**Title:**

**Location-Based Services—A Database Perspective**

**What is the research problem?**

Billions of wireless connected devices offer location-based services includes tracking, way-finding, traffic management, safety-related services, and mixed-reality games. Data warehousing plays a central role, and it describes central challenges to be met by the involved software technologies in order for them to reach their full potential for usage in location-based services.

**Overview/main points of the proposed approach/architecture**

* Computing will become increasingly ubiquitous in the coming years, as wireless computing will find widespread application in emergence of the commercial Internet.
* Technologies like WAP and Bluetooth in Mobile phone, PDA, wristwatches, smart clothing and jewelry, cameras, home appliances, cars, smart dust will create wireless revolution.
* Location-based services will use positioning systems based on satellite technologies and GPS to offer Position-enabled tourist services, safety and security services, metered services, traffic services and management.
* Example of location based service:
  + Traffic coordination and management: Based on the position identify traffic jams and determine the fasted route
  + Location-aware advertising and general content delivery: Based on the current location user may receive sale information based on the “Shopping mode”.
  + Integrated tourist services: Information/service such has hotels, restuarents, accommodation, transportation, cultural events can be made available based on location.
  + Safety-related services: Service for emergency situations based on location like skiing or sailing based on the locations.
  + Location based virtual games and entertainment are also possible. Virtually the location in the game can hold a treasure and the gamer on reaching the location can be assumed to have found the clue/treasure.
* Database-centric usage scenario for location-based services and exemplifies such services.

**Data Warehouse Case Study**

* A small case study of a data warehouse for LBS, which stores requests made to a service and makes them available for analyses.
* Two of the five dimensions of this data warehouse concern time. The Date dimension

captures the date the request was made. Days roll up to weeks and months, but weeks do not roll up into months.

* The Location dimension captures the location from which a service was requested. Some user locations can be obtained very precisely. The Delivery Time measure captures the number of seconds used to serve the requests for the given combination of dimension values.
* The warehouse is used for answering questions about the connection between the

user, the user’s location, the time of day, and the content of the service being requested. This can be used for providing customized services

**Research Challenges:**

* **Non-Standard Dimension Hierarchies:** In traditional data warehouse environments, the dimension hierarchies must have a very regular structure, more precisely, they must be balanced trees. In contrast, location based services require support for irregular dimensions.
* **Imprecision and Varying Precision:** User locations are sampled according to some specific protocol. Complete traces of the users’ movements are unavailable. The service only knows the locations of the users at discrete times.
* **Movement Constraints and Transportation Networks:** The movements of the users of location-based services are often subject to two types of constraints. In the blocking objects type of constraints, objects block the movement of users. In network type of constraint, the movement of objects is constrained by networks. Such networks encompass transportation networks, including road and rail networks, and the infrastructures of buildings consisting of rooms connected by walkways and stairways.
* **Multi-Resolution Objects and Maps in Data Modeling:** Location-based services call for the availability of multi-scale objects and maps. User follows a route that leads in the direction of the restaurant, as indicated on a large-scale map. This map offers a more detailed image of not only of the geographic area, but also of the target object. Entity-Relationship, the Unified Modeling Language, and the relational model to capture multi-resolution maps and objects is highly desirable.
* **Spatial Data Mining on Vehicle Movement:** Extraction of knowledge about the movement of vehicles based on already existing data. Prediction of the times and locations of troublesome situations, such as traffic jams. Provision of alternatives, such as alternate routes with different characteristics like small probability of accidents, low toll, scenic, small variation in travel time
* **Continuous Location Change in Query Processing Techniques:** Traditional indexing techniques work only for static data. Challenge is to do indexing by the continuous change of user locations.

**Conclusions:**

* Location-based services is rapidly emerging as a prominent area of deployment of “geographic”and data management technologies.
* Existing, promising technologies must meet new and tough challenges in order for them to reach their full potential in this area.
* The challenges concern various aspects of the support for location and they stem

From the complex types of spatial regions in which objects move.