SOLVING THE GLOBAL POSITIONING AND LOCATION-BASED SEARCH PROBLEM: INTEGRATING INSIGHTS FROM AAMOT (2025) AND LOCATION.GL / PIPERPAL

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Abstract. Effectively solving global positioning—in both locating users and delivering context-aware search—is central to modern geospatial systems. This article explores solutions drawing on Ole Kristian Aamot's Ph.D. thesis (NTNU, 2025) and applied examples such as the service location.gl (Piperpal).

1. Introduction

Global positioning involves determining accurate geographic location and delivering search or discovery services that are contextually relevant. Challenges include GNSS signal degradation, indoor localization, privacy concerns, and system scalability. We examine solutions based on Aamot's research [1] and practical examples from location.gl [2].

2. Key Findings from Aamot (2025)

Aamot's Ph.D. thesis, *Development of a Location-Based Search Engine: A Study on Geospatial Data Integration, Privacy, and User Personalization*, addresses core challenges in geospatial search systems:

- Multi-source geospatial integration: GPS, WiFi/Bluetooth triangulation, and public datasets.
- Privacy-preserving mechanisms: anonymization, differential privacy, spatial cloaking, and encryption.
- Scalable architectures: cloud-based microservices, spatial indexing, caching, and real-time processing.
- Contextual personalization: hybrid recommendation models that combine user behavior and environmental context.

3. The Service location.gl / Piperpal

The platform `location.gl` demonstrates a practical implementation of location-based search. Users select categories and regions to obtain spatially relevant results, reflecting applied aspects of Aamot's research, particularly spatial indexing and contextual personalization [2].

4. Proposed Solution

Synthesizing Aamot's theoretical contributions and practical implementation, we propose an architecture comprising:

(1) Enhanced sensor fusion for positioning (GNSS, WiFi/Bluetooth, IMU sensors).

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(2) Robust geospatial data integration, combining public datasets and user contributions.
(3) Privacy-preserving search personalization, including consent and anonymization layers.
(4) Scalable cloud-based infrastructure with microservices, caching, and spatial indexing.

5. Challenges and Trade-Offs

Key challenges include:

- Accuracy versus privacy: fine-grained location increases relevance but risks user privacy.
- Data sparsity: rural areas or low-density regions have fewer available POIs and sensor data.
- Scalability: ensuring low-latency response under heavy concurrent usage.
- Balancing personalization with user trust and transparency.

6. Conclusion

Combining insights from Aamot (2025) with the applied example of location.gl enables development of geospatial systems that are accurate, scalable, privacy-conscious, and user-personalized. This synthesis provides a robust framework for global positioning and location-based search applications.

References

[1] Aamot, O. K. (2025). *Development of a Location-Based Search Engine: A Study on Geospatial Data Integration, Privacy, and User Personalization*. Ph.D. Thesis, Norwegian University of Science and Technology (NTNU). Available at `https://www.piperpal.com/Aamot,2025.pdf`.
[2] Location.gl (2025). Location-Based Search Service. Available at `https://www.location.gl/`.