LBS Research Agenda: Key Problems (Draft)
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ICA Commission on Location-Based Services (http://lbs.icaci.org/)

1. Ubiquitous positioning
- How can we determine the user's position in indoor environments and adverse GNSS conditions? Can sensor fusion help? Can cooperative positioning help?
- Can a global and low cost indoor localization method be developed?
- Can we "standardize" the indoor positioning solutions (like GPS for outdoor, or OGC's WMS, WFS, WCS and WPS, which standardize the input/output of geospatial data and processing services)?

2. From location to place
- How can we enrich the abstract concept of "location" to reflect people's understanding of place, both individually and collectively, in LBS applications?
- How can place, which relates the abstract word with human experience, experiences and interaction, be modeled for LBS?
- How can "space usage rules" (e.g., "no smoking here") be modeled and used in LBS?
- How can place dynamics and (semantic) connection be modeled and used in LBS?
- How should we design LBS to consider place (place-based LBS)?

3. Personalization and context-awareness
- What is context? Can a generally-agreed definition of context be found?
- In which ways can context be modeled and used in LBS?
- How can context-awareness and personalization be provided in LBS?
- Can we find a balance between autonomy and automation (human-in-the-loop)?
- How can we develop LBS to support collective actions and activities?
- How can LBS make use of and contribute to "internet of things"?

4. Towards more non-intrusive and "natural" interface for LBS
- How can non-intrusive and „natural" interfaces be developed for LBS?
- How can we employ newly emerging mobile devices (e.g., smart watches, smart glasses) for LBS applications? Can we predict what design patterns/principles will work for future emerging devices?
- How can cartographically pleasing interfaces be provided in LBS?
- How can visual, sound, and tactile methods be meaningfully integrated to effectively communicate spatial information in LBS?

5. Evaluation
- How can a comprehensive framework (beyond usability) for LBS evaluation be developed, considering user interface, user properties and skills, cognition, device and service properties, environmental factors, and social aspects?
- What is the usability of user research techniques and methods (longstanding and emerging) in LBS research (in laboratory and in the field)?

6. Privacy
- What is privacy in LBS?
- Can we computationally model privacy in LBS?

- How can we best address users' privacy in LBS applications?

7. Side effects and social impact of LBS applications
- How do LBS (e.g., navigation systems) influence people's spatial knowledge acquisition, spatial awareness and spatial ability? Why it happens?
- How can we design LBS that facilitate people's activities and decision-making without harming their spatial abilities?
- How do LBS influence the way people interact with each other and their behaviors at different environments?

8. Selected Applications (not exclusive)
- Indoor and outdoor pedestrian navigation
- Transportation (navigation, safety)
- Mobile guides
- Mobile healthcare (Ambient living)
- Smart cities (smart mobility, smart living, smart governance, smart people, …)
- Location-Based Games (e.g., PokemonGo)
- Disaster management
- Maritime applications
- Self-driving cars

9. Analysis of LBS-generated data (e.g., tracking data, social media data)
- Theories and data models of location-based social media data and tracking (outdoor and indoor)
- Analysis and visual analytics for social media data and tracking data
- Privacy-preserving analysis
- Applications: healthcare, marketing, tourisms, …