Design of an Intelligent Location-Aware Architecture for Mobile Computing Environments





Santipong Thaiprayoon

Faculty of Mathematics and Computer Science FernUniversität in Hagen, Germany

About Me



Work Experiences:

- 2005 2007 Master of science in information technology at KMUTNB, Thailand
- 2007 2020 Research assistant at NECTEC, Thailand
- 2020 Research assistant and PhD student at FernUniversität in Hagen, Germany

Research Interests:

- Natural language processing
- Information retrieval
- Machine learning
- Graph algorithms
- Distributed system

Research Topics:

- Context-aware and hybrid recommender systems
- POIs recommendation
- Text clustering

Introduction



Location-Aware System (LAS): A computing system that provides customized services or information based on the location of a user



Navigation and Mapping

Local Search



Location-based Advertising



Personalized Information





Contextual Data: Considering only one contextual data in the current location of users may not provide enough relevant information



Information Overload: Continuously providing location-based information can lead to data overload, making it hard for users to identify which information is truly relevant or important



Data Security, Privacy, and Control: Sharing personal data, especially on social platforms, can expose users to potential threats

Intelligent Location-Aware Architecture

- Designing an intelligent location-aware architecture in mobile computing environments based on the current context and situation of users
- Providing services, information, and recommendations that are tailored to the current locations of users, making decisions more seamless and convenient
- Implementing as a client-side mobile application, giving mobile users more control and ownership over their personal data
- For businesses, the ability to offer location-based promotions or services, driving user experience, satisfaction, engagement, and sales

Architecture



Client Side: Mobile Device

- Mobile users obtain services and menus represented by local workflows through dialogues.
- These local workflows allow mobile users to easily navigate through various menus and access the services they need according to their location.
- The personal data of mobile users is locally stored on mobile devices to enable them to control their data.



Server Side: Sandbox



- The sandbox enables mobile users to access, interact with, and contribute contents and local services directly and safely through their mobile devices within their vicinity over a local network.
- Mobile users need to authenticate before accessing a sandbox via Bluetooth proximity.
- Service providers can publish their own information and services.
- The sandbox offers a direct connection to other local servers via a tunneling network.
- The sandbox can also be designed to only collect and store sensitive data that is necessary for a specific purpose.





Data Ownership: Users have more control and ownership over their data.



Personalized Information: Users receive real-time content, advertisements, and relevant updates based on their location.



User Authentication: The identity of users is verified to protect access.



User Matchmaking: Users can discover matching friends who have shared profiles.



User Tracking: Users are tracked for their position and movement based on BT.



POI Recommendation: Users receive next-suitable and similar POIs based on their current location.



Search and Filter: Users can find specific files or information from databases.



Community Forum: Users can ask questions, get feedback, and discuss with their community.



• The experiments are conducted on a realistic simulation under different scenarios of user loads to validate the robustness and effectiveness.





Testing individual web pages with the number of users increases

- 500 virtual users
- 60 seconds running time
- 10 seconds ramp-up

Testing API endpoints with a high volume of requests

- 1,000 virtual users
- 100 seconds running time
- 5 seconds ramp-up

Experimental Results

• The response time of web pages and APIs remained below the desirable threshold of 200 milliseconds.



Opportunities for Further Integration

Conference

Participants: Real-time information services proactively based on profile **Challenge**: Accuracy

Mall

Smart City

Customers: Personalized recommendations, coupons, and other offers based on location **Challenge**: Reliability on internet connectivity

People: Traffic management, and public transportation optimizationChallenge: Infrastructure, and costs







Conclusion



An intelligent location-aware architecture for mobile computing environments.



The aim is to offer services, information, and recommendations to users in close proximity based on their current location and profile.



AI and NLP techniques are used to deeply understand contextual data.



Personal data is locally stored on a mobile device to preserve data privacy.



GPS, Wi-Fi, and Bluetooth technologies are adopted to determine the location and provide location-based information.





Contextual Awareness: Understanding the contextual data of a user, such as historical locations, demographics, preferences, social connections, and behavioral data, and recommending more meaningful items to the user



Adaptive Learning: Future systems might utilize AI to understand user preferences over time, present more relevant information, and filter out unnecessary notifications.

Thank You