

A New Paradigm for Developing and Delivering Ubiquitous Positioning Capabilities

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Definition:

“to locate people, objects, or both, anytime, whether they are indoors or outdoors or moving between the two, at predefined location accuracies, with the support of one or more location-sensing devices and associated infrastructure”

(Meng et al., 2007)

Scope

It is based on achieving an idealized positioning performance, modeled on the Global Positioning System (GPS) through the combination of technologies and signals that include, but are not limited to, Global Satellite Navigation Systems (GNSS), cellular and WiFi networks, Radio Frequency Identification (RFID), Ultra Wide Band (UWB), ZigBee, etc.

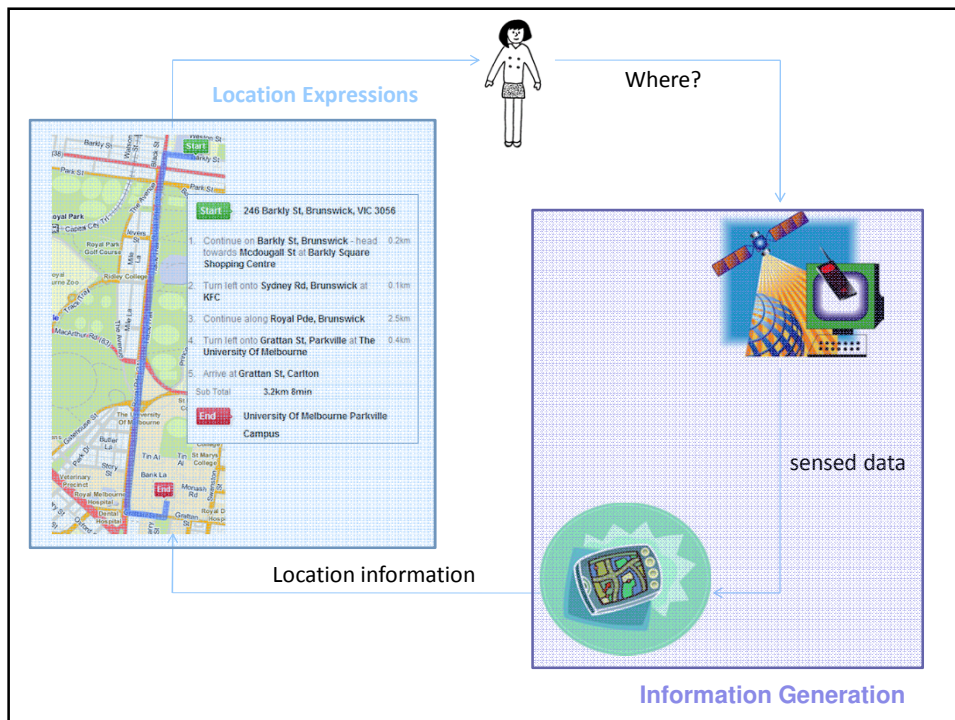
Challenges

- Trying to achieve indoor GPS like performance may be unnecessary!
- What performance metrics are we looking at?
- Platform capabilities for signal processing etc.
- Developing truly interoperable or compatible geopositioning devices that takes into account all signals of opportunity
- Developing computationally efficient measurement fusion algorithms that can undertake real-time signal processing, interference detection and measurement fusion computations.
- Robust procedures for unification of the disparate infrastructure components; definition of best practice guidelines; classification of the different service levels that can be provided under different operating conditions, etc.

Performance Metrics

- Accuracy
- Reliability
- Availability
- Integrity
- Cost
- Complexity

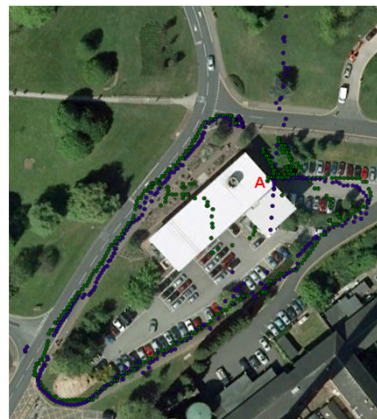
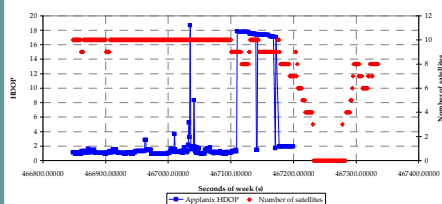
This project attempts to redefine the goal of ubiquitous positioning within the context of balancing performance metrics against cost and complexity.



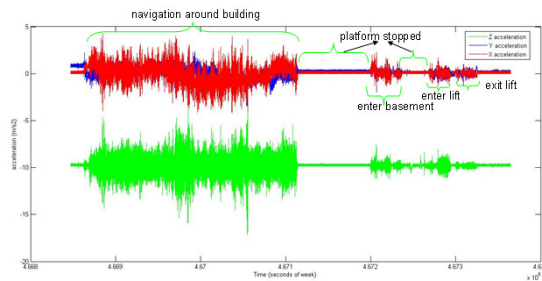
FIG/IAG Working Group

- Performance characterization of positioning sensors and technologies that can play a role in the development of ubiquitous positioning systems
- Theoretical and practical evaluation of current algorithms for measurement integration within ubiquitous positioning systems.
- The development of new measurement integration algorithms based around innovative modeling techniques in other research domains such as machine learning and genetic algorithms, spatial cognition etc.
- Establishing links between the outcomes of this WG and other IAG and FIG WGs (across the whole period)
- Generating formal parameters that describe the performance of current and emerging positioning technologies that can inform FIG and IAG members.

Qualitative vs Quantitative Positions

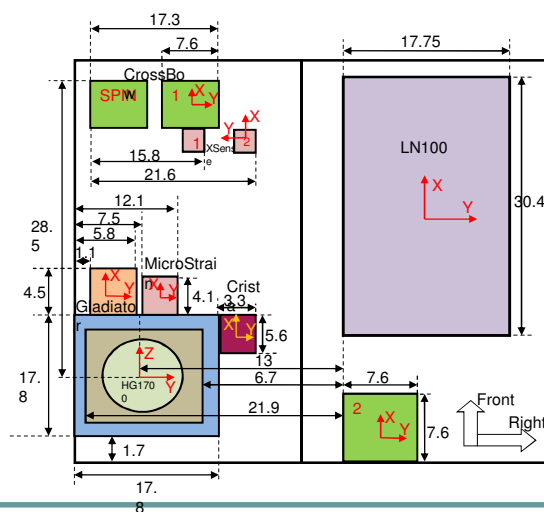


Qualitative vs Quantitative Positions

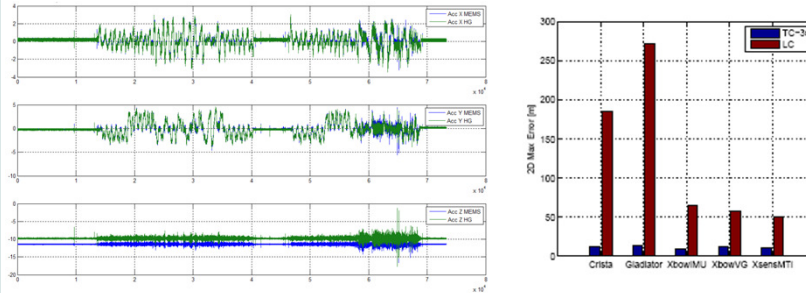


Time	Qualitative information detected	Information provided to user
467110	Poor GPS HDOP/change in satellite visibility. INS detects no motion	You have stopped outside the Institute of Engineering Science and Space Geodesy (IESSG)
467220	No satellites available and building in close proximity	You are in the basement of the IESSG building
467300	Only Z acceleration detected and lift close by	You are in the lift of the IESSG building
467305	Sharp heading change	Exiting lift on second floor of IESSG building

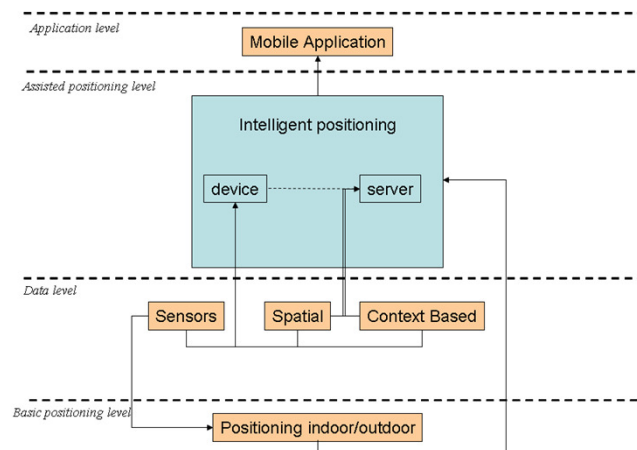
Benchmarking MEMS INS



Benchmarking MEMS INS



Ubiquitous Positioning Concept



Conclusions

- Does the concept of ubiquitous positioning need to be redefined.
- A collaborative FIG/IAG working group has been established with the goal of addressing the challenges to establishing a ubiquitous positioning capability.
- The focus to date has been on redefining the concept of ubiquitous positioning in the evolving landscape of competing performance requirements for current and next generation LBS.
- Current activities have centered on the development of datasets for use by the broader research community for benchmarking and algorithm development activities.
- Future work will focus on a broader assessment of alternative positioning signals as well as an analysis of the infrastructure components required for ubiquitous positioning and procedures for its unification and management.