

i-locate - Indoor/outdoor LOCation and Asset management Through open gEodata

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Recent studies have highlighted that, on average, we spend approximately 90% of our time indoors, often in unfamiliar environments. Nevertheless, Location Based Services (LBS), for both business or personal use, today are essentially limited to outdoor scenarios and are based virtually only on GPS location. Clearly, being able to seamlessly locate people or objects within indoor AND outdoor spaces could enable a number of new Location-Based Services (LBS) of significant economic relevance in domain such as logistics, personal services, mobility, retail, health, to name but a few.

In particular domains, such as logistics or in modern hospitals, the availability of asset management & maintenance platforms with integrated RTLS (Real-Time Location Systems) features becomes an significant service enabler and business driver, thanks to the real time control of where each piece of equipment is located. The derived information can be then used to infer usage patterns, derive indicators essential to assess actual levels of use, to increase safety, to reduce maintenance errors and, ultimately, to lower costs. In some specific domains, such as healthcare, being able to provide real-time efficient and accurate “asset” tracking and management (be this medical staff, patients, visitors, equipment, etc.) is extremely important in economic as well as in social terms.

All market analysts agree that market of indoor LBS is set to grow in the next 4 years to a multi-billion market. Players such as Google, Apple, Nokia, as well as a multitude of SMEs, are investing significant resources to create indoor mapping databases and services. Technology, from a hardware point of view, has already reached full maturity and has consumer-grade costs. In fact, over the past few years, increasingly accurate indoor localisation technologies, based on technologies such as Bluetooth, ZigBee, and Wi-Fi, have expanded the scope of LBS to include indoor spaces.

Nevertheless, the development of true seamless indoor/outdoor location services still requires removing three major barriers:

- 1) **Lack of Geographic Information (GI) indoor spaces.** While outdoor data can be easily accessed as Open Data (OD), a notable example being OpenStreetMap (OSM), the availability of Geographical Information of indoor spaces is not available on a large scale as Open Data. In case of publicly accessible buildings, such as hospitals, stations, airports, shopping malls, and public offices, having access to geographical data of indoor spaces, and particularly as Open Data, could allow new business activities and bring a number of social benefits.
- 2) **Lack of technological ecosystems.** Technological fragmentation essentially bind location based services to specific native technologies, limited to specific functionalities. No ecosystem allow leveraging on multiple (concurrent) location technologies for indoor and outdoor scenarios to create innovative Location Based Services based on routing and asset management.
- 3) **Lack of support to indoor/outdoor LBS by current GI standards.** This limitation does not allow mixing technologies or solutions from different vendors.

i-locate tries to overcome the aforementioned three barriers so as to enable the creation of

innovative businesses based on indoor and outdoor localisation of people and objects. To this extent, i-locate has been engineered to address very clear market requirements emerging from a core of specialised SMEs, targeting the following objectives:

- To create a public geoportal, the so-called “virtual hub”, that collects, makes discoverable, and provides access to indoor geographical information as Open Data. To this extent, the portal will represent an indoor counterpart to OpenStreetMap.
- To adopt and extend of open standards in the field of indoor/outdoor LBS.
- To create a open source “toolkit” (technically a middleware) for software developers, that allows integrated indoor-outdoor LBS based on the aforementioned open standard.
- To ensure that such a toolkit is built on sound privacy and security policies, for the highest protection of personal/critical data.
- To develop template of client software for mobile devices (App), addressing real world scenarios, for LBS that use the toolkit’s services via the aforementioned open standard protocols.
- To test –for more than one year- the “virtual hub”, the “toolkit,” and the final applications in real operational scenarios with real users and stakeholders within 14 pilots sites in 8 EU countries.
- To stimulate innovation and business activities around indoor Geographic Information through direct engagement of industrial players and SMEs, to ensure that the relevant critical mass is created around the results of i-locate and to foster development of innovative services.

The activities of the project started with a very comprehensive analysis and design phase, the consortium engaged in a very in-depth analysis of the various use cases to be addressed by the pilots and of the requirements emerging from the real downstream users (e.g. technicians, doctors, public officers, etc.), as well as in a very precise definition of the exact geographical scope (both outdoor and indoor) of each pilots. Such an attentive pilot-driven work, which saw the engagement of both technical and pilot partners, was complemented by a very accurate analysis of regulatory constrains at international, national, and local level, paying particular attention to privacy, ethical, and security issues.

Concurrently, from a more technical description, the consortium has identified the various technical requirements emerging from various technology providers. This phase greatly benefitted from the involvement of few key experts from the industrial and standardisation world, in particular from OGC – Open Geospatial Consortium (the reference standard organisation in the geospatial domain), who were formally engaged as members of the advisory board. As a result, a key decision was made regarding the best standard on top of which later development should be based.

The final choice fell on IndoorGML, at that time a standardisation candidate from OGC specifically designed for indoor Location Based Services, which was scheduled to be officially approved as standard in the course of 2014 (eventually officially voted as standard in September 2014). It soon become clear that the current (modular) core of the standard would have to be extended with an additional module, to be proposed as a result of i-locate, for location based services specifically designed for asset management. It was designed, in turn, that such a module should be designed following the principles of the very recent (2014) ISO 55000 abstract standard specifications on asset management. Further standards selected for some of the core features included, among other, support for ISO/IEC 24730-1:2014 standard on “Information technology — Real-time locating systems (RTLS)”. Such a very strong attention to standards was essential to ensure that the result of the project could have a wide industrial update.

This choice, was borne out of real market requirement as perceived by the companies involved in the consortium. This initial phase set the foundation for the definition of a

comprehensive system architecture, comprising a number of very complex services, from localisation to geofencing, from generation of analytics to spatial services, etc. At this phase, it became clear that i-locate would have the unique opportunity to become the first reference implementation of IndoorGML, a very new and innovative standard within the promising LBS market.

Additional, earlier activities, also included a detailed survey of the data available to the various pilot sites, their adjustments and loading into the central database that in the meantime was being deployed as part of on-going development of the core “virtual hub” (the geoportal).

The latter has been progressively extended with a number of “connectors” required to provide real-time access to other open data repositories and with a specifically-designed service that allowed geometrical and topological validation of data against the specifications of IndoorGML. The first core of virtual hub was progressively extended with graphical user interface capabilities that allow ingestion of indoor mapping data as well as interactive drawing of indoor graphs encoded as IndoorGML. The first tangible result has been the early public deploy of a first version of the i-locate portal, which can be already used for the pilot preparation activities.

Meanwhile, after the design phase was concluded with the release of the system architecture, the software development activities started. The result of this phase has been the successful release to the public of the first version of the toolkit that marked the end of the first year, as open source solution.

During the first year the consortium has also engaged in several preparatory activities of the pilots, including definition of detailed deployment and validation plan as well as in the creation of a proper infrastructure for online training (available from the project website) and related interactive training material. This will be particularly important to ensure wide uptake of technologies within the wide community of stakeholders and users.