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Enhancing the Privacy and Content-Protection using Location Based Queries

B Kishore Kumar#1, R Hari Priya #2, M Dhana Lakshmi #3, Sk Asha #4, J Joy Mercy #5
#1 Asst. Professor, Dept of Computer Science and Technology
#2,3,4,5 B.Tech.,Scholars, Dept of Computer Science and Technology
#1,2,3,4,5 QIS College of Engineering and Technology, Ongole

Abstract:

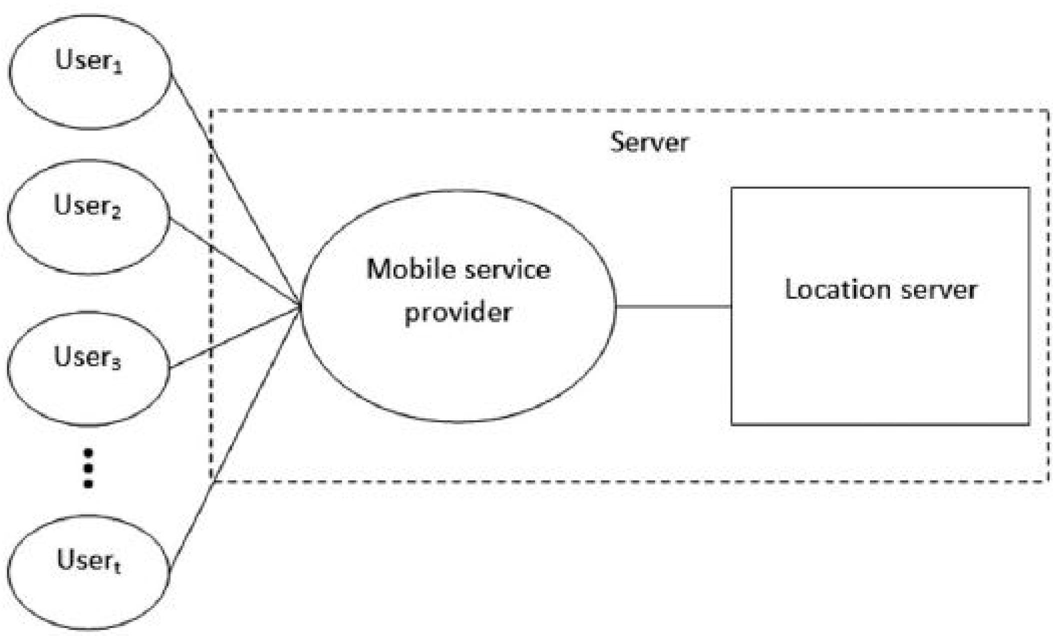
In this paper we present a solution to one of the location-based query problems. This problem is defined as follows: (i) a user wants to query a database of location data, known as Points Of Interest (POIs), and does not want to reveal his/her location to the server due to privacy concerns; (ii) the owner of the location data, that is, the location server, does not want to simply distribute its data to all users. The location server desires to have some control over its data, since the data is its asset. We propose a major enhancement upon previous solutions by introducing a two stage approach, where the first step is based on Oblivious Transfer and the second step is based on Private Information Retrieval, to achieve a secure solution for both parties. The solution we present is efficient and practical in many scenarios. We implement our solution on a desktop machine and a mobile device to assess the efficiency of our protocol. We also introduce a security model and analyse the security in the context of our protocol. Finally, we highlight a security weakness of our previous work and present a solution to overcome it.

I. Introduction:

Area Based Services (LBSs), otherwise called area subordinate data administrations (LDISs), have been perceived as a significant setting mindful application in inescapable figuring conditions. Spatial questions are one of the main LBSs. As per spatial imperatives, spatial questions can be isolated into a few classifications counting closest neighbor (NN) inquiries and window questions. A NN question is to discover the closest information object with regard to the area at which the question is given (alluded to as the inquiry area of the NN question). For instance, a client may dispatch a NN inquiry like "show the closest bistro regarding my present area." On the other hand, a window inquiry is to locate all the articles inside a particular window outline. A model window inquiry is "show all cafés in my vehicle route window." as a rule, a versatile customer ceaselessly dispatches spatial inquiries until the customer acquires an acceptable answer. For instance, a question "show me the pace of the closest lodging with deference tomy current area" is consistently submitted in a moving vehicle in order to locate an ideal lodging. The gullible technique noting consistent spatial questions is to present another inquiry at whatever point the question area changes. The innocent strategy can give right

ISSN- 2394-5125 VOL 9, ISSUE 04, 2022

outcomes, however it represents the accompanying issues: High force utilization. The force utilization of a cell phone is high since the cell phone continues to submit questions to the LBS worker. Hefty worker load. A persistent question ordinarily comprises of various inquiries to the LBS worker, in this manner expanding the heap on the LBS worker. Luckily, in reality, the inquiries of a ceaseless question generally display spatial territory. In this way, storing the question result and the relating substantial district (VR) in the customer side reserve was proposed to alleviate the above issues. The legitimate locale, otherwise called the substantial degree, of an inquiry is the area where the answer of the inquiry stays substantial. Resulting inquiries can be stayed away from as long as the customer is in the substantial district. In the event that a customer keeps moving after it gave an inquiry, the question result would keep on changing as per the customer's development. All things considered, it is hard to acquire results which are exact regarding the position pat which the client gets them. Notwithstanding the way that LBSs open up new exploration openings, the greater part of the on-going examination work still focuses on customary questions which return answers autonomous to the areas of the inquiry guarantors. In other words, every information object has just one bunch of property estimations in the worker. On the off chance that a customer stores a neighborhood duplicate of the information to improve execution, the stored information become invalid just when the relating duplicate in the worker is refreshed. As for area subordinate inquiries, an information object typically has different arrangements of property estimations, every one of which is legitimate as



it were at the point when the customer is situated inside a particular locale. While versatile information storing and negation for locationindependent inquiries has been effectively sought after in the portable registering research local area, not many work had been done on ordering and inquiry handling procedures for area subordinate inquiries.

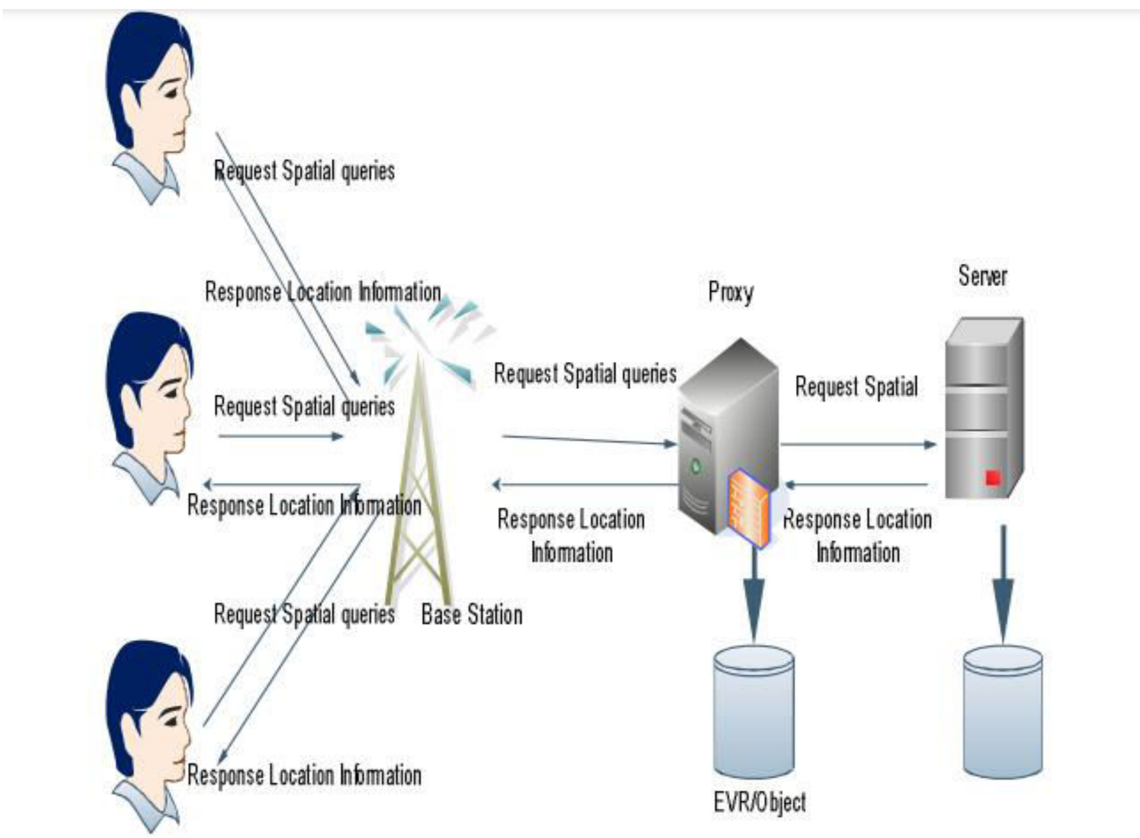
II. Related Work:

The advent of high-speed wireless networks and the popularity of portable devices have fueled the development of mobile computing. Compared to traditional computing paradigms, mobile computing enables clients to have unrestricted mobility while maintaining network connection. The ability of users to move and identify their own locations opens up a new kind of information services, called location-dependent information services (LDISs), which produce the answer to a query according to the location of the client issuing the query . Examples of mobile LDISs include nearest object searching (e.g., finding the nearest restaurant) and local information access (e.g., local traffic, news, and attractions. The spatial property of location-dependent data introduces new problems for data caching research. First, the cached result for a query (e.g., the nearest restaurant) may become invalid when the client moves from one location to another. The maintenance of the validity of the cached data when the client changes location is called location-dependent cache invalidation. Second, the cache replacement policy on the client has to consider the sizes of the valid scopes p(hereinafter called valid scope areas) of the cached values. The valid scope of a data value is defined as the geographical area within which the data value is valid. When the valid scope of a data value is large, the chance for the client to issue the same query within the valid scope, thus generating a cache hit, is also large. As such, the cache replacement policy should try to retain the data value with pa larger valid scope area in the cache. [1]

Owing to increasing demands from mobile users, Location-Based Services (LBSs) have received a lot of attention in recent years. Examples of queries for location-based services include “find the nearest gas station from my current location”, “find all the cinemas within 1 km radius”, “which buses will pass by me in the next 10 minutes?” and so on. While data objects in the first two examples are stationary, those in the last example are mobile. In this paper, we focus on queries issued by mobile users on relatively static data objects, because they are the most common kind of queries in LBSs. The movement of mobile clients presents many new research problems for location-dependent query processing there are several technical issues involved with the implementation of an LBS, which include locating the position of a mobile user, tracking and predicting movements, processing queries efficiently, and bounding location errors. [2]

ISSN- 2394-5125 VOL 9, ISSUE 04, 2022

Consider a computing environment with a large number of location-aware mobile objects. We want to retrieve the mobile objects inside a set of user-defined spatial regions and continuously monitor the population of these windows over a time period. In this paper, we refer to such continuous queries as range-monitoring queries. Efficient processing of range-monitoring queries could enable many useful applications. similarly, we might want to track traffic condition pin some area and dispatch more police to the region if the number of vehicles inside exceeds a certain threshold. In such applications, it is highly desirable and sometime critical to provide accurate results and update them pin real time whenever mobile objects enter or exit the regions of interest. Unlike conventional range queries, a range-monitoring query is a continuous query. It stays active until it is terminated explicitly by the user. As objects continue to move, the query results change accordingly and require continuous updates. A simple strategy for computing



range monitoring queries is to have each object report its position as it moves. The server uses this information to identify the affected queries, and updates their results accordingly. This simple approach requires excessive location updates, and obviously is not scalable. Each location update consists of two expenses - mobile communication cost and server processing cost. If a battery-powered object has to constantly report its location, the battery would be exhausted very quickly.

ISSN- 2394-5125 VOL 9, ISSUE 04, 2022

Consequently, new mobile computing applications are expected to emerge, allowing users to issue location-dependent queries in a ubiquitous manner. Consider, for instance, a user (mobile client) in an unfamiliar city, who would like to know the 10 closest restaurants. This is an instance of a k nearest neighbor (kNN) query, where the query point is the current location of the client and the set of data objects contains the city restaurants. Alternatively, the user may ask for all restaurants located within a certain distance, i.e., within 200 meters.[5] This is an instance of a range query. Spatial queries have been studied extensively in the past, and numerous algorithms exist (for processing snapshot queries on static data indexed by a spatial access method. Subsequent methods focused on moving queries (clients) and/or objects. The main idea is to return some additional information (e.g., more NNs expiry time validity region that determines the lifespan of the result. Thus, a moving client needs to issue another query only after the current result expires. These methods focus on single query processing, make certain assumptions about object movement and do not include mechanisms for maintenance of the query results (i.e., when the result expires, a new query must be issued). Recent research considers continuous monitoring of multiple queries over arbitrarily moving objects. In this setting, there is a central server that monitors the locations of both objects and queries. The task of the server is to report and continuously update the query results as the clients and the objects move. As an example, consider that the data objects are vacant cabs and the clients are pedestrians that wish to know their k closest free taxis until they hire one. [6]As the reverse case, the queries may correspond to vacant cabs, and each free taxi driver wishes to be continuously informed about his/her k closest pedestrians. Several monitoring methods have been proposed, covering both range and kNN queries. Some of these methods assume that objects issue updates whenever they move, while others consider that data objects have some computational capabilities, so that they inform the server only when their movement influences some query.

III. System Study

The Location Server (LS), which offers some LBS, spends its resources to compile information about various interesting POIs. Hence, it is expected that the LS would not disclose any information without fees. Therefore the LBS has to ensure that LS's data is not accessed by any unauthorized user. During the process of transmission the users should not be allowed to discover any information for which they have not paid. It is thus crucial that solutions be devised that address the privacy of the users issuing queries, but also prevent users from accessing content to which they do not have authorization.

Disadvantages of Existing System:

- Among many challenging barriers to the wide deployment of such application, privacy assurance is a major issue

- The user can get answers to various location based queries

ISSN- 2394-5125 VOL 9, ISSUE 04, 2022

Proposed System:

In this paper, we propose a novel protocol for location based queries that has major performance improvements with respect to the approach by Ghinita at el. And. Like such protocol, our protocol is organized according to two stages. In the first stage, the user privately determines his/her location within a public grid, using oblivious transfer. This data contains both the ID and associated symmetric key for the block of data in the private grid. In the second stage, the user executes a communicational efficient PIR, to retrieve the appropriate block in the private grid. This block is decrypted using the symmetric key obtained in the previous stage. Our protocol thus provides protection for both the user and the server. The user is protected because the server is unable to determine his/her location. Similarly, the server’s data is protected since a malicious user can only decrypt the block of data obtained by PIR with the encryption key acquired in the previous stage. In other words, users cannot gain any more data than what they have paid for. We remark that this paper is an enhancement of a previous work.

Advantages of Proposed System:

- Redesigned the key structure.
- Added a formal security model.
- Implemented the solution on both a mobile device and desktop machine.

IV. Implemention

Modules:

1. Users
2. Mobile Service Provider
3. Location Server

Users:

The users in our model use some location-based service provided by the location server LS. For example, what ishe nearest ATM or restaurant? The purpose of the mobile service provider SP is to establish and maintain the communication between the location server and the user. The location server LS owns a set of POI records ri for 1≤ri ≤ρ. Each record describes a POI, giving GPS coordinates to its location (xgps,ygps), and a description or name about what is at the location.

Mobile Service Provider:

We reasonably assume that the mobile service provider SP is a passive entity and is not allowed to collude with the LS. We make this assumption because the SP can determine the whereabouts of a mobile device, which, if allowed to collude with the LS, completely subverts any method for privacy. There is simply no technological method for preventing this attack. As a consequence of this assumption, the user is able to either use GPS (Global Positioning System) or the mobile service provider to acquire his/her coordinates.

Location Server:

We are assuming that the mobile service provider SP is trusted to maintain the connection, we consider only two possible adversaries. Each and every one for individual communication direction. We consider the case in which the user is the adversary and tries to obtain more than he/she is allowed. Next we consider the case in which the location server LS is the adversary, and tries to uniquely associate a user with a grid coordinate.

V. Conclusion

In this paper we have presented a location based query solution that employs two protocols that enables a user to privately determine and acquire location data. The first step is for a user to privately determine his/her location using oblivious transfer on a public grid. The second step involves a private information retrieval interaction that retrieves the record with high communication efficiency. We analyzed the performance of our protocol and found it to be both computationally and communicational more efficient than the solution by Ghinita et al., which is the most recent solution. We implemented a software prototype using a desktop machine and a mobile device. The software prototype demonstrates that our protocol is within practical limits. Future work will involve testing the protocol on many different mobile devices. The mobile result we provide may be different than other mobile devices and software environments. Also, we need to reduce the overhead of the primarily test used in the private information retrieval based protocol. Additionally, the problem concerning the LS supplying misleading data to the client is also interesting. Privacy preserving reputation techniques seem a suitable approach to address such problem. A possible solution could integrate methods from. Once suitable strong solutions exist for the general case, they can be easily integrated into our approach.

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