ABSTRACT:

With the popularity of location-based services and the abundant usage of smartphones and GPS-enabled devices, the necessity of outsourcing spatial data has grown rapidly over the past few years. Meanwhile, the fast rising trend of cloud storage and cloud computing services has provided a flexible and cost-effective platform for hosting data from businesses and individuals, further enabling many location-based applications. Nevertheless, in this database outsourcing paradigm, the authentication of the query results at the client remains a challenging problem. In this paper, we focus on the Outsourced Spatial Database (OSDB) model and propose an efficient scheme, called VN-Auth, which allows a client to verify the correctness and completeness of the result set. Our approach is based on neighborhood information derived from the Voronoi diagram of the underlying spatial data set and can handle fundamental spatial query types, such as k nearest neighbor and range queries, as well as more advanced query types like reverse k nearest neighbor, aggregate nearest neighbor, and spatial skyline. We evaluated VN-Auth based on real-world data sets using mobile devices (Google Droid smart phones with Android OS) as query clients. Compared to the current state-of-the-art approaches (i.e., methods based on Merkle Hash Trees), our experiments show that VN-Auth
produces significantly smaller verification objects and is more computationally efficient, especially for queries with low selectivity.

**EXISTING SYSTEM:**

The current state-of-the-art solution for authenticating spatial queries is the Merkle R-tree (MR-tree). The MR tree is essentially an R-tree that is augmented with authentication information, i.e., hash digests. In particular, every leaf node of the tree stores a digest that is computed on the concatenation of the binary representation of all objects in the node. Internal nodes are assigned a digest that summarizes the child nodes’ minimum bounding rectangles (MBRs) and digests. Digests are computed in a bottom up fashion, and the single digest at the root is signed by the DO. Range queries on the MR-tree are handled by a depth first traversal of the tree. The resulting VO contains 1) all the objects in every leaf node visited and 2) the MBRs and digests of all the pruned nodes. Having this information, the client can reconstruct the root digest and compare it against the one that was signed by the owner. In addition, the client also examines the spatial relations between the query and each object/MBR included in the VO, in order to verify the correctness of the result.
DISADVANTAGES OF EXISTING SYSTEM:

- First, the authentication information (hash digests) embedded in the MR-tree reduces the node fan out, leading to more I/O accesses during query processing.
- Second, in the presence of updates from the DO, all digests on the path from an affected leaf node to the root have to be recomputed.
- Consequently, when updates are frequent, query performance is degraded.

PROPOSED SYSTEM:

In this paper, we propose VN Auth, a novel approach that authenticates arbitrary spatial queries based on neighborhood information derived from the Voronoi diagram of the underlying spatial data set. In particular, before delegating its database to the SP, the owner transforms each data object by creating a signature of the object itself along with information about its Voronoi neighbors. A key aspect of our method is that it separates the authentication information from the spatial index. As a result, the efficiency of the spatial index is not compromised, and updates affect only the neighborhoods of the updated objects. Furthermore, for k NN and range queries the VO is extremely compact, since it only includes the transformed objects that belong to the result set. We implemented our verification algorithms on Android mobile devices and run experiments using real-world data sets. Our experiments and results show that, compared to the MR-tree variants, VN-Auth produces...
significantly smaller verification objects and is more computationally efficient, especially for queries with low selectivity.

ADVANTAGES OF PROPOSED SYSTEM:

- Our proposed system is more computationally efficient, especially for queries with low selectivity than the previous MR-tree variants system.
- The proposed system tackles the query verification problem for these types of queries.

ARCHITECTURE:
MODULES:

1. Presence Cloud server overlay.
2. One-hop caching strategy.

MODULES DESCRIPTION:

1. **Presence Cloud server overlay**

   The Presence Cloud server overlay construction algorithm organizes the PS nodes into a server-to-server overlay, which provides a good low-diameter overlay property. The low-diameter property ensures that a PS node only needs two hops to reach any other PS nodes.

2. **Spatial database outsourcing**

   To improve the efficiency of the search operation, Presence Cloud requires a caching strategy to replicate presence information of users. In order to adapt to changes in the presence of users, the caching strategy should be asynchronous and not require expensive mechanisms for distributed agreement. In Presence Cloud,
each PS node maintains a *user list* of presence information of the attached users, and it is responsible for caching the *user list* of each node in its PS list, in other words, PS nodes only replicate the *user list* at most one hop away from itself. The cache is updated when neighbors establish connections to it, and periodically updated with its neighbors. Therefore, when a PS node receives a query, it can respond not only with matches from its own *user list*, but also provide matches from its caches that are the user lists offered by all of its neighbors.

3. **Voronoi Neighbors**

We contend that minimizing searching response time is important to mobile presence services. Thus, the buddy list searching algorithm of Presence Cloud coupled with the two-hop overlay and one-hop caching strategy ensures that Presence Cloud can typically provide swift responses for a large number of mobile users. First, by organizing PS nodes in a server-to-server overlay network, we can therefore use one-hop search exactly for queries and thus reduce the network traffic without significant impact on the search results. Second, by capitalizing the one-hop caching that maintains the user lists of its neighbors, we improve response time by increasing the chances of finding buddies. Clearly, this mechanism both reduces the network traffic and response time. Based on the mechanism, the population of mobile users can be retrieved by a broadcasting
operation in any PS node in the mobile presence service. Moreover, the broadcasting message can be piggybacked in a buddy search message for saving the cost.

4. Voronoi Diagrams

A Voronoi diagram is a way of dividing space into a number of regions. A set of points (called seeds, sites, or generators) is specified beforehand and for each seed there will be a corresponding region consisting of all points closer to that seed than to any other. The regions are called Voronoi cells. It is dual to the Delaunay triangulation.

**SYSTEM REQUIREMENTS:**

**HARDWARE REQUIREMENTS:**

- **System**: Pentium IV 2.4 GHz.
- **Hard Disk**: 40 GB.
- **Floppy Drive**: 1.44 Mb.
- **Monitor**: 15 VGA Colour.
- **Mouse**: Logitech.
- **Ram**: 512 Mb.
- **MOBILE**: ANDROID.
SOFTWARE REQUIREMENTS:

- Operating system : Windows XP.
- Coding Language : Java 1.7
- Tool Kit : Android 2.3
- IDE : Eclipse