific office they had to contact to put forward requests and proposals, or to inform the administration about issues concerning services such as public transport, street conditions, waste management, green areas, and street lights, among others.

The Municipality of Trieste was hence looking for viable solutions to maintain a smooth and continuous dialogue with city residents, in order to better understand their needs and to inform them of any relevant issue concerning the local territory.

## The satellite solution

The solution to these needs has been provided by "Comuni-Chiamo", a system created by a group of students for the City of Bologna and today used by more than 80 Italian local authorities. The system consists of an online management software allowing residents to send and monitor requests to the city authorities through a web page or their smartphones. Residents can choose among 11 categories of matters (such as streets, water, lighting, and waste) and can report related problems, such as damaged street or leaking pipes. Each entry has GPS coordinates attached and can include pictures and comments.

At first, the report is received by the Public Relations Office of the City, which verifies its relevance and informs the competent office. According to the number of entries related to each issue, the system automatically grades its priority. This allows city authorities to have a timely understanding of residents' needs and priorities, and to act accordingly. On their side, residents can follow the status of their requests in real time.

## The results

Residents appreciate the functions of the application and the opportunity to follow the status of their request.

Since 2012, 1,500 entries per year have been recorded into the system. Thanks to the reporting system, the Municipality of Trieste is able to communicate smoothly with its residents and to solve daily local problems with less time and resources.

Moreover, the data collected through Comuni-Chiamo is used by the Municipality to build real-time statistics and periodical reports about city management trends. In 2013, Comuni-Chiamo has been awarded the Social App Italia competition, and in 2015 the Bocconi Start-Up Award.

www.comuni-chiamo.com
www.comune.trieste.it

# WEST MIDLANDS: Putting Satellite Communication to use in public health



## The University Hospitals Coventry and Warwickshire

The University Hospitals Coventry and Warwickshire NHS Trust (UHCW) are located in the English region of West Midlands, serving a population of over a million people.

The Breast Screening service at UHCW provides a free breast screening service for women with the aim of finding breast cancers at an early stage. The breast screening (mammography) lasts between 5 and 10 minutes, while the whole visit takes no more than 15 minutes. Early detection increases the chance of a successful recovery. Indeed, it is estimated that breast screening saves 1,400 lives each year in England.



## The challenge

The Breast Screening Service at UHCW uses two mobile vans, equipped with screening units, which stand in front of well-frequented locations, like supermarkets or leisure centres. Eligible women are invited to attend for screening every three years, and receive test results directly to their home within two weeks of the screen.

Traditionally, the images (downloaded onto an encrypted hard disk) and clinical paperwork were transported by car on a daily basis by a staff member. This procedure entailed challenges in terms of patient data security, speed of turnaround, requirement for a courier and lack of live administration systems.

To overcome some of these hurdles, the mobile vans were connected via 3G to the hospital network system allowing a live administration system to be used, but not allowing transfer of images. However, as the 3G connection would drop out quite often, a different and more resilient solution was needed to efficiently sustain a paper free screening environment.

## The satellite solution

In December 2012, the UHCW Breast Screening Service was invited by RedFoot Technologies to test a satellite connection on the mobile vans within the framework of the ESA-funded Mercury project. The mobile vans were equipped with a satellite antenna, which allows the sending of screening tests directly to the hospitals. The satellite connection ensures a secure online access to the hospital intranet, while supporting the transmission of screening patient data back to the remote units. Moreover, the system includes pre-packaging of the images and embeds indelible GNSS data into the patient medical records, for date and location identification.

After completion of the Mercury project, the UHCW decided to keep the service by contracting RedFoot directly. The decision followed a cost-benefit analysis of the service, showing that the satellite-based system was cost-neutral when compared to the previous system.

## The results

The satellite connection enables significant time-saving, since the tests are available for the radiologists and reporting radiographers by the following morning after the screenings are performed. It ensures that no clinical data is lost during the transfer to the hospitals and it grants a secure connection for the staff working on the mobile vans.
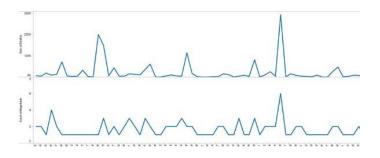
www.uhcw.nhs.uk/

# LASTQUAKE: Engaging citizens in earthquake early warning



## The Euro-Med Seismological Centre

Created in 1975 as a non-governmental organisation, the Euro-Mediterranean Seismological Centre (EMSC) is tasked with collecting data from seismological observatories in 81 institutes across 57 countries.

The EMSC collates data to locate earthquakes in almost real time, in order to alert concerned populations and the public authorities responsible for activating rescue forces in the briefest time.



## The challenge

The Euro-Mediterranean region is periodically affected by potentially dangerous seismic activities, with all the associated consequences such as landslides and tsunamis. To minimise the damages produced by such phenomena, the EMSC looked for ways to detect seismic events in almost real time and to provide advice to those witnessing to earthquakes.

## The satellite solution

To detect earthquakes that can be felt by humans, the EMSC relies on several digital information sources: it tracks the use of the word "earthquake" on Twitter in various languages and it closely monitors its website traffic, as well as of the use of its mobile app LastQuake.

By compiling this information together, the EMSC can automatically detect felt earthquakes before seismic information is available (typically within 15 to 90 seconds).

The LastQuake app can be downloaded free of charge and is currently being used by 360,000 people worldwide. It allows earthquake witnesses to report seismic events directly to the EMSC and to automatically locate the epicentre and assess damages through their Smartphone built-in GNSS receiver.

When using the app, witnesses are asked to report about the perceived shaking or the damages seen through a set of user friendly cartoons. Through the app, witnesses have also the possibility to share geo-located photos and videos of the affected areas.

## The results

By combining mobile and internet technologies, the EMSC is able to provide the public with real-time information on seismic events and post-earthquakes safety tips. The app also allows users to send messages via SMS to their family and friends to confirm they are safe and to share information on social media.

Within a few minutes, the information supplied through the app allows the EMSC to automatically map the earthquake's impact with eyewitnesses acting as real-time motion sensors.

On 15 January 2018, the LastQuake app allowed EMSC to detect a 4.4 Magnitude earthquake close to Athens (Greece) in 24 seconds thanks to 544 real-time testimonies. Seismographers needed 292 seconds to detect and locate the same event.

www.emsc-csem.org