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Dynamic Monitoring of Moving Objects: A Novel Model to Improve Efficiency, Privacy and Accuracy of the Framework

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***Abstract*— Millions of users in the world are making use of wireless mobile services from personal to business applications. Monitoring of dynamically moving object is a challenging task for the service providers. In order to provide user interested trustworthy services, tracking of moving objects is necessary. Location-based services are the scalable processing of location monitoring requests on a large collection of mobile objects. Location Updates are being affected to the repository centers. This can be authenticated by the mobile clients (users) by reporting the query updates while moving from one place to other in specified region. Most of the Users are expected to cloak from other parties. The bury of user is due to privacy issues. This paper addresses the Privacy, Accuracy and Efficiency of dynamically moving objects in a safe region. The proposed model draws the enhanced results with the general methods of monitoring accuracy, Privacy and scalability with minimal communication cost.**

***Keywords*— Moving Object, Location update, Query Index, Safe Regions, Object index.**

Introduction

In the Proliferation of Mobile communication, the users are more comfortable with the nascent wireless communication technology adaptations. Monitoring moving mobile clients is necessary to provide best services in this competitive world. To track and coordinate large numbers of continuously moving objects, their positions are stored in databases [1]. While capturing moving objects it is the responsibility of parent network to provide privacy to the users. Location privacy is the ability to prevent other parties from learning one's current or past location. Privacy of location information is about controlling access to this information [2]. Pervasive Computing applications track people's movements so they can offer various useful services. Users who do not want such services can trivially maintain location privacy by refusing to be tracked—assuming they have the choice [2]. One of the challenging issues we address in this paper is how location-aware applications are identical to the users sensitive data, that is being effected and retaining their location privacy. To protect the privacy of user location information they wish to hide their true identity or sensitive information from the applications receiving their location, at a very high level, this is taken as security policy in this paper. 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 [3]. The application servers capture the client requests and registers update queries in the corresponding databases until the queries are deregistered. Each location update consists of two expenses - mobile communication cost and server processing cost [3]. Systems for continuous monitoring or tracking of mobile objects receive updated locations of objects as they move in space [4], [9], [10], [11]. The database server manages the location information of the objects. There are two representative types of emerging location based services: location-aware content delivery and location sensitive resource management. The former uses location data to tailor the information delivered to the mobile users in order to increase the quality of service and the degree of personalization [6]. The latter uses location data combined with route schedules and resource management plans to direct service personnel or transportation systems, optimize personnel utilization, handle emergency requests, and reschedule in response to external conditions like traffic and weather [6]. In [7] personalized k-anonymity model for providing location privacy. Our model allows mobile clients to define and modify their location privacy specifications at the granularity of single messages, including the minimum anonymity level requirement, and the inaccuracy tolerances along the temporal and spatial dimensions [7], this compromises the accuracy and Quality of Service. The fundamental problem in a monitoring system is when and how a mobile client should send location updates to the server because it determines few major measures of monitoring, such as Privacy, accuracy and efficiency. Accuracy means how often the monitored results are correct, and it heavily depends on the frequency and accuracy of location updates [8]. As for efficiency, two dominant costs are: the wireless communication cost for location updates and the query evaluation cost at the database server, both of which depend on the frequency of location updates. As for privacy, the accuracy of location updates determines how much the client's privacy is exposed to the server.

I. System Framework

n this Framework we focused to capture the whereabouts of continuous moving objects from one safe region to another safe region. The frame work is shown in Fig. 1. The flow of

work in this framework has shown in Fig.2 that clears how a query is updated in the database while a mobile client moves from on region to another region. Few studies on continuous query monitoring are focused on location updates [12]. All the registered clients report their updations to the server in periodic intervals. A client performs an update when its location or velocity changes significantly [13].

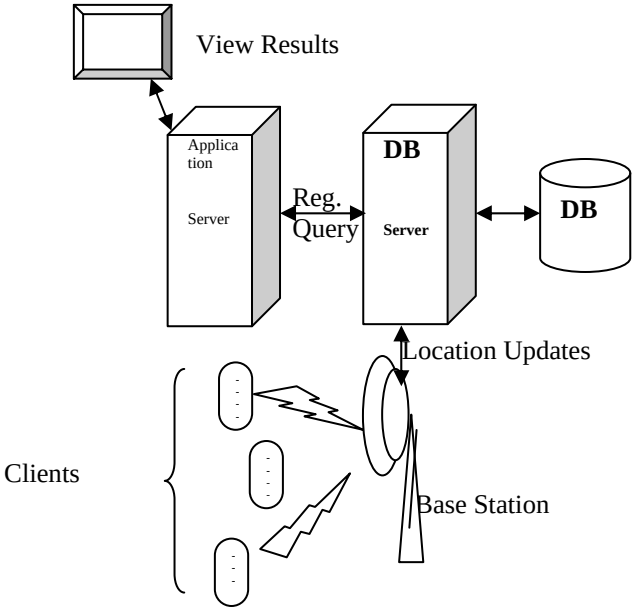

Fig 1. System Framework

The system frame work maintains needed equipments mainly at the server and the user side. Moving objects index is to be maintained by the server in order to get the changes when they were found location updates. This is to be maintained with object address as object index, Updating query index, Query processing unit as query processor and update manager. Moving objects generally maintains un broken connection to maintain consistent updated information.

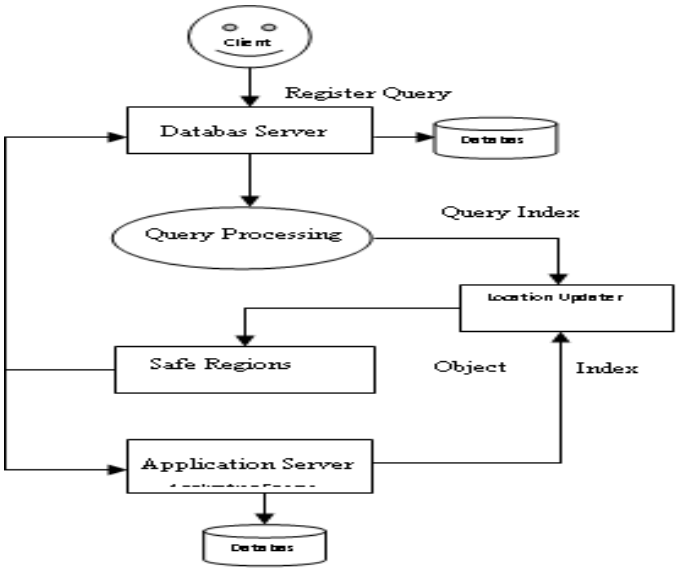

Fig. 2 Query Updation while location change by moving objects.

II. Related Work

In mobile and spatiotemporal databases, monitoring continuous spatial queries over moving objects is needed in numerous applications such as public transportation, logistics, and location-based services. A typical monitoring system consists of a base station, a database server, application servers, and a large number of moving objects (i.e., mobile clients). The database server manages the location information of the objects. The application servers gather monitoring requests and register spatial queries at the database server, which then continuously updates the query results until the queries are deregistered. The fundamental problem in a monitoring system is when and how a mobile client should send location updates to the server because it determines three principal performance measures of monitoring—accuracy, efficiency, and privacy. Accuracy means how often the monitored results are correct, and it heavily depends on the frequency and accuracy of location updates. As for efficiency, two dominant costs are: the wireless communication cost for location updates and the query evaluation cost at the database server, both of which depend on the frequency of location updates. As for privacy, the accuracy of location updates determines how much the client's privacy is exposed to the server.

A. Periodic Updates and Deviation Updates

Two commonly used updating approaches are periodic update (every client reports its new location at a fixed interval) and deviation update (a client performs an update when its location or velocity changes significantly). Monitoring accuracy is low: query results are correct only at the time instances of periodic updates, but not in between them or at any time of deviation updates. Location updates are performed regardless of the existence of queries—a high update frequency may improve the monitoring accuracy, but is at the cost of unnecessary updates and query re-evaluation. Server workload using periodic update is not balanced over time: it reaches the peak when updates arrive (they must arrive simultaneously for correct results) and trigger query re-evaluation, but is idle for the rest of the time. Privacy issue is simply ignored by assuming that the clients are always willing to provide their exact positions to the server. Some recent work attempted to remedy the privacy issue. Location cloaking was proposed to blur the exact client positions into bounding boxes. By assuming a centralized and trustworthy third-party server that store all exact client positions, various location cloaking algorithms were proposed to build the bounding boxes while achieving the privacy measure such as k-anonymity. However, the use of bounding boxes makes the query results no longer unique. As such, query evaluation in such uncertain space is more complicated. A common approach is to assume that the probability distribution of the exact client location in the bounding box is known and well formed. Therefore, the results are defined as the set of all possible results together with their probabilities. However, all these approaches focused on one-time cloaking or query evaluation; they cannot be applied to monitoring applications

where continuous location update is required and efficiency is a critical concern. Previous work proposed, a monitoring framework where the clients are aware of the spatial queries being monitored, so they send location updates only when the results for some queries might change. Our basic idea is to maintain a rectangular area, called safe region, for each object. The safe region is computed based on the queries in such a way that the current results of all queries remain valid as long as all objects reside inside their respective safe regions. A client updates its location on the server only when the client moves out of its safe region. This significantly improves the monitoring efficiency and accuracy compared to the periodic or deviation update methods. However, this framework fails to address the privacy issue, that is, it only addresses "when" but not "how" the location updates are sent.

B. Limitations of Existing System

The accuracy is low since the query results are correct only at the time instances of periodic updates, but not in between them or at any time of deviation updates.

- The updates are performed regardless of the existence of Queries a high update frequency may improve the monitoring accuracy, but is at the cost of unnecessary updates and query re-evaluation.
- The privacy issue is simply ignored by assuming that the clients are always willing to provide their exact positions to the server.

III. ALGORITHMIC APPROACH

Step1 **:** When an Object starts moving it registers the query through Application Server. i.e Register query.

Step2 **:** When an Object changes region and sends location updates, It modifies the information using Query index and Object index.

Step 3 **:** Updated results will be acknowledged to the registered objects through application server.

Step 4 **:** Location manager updates the information and find the new safe region for such updating objects and acknowledges to the object.

Step 5 **:** Whenever new query is created repeat Steps from 1 to 4.

IV. MODEL WORKFLOW

In our approach to maintain safe region we have object index, Query index, the query processor and location manager. As for efficiency, the framework significantly reduces location updates to only when an object is moving out of the safe region, and thus, is very likely to alter the query results. The safe region is computed based on the queries in such a way that the current results of all queries remain valid as long as all objects reside inside their respective safe regions.

- Safe Region Evaluation.
- Object Index and Query Index
- Query Processing.
- Location Updater.

A. Safe Region Evaluation

In this safe region is assumed as a rectangle change of object inside the rectangle would not affect spatial query in the database. The safe region is computed based on the queries in such a way that the current results of all queries remain valid as long as all objects reside inside their respective safe regions. Client updates its location on the server only when the client moves out of its safe region based on the location of client. The safe region ring is based on the rectangle of the centric.

B. Object Index and Query Index

Object index is the server side information about spatial query range and used to evaluate safe region. Query Index as the following parameter query point, current query result and the quarantine area. The quarantine area is used to identify the queries whose results might be affected by an incoming location update. The number of objects is some orders of magnitude larger than that of queries. As such, the query index can accommodate all registered queries in main memory, while the object index can only accommodate all moving objects in secondary memory

C. Query Processing

In the PAM framework, based on the object index, the query processor evaluates the most probable result when a new query is registered, or re-evaluates the most probable result when a query is affected by location updates. Obviously, the re-evaluation is more efficient as it can be based on previous results.

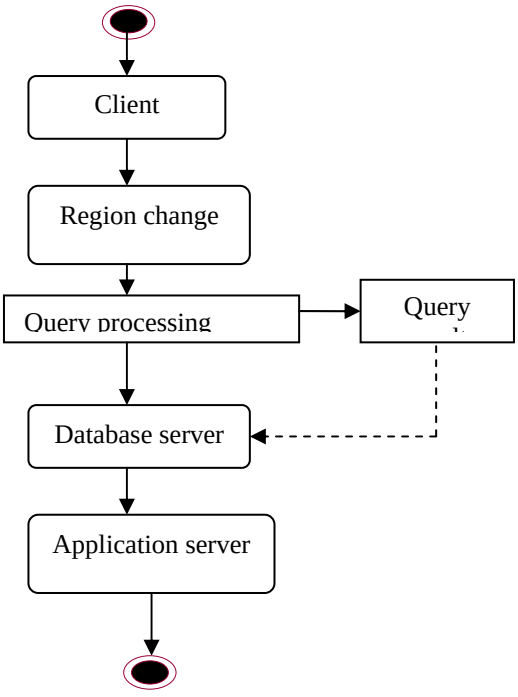

Fig 3. Workflow diagram for framework

D. Location Updater

The each time a client detects the genuine point location, it is wrapped into a bounding box. Then, the client-side location updater decides whether or not to update that box to the server without any other knowledge about the client locations or moving patterns, upon receiving such a box, the server can only presume that the genuine point location is distributed uniformly in this box

V. EXPERIMENTAL SETUP

We implemented this framework to simulate the proposed work that how a server dynamically monitors the moving objects. We provided automatic refresh option that gets the distance changes of moving objects time to time. Server captures the dynamic changes from the registered objects and displays on the server screen as shown in fig.4. i.e Application Server Monitor.

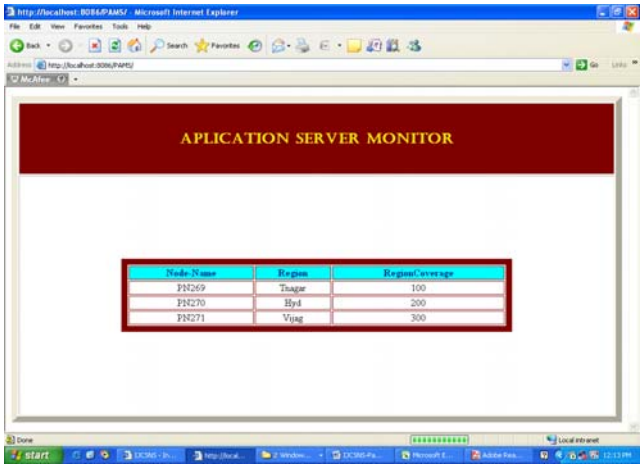

Fig 4. The Application Server Monitors the dynamic changes to the registered objects.

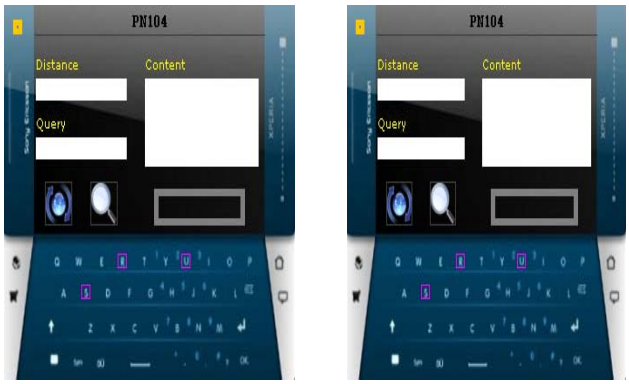

Fig 5. Multiple clients' continuous movement is represented using distance and query through the individual interface to each object.

Above **Fig.** 5. Represents the multiple moving clients that are continuously change their positions over the time. In general this comes under the spatio-temporal objects changes their positions from time to time i.e. periodically with respective to time. Whenever any object changes its location, location update is provided by entering distance as an integer. Base station regions are defined with fixed coverage area. When an object comes to that region it shows the new region by location updates.

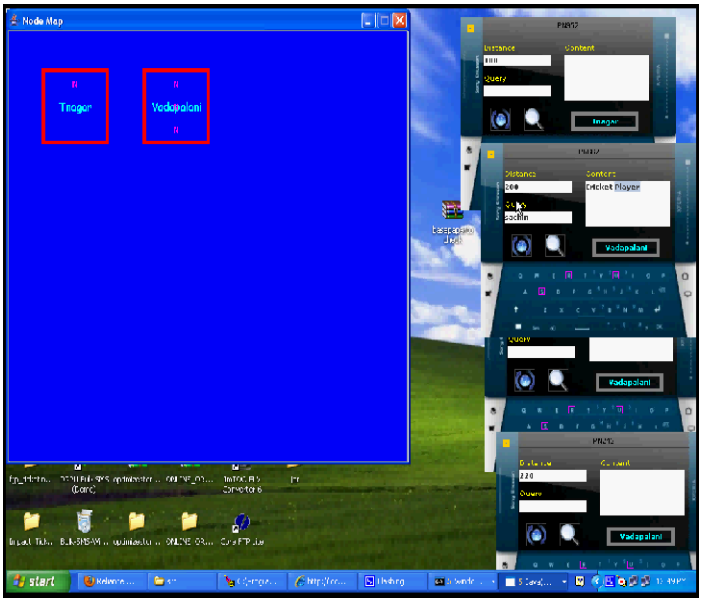

Fig 6. Safe Region Monitoring and query updates

When we enter distance in any clients interface it shows the region in which you belong to. If any query is posted by the clients the relevant answer is given according to the region. When client enter distance that crosses the current region (coverage area) it immediately show the new region. It updates the user queries and replies accordingly as shown in Fig. 6.

VI. RESULT ANALYSIS

With the above experimental setup we simulated the framework. We observe this works good for Dynamic Monitoring of moving objects, Location updates, Even it provides privacy based on the user choice. There are few challenges while we implement this framework. If we allow automatic monitoring of moving objects the clients lose their privacy for this we provided early registration and deregistration.

VII. CONCLUSION AND FUTURE SCOPE

This model focused on Location updates and dynamic monitoring of moving objects. It provides users expected privacy with prior registration and deregistration. Whenever the safe region coverage area is more it gives poor performance. In our future work we planned to address this problem by splitting fixed safe region into sub-regions and extend for more near accurate updates of the location.

VIII. ACKNOWLEDGEMENT

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