Press kit

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Creating continuity between outdoor and indoor navigation systems
By Valérie Renaudin, director of the GEOLOC laboratory at Ifsttar

Providing a global and effective positioning and navigation solution inside buildings and in dense urban areas is a challenge that researchers and businesses have been trying to solve for over a decade. They have developed a variety of separate approaches towards making it easier for people and goods to move through indoor spaces, by building denser networks of sensors, or using the internet of things, simultaneous localisation and mapping, smart floor technology or inertial navigation. But optimising these technologies is complex and privacy and data protection are becoming increasingly crucial, so hasn’t the time come to combine ideas, share knowledge and perhaps even merge these technologies? More than 400 industry experts and academics specialising in IT, telecommunications, electronics and topography will be exploring all of these issues for 4 days at the 9th International Conference on Indoor Positioning and Indoor Navigation (IPIN) from 24 to 27 September at the Cité des Congrès in Nantes.

The event will kick off with two master classes on Monday 24 September from 10am to 12pm. The first will teach participants more about using cameras and imaging for geolocation, and the second will look at using and processing the GNSS (Global Navigation Satellites Systems) raw measurements that Google has been providing from its Android devices for the past year. Four keynote speakers will address topics such as the new compact cold-atom sensors for inertial navigation, modernising GNSS signals or using augmented and virtual reality for geolocation. Some 140 scientific and industry presentations will follow as part of the conference programme, which is structured around three main themes: ubiquitous geolocation technologies, sharing indoor localisation data in the context of the Internet of Things, and intelligent and connected urban mobility.

Another highlight of the IPIN conference will be the geolocation competition on 22 September. The competition is open to all and is being held in a public space for the first time, at the Atlantis shopping mall. 39 teams of researchers and industry experts will deploy their technology, competing in two categories: on-site and off-site. The on-site challenge involves geolocating in real time 180 targets spread throughout the mall's 9000 m² area. Teams competing off-site will be tasked with estimating the positions, without moving and using only data provided by the IPIN organisers. The winning teams and the best conference speakers will each give a six minute presentation on the fourth and last day of the event.

Event organised by Ifsttar under the auspices of ITSS and the Instrumentation & Measurement Society, both members of the American professional organisation IEEE (Institute of Electrical and Electronics Engineers). Sponsors include the European GNSS Agency, the Atlantis shopping mall, Sysnav, IRSTV (the Institut de Recherche en Sciences et Techniques de la Ville), Viametris and the Id4Car competitiveness cluster.
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Intelligent and connected mobility

Sharing georeferenced data

Georeferenced data and information is key to guiding users through spaces, informing them of new events along their route and improving the safety of self-driving cars. There are many researchers working on the topic, from mapping indoor spaces to developing more precise algorithms.

You are on your way to an interview when the train line you are travelling on is disrupted and you have to alight at the next station. No problem. Your smartphone - or any one of your connected devices - suggests an alternative route, making sure that you steer clear of congested zones or repair works. It also suggests two new transport options: a Segway or a self-driving taxi. You select the second option and as soon as you walk out of the station, your car is there, parked and waiting for you. It drives you to your appointment and you make it to your interview on time.

This scene may still be science fiction today but it is the kind of intelligent and connected urban mobility that researchers and industry experts are working towards. What role does geolocation play in the mobility of the future? “All these functionalities rely on shared georeferenced data”, says Valérie Renaudin, director of the GEOLOC lab at Ifsttar. Without georeferenced data about people and incidents, we cannot guide users or inform them about disruptions along the way, and self-driving vehicles cannot drive safely without geolocating the obstacles.

We want to offer independent mobility in all spaces and customised navigation.

Better traffic flow, fewer CO2 emissions and improved health and safety are three important goals for society that intelligent and connected mobility can help us achieve. Various navigation solutions are currently being developed for this to be deployed. “They use algorithms and more precise sensors to determine whether someone is walking or cycling for example, or visual odometry, analysing images from security or private cameras to calculate a geographic position. Collaborative geolocation is another solution,” Valérie Renaudin points out. Google is using this last method to add altitude measurements to its maps. “One of the biggest challenges with indoor geolocation is mapping different storeys,” the researcher says. To do this, Google takes elevation data from several smartphones with the same location and then performs numerous, more precise calculations to determine altitude. Another example of work in this field is standardising how we represent things on maps. This is one of the topics the GEOLOC lab in Nantes is working on. “The idea is that, whatever technology we use, the symbols for toilets, escalators, lifts or mailboxes should always be the same. This will make it easier to deploy self-driving cars for example.”

An array of innovation and research on geolocation for mobility will be on display at the IPIN conference, including GEOLOC’s research on pedestrian dead reckoning, or PDR. “We use inertial data from smartphones and all wearable connected objects like T-shirts or glasses to offer independent mobility in all spaces and customised navigation. With this method, we can do away with pre-equipped infrastructure,” says Valérie Renaudin, “and we become more independent from access providers or manufacturers. It also means that none of our personal data is accessible.”
Ubiquitous geolocation technologies
For independent mobility in all environments

The ability to know where you are, everywhere, at all times. This is how Miguel Ortiz, researcher at Ifsttar’s GEOLOC laboratory, sums up the purpose of ubiquitous geolocation technologies. The IPIN conference agenda includes some thirty presentations by indoor positioning and navigation experts.

“Today’s geolocation systems don’t perform so well in narrow streets or around tall buildings for example. The technology we are developing must allow independent mobility in all spaces, particularly in built-up environments and indoor, extreme or inaccessible spaces with no GPS signal reception” Miguel Ortiz explains. The GEOLOC lab’s research team are focussing their work on these so-called “ubiquitous” geolocation technologies. Our mobility practices and means of transportation are evolving, and we can support this with technology that leverages the inertial sensors in smartphones, which contain accelerometers and gyroimeters for example. The researchers have developed ULISS (Ubiquitous Localization with Inertial Sensors and Satellites), a light and compact device weighing less than 200g that can “collect signals that are accurately synchronised with GPS time with 4 hours’ autonomy in any environment and irrespective of acquisition conditions”. The device is helping the development of new location algorithms.

GEOLOC, the IPIN conference organiser, has been researching geolocation since the late 1980s. It began with construction site robotics, then in 2005 the lab turned its attention to road transport and GNSS or Global Navigation Satellites Systems, focussing first on positioning vehicles and then adding pedestrians in 2012. Now, this expanded field of research is geared towards ubiquitous geolocation. The aim is to support people on the move, whatever means they are using and in all indoor and outdoor environments. “We are seeking ways to position a traveller in as many spaces and modes of transport as possible: walking, cycling, trams, trains etc” says Miguel Ortiz. All this research is focussed on ensuring that people will no longer be dependent on infrastructure that could be private or defective in some way, and that their privacy is protected. “Locating yourself is quite different from being located” the researcher points out. “We want to protect personal data by no longer relying on the equipment installed in shopping malls and airports for example, like bluetooth and wifi”. 

ULISS
Positioning objects and people inside buildings
Why and how?

Sharing indoor localisation data in the context of the Internet of Things is one of the three main themes of the IPIN 2018 conference. Élizabeth Colin is a researcher and faculty member at EFREI Paris, in the AlliansTIC laboratory. She and Ifsttar’s geolocation team have been working jointly on this topic, and we asked her to tell us about this new technological challenge.

There are many ways in which institutions, businesses and individuals can benefit from being able to locate an object or a person inside a building. This ranges from museums offering customised guided tours to locating a cable inside a hanger or a lost pill organiser in a patient’s room. At EFREI’s AlliansTIC lab, Élizabeth Colin and her team are researching this new technology and the challenges it raises. “In an outdoor environment, we use GPS to locate connected objects by using the time the signal takes to reach the object to estimate its distance from the satellites. In a building, we can’t use that technology in the same way. The walls and furniture and the people moving around inside absorb and reflect the signals”. Researchers are exploring several avenues to address this. “These connected objects have to be mass-produced, so we are looking at reliable but relatively low-cost solutions like RFID (radio frequency identification), which is already widely used in electronic badges,” says Élizabeth Colin. Another challenge researchers face is locating very small objects with an accuracy of just a few centimetres.

Opportunities for business and industry
Indoor localisation data can be shared for many different purposes. Businesses can use it to manage their stock of company laptops or smartphones for example. Researchers are also exploring how it can be used in complex industrial environments like mines, or in industrial warehouses full of metal items that reflect signals from connected objects. The data can also be useful for preventive maintenance by facilitating faster access to machines that require attention.

As it becomes more commonly used, indoor localisation data sharing raises ethical and legal concerns also addressed by the research projects. “Our researchers are working with sociologists and other experts to help define the right framework of use. We take their recommendations and turn them into technical specifications for these objects,” Élizabeth Colin concludes.

"Business, industry and the care sector can all benefit from the ability to locate an object inside a building.”
Geolocation competition at Atlantis Le Centre

During the IPIN conference, the Atlantis Le Centre shopping mall will host a geolocation competition on Saturday 22 September from 8.30am to 9pm. 42 teams with players from 15 different countries, some representing IT giants like Google and Sony and others from research and industry, will compete and test their scientific and tech innovations in a real-life public setting.

Atlantis Le Centre is providing financial and logistics support for the world’s first ever competition of its kind to take place outside of a convention centre. A shopping mall presents all the challenges of real-life conditions. Signal propagation from beacons is modified in crowded spaces and as these crowds move around, they can partially block cameras used by geolocation systems, while the large floor space means people walk long distances. All of these conditions degrade the performance of many existing technologies.

Most current indoor localisation solutions rely on beacons installed throughout the building, but it would not be feasible to place beacons everywhere. Moreover, this type of infrastructure is comprised of multiple proprietary solutions, which raises the issue of universality. But beacons do not need to be compatible in order to work, and competitors will not be allowed to install their own beacons in the Atlantis mall. Their solutions will have to work without modifying the existing infrastructure, using standalone technology that could represent the future of geolocation. Any standalone solution must also protect user data. An indoor geolocation solution does not require data to be shared.

During the competition, participants will follow a mapped itinerary and their results will be used to compare positioning precision and rank their technology. All the itineraries are about 1km long with targets mapped to 10cm accuracy. To push the competing solutions to their limits, obstacles such as lifts and floor changes have been incorporated, and itineraries will be revealed just before the start of the competition for the most realistic results.

There will be four challenges, two inside the mall and two more in a post-processing environment using pre-recorded data. Each challenge carries a 1000€ prize for the winners.

For more information about the competition, visit: http://ipin2018.ifsttar.fr/competition/competition-teams/