LOCATION BASED UML DEVELOPMENT - A UML BASED MODELING FOR USAGE OF LOCATION BASED SERVICES

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ABSTRACT

A new kind of comfort and confidence has been created by location based services in the mind of mobile and internet users by providing automotive help in many areas like tracking, navigation, gaming and information fetching about a specific concern. With the increasing usage of said services, this is irrelevant to say much about the critical role of LBS in various fields. After closely analyzing the present situation related with exploitation of LBS conclusion can be made that anything can be tracked dynamically, rapidly and correctly by the technological background provided by LBS and associated services. With increasing utilization of location related services the duties of service providers has been occurring on its peak with respect to customer satisfaction. Number of approaches and methods are being adopted for providing best services to customers. This paper is providing a modeling approach for vehicle tracking process by using LBS in logistics sector through Unified Modeling Language (UML). By using UML, various sessions and operation of tracking have been modeled. With consideration of running Vehicle Tracking System (J-Track) various reports are analyzed for setting some objectives about future research. An Object Oriented Data Modeling technique is being used to process the data and it is represented with the help of UML- Use-Case diagram, Class Diagram, Sequence diagram, Activity diagram and State diagram.

Keywords: GPS, LBS, Logistics, Navigation, UML, Vehicle Tracking System, etc..

1. INTRODUCTION: ROLE OF LBS IN TRACKING AN OBJECT

A critical role has been played by Location Based Services in vehicle tracking, fuel monitoring, route management and service messaging. Location based services are being offered by different service providers in major extent for facilitating social and business community. Figure 1 is reflecting the working model of LBS.
The first version of LBSs is mostly “finder based services” which show the user’s existence in a close proximity and treat that as a single point of interest. These services are offered by a server controlled by service provider based on self-referenced, single-target, and sporadic pull location access. Privacy in location is provided by a degree of secrecy from many of these systems.

The working of service can be explained by following real life situation. An alert message is sent to subscriber when a vehicle is within certain proximity. The service can be integrated with an Instant Message system which requests the location information of its subscribers from the location server. We are considering the case in which only the vehicle is members of the location information group, i.e., the Instant message server is not a member of the location information group. In this case, the server plays the role of the application server in Figure 2 and requests location information from the location server sporadically. The location server provides the encrypted information to the server, which sends it to the group server to be disseminated to all members of the vehicle list. The end devices of these subscribers decrypt the information, compare it to their own location, and generate an alert locally if a vehicle is within proximity of the device. This demonstration of the service has two considerable characteristics. First, the user has complete control over which vehicles know its location information. Second, the additional service of immediacy discovery is mounted primarily in the end device; the server is simply facilitating the delivery of the information. Now consider another case in which the server is a member of the location information group. In this consideration, server receives the location information from the location server; it will decrypt the information, compare it to the location of the other members of the vehicle list, and execute directed alerts to only those candidates that are within range of each other. This demonstration has some important features. First, the user must trust the server to only passing its location information to approved vehicles. Second, the delivery of message is more efficient, especially for large groups. And third, the server is able to provide extended value to the service without giving burden on the end device [1].
Many kind of location based services are offered in today’s scenario. The service related with navigation provides route for destination like logistics navigation. The directory related service provides the information around the location of user like list of restaurants and traffic jam. The tracking service provides the location of target object like vehicle tracking. For supporting above task location database is created by following prototype as explained in table1. The modeling of vehicle tracking process can be done by using Unified Modeling Language (UML). Nature of database, in LBS related applications is being reflected through table 1.

### Table1: Location Database [5]

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Name</th>
<th>Type of Data</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Register_id</td>
<td>String</td>
<td>ID of Register</td>
</tr>
<tr>
<td>2</td>
<td>Device_id</td>
<td>String</td>
<td>ID of Device</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>Bigint</td>
<td>Positioning Time</td>
</tr>
<tr>
<td>4</td>
<td>LRS</td>
<td>String</td>
<td>LRS is used by positioning Device</td>
</tr>
<tr>
<td>5</td>
<td>Location</td>
<td>String</td>
<td>Location outputted by positioning device</td>
</tr>
<tr>
<td>6</td>
<td>Min_Res</td>
<td>String</td>
<td>Minimum resolution of current entry</td>
</tr>
<tr>
<td>7</td>
<td>Max_Res</td>
<td>String</td>
<td>Maximum resolution of current entry</td>
</tr>
<tr>
<td>8</td>
<td>Latitude</td>
<td>Geometry</td>
<td>Latitude of centre point</td>
</tr>
<tr>
<td>9</td>
<td>Longitude</td>
<td>Geometry</td>
<td>Longitude of centre point</td>
</tr>
</tbody>
</table>

### 2. UML SPECIFICATIONS

UML can be defined as follows: “The Unified Modeling Language (UML) is a graphical language for visualizing, specifying, constructing, and documenting the artifacts of a software-intensive system. The UML offers a standard way to write a system’s blueprints, including conceptual things such as business processes and system functions as well as concrete things such as programming language statements, database schema, and reusable software components” [4]. UML design methodology and notations are used to graphically depict object-oriented analysis and design models. UML is a language for specifying, visualizing and constructing the artifacts of software systems and business modeling. In recent years, the Unified Modeling Language (UML) has emerged as the defacto standard for the representation of software engineering diagrams [6]. The UML class diagram contains classes, interfaces, collaborations, and dependencies, associations and
interface relationships [5]. We are going to create a unified modeling language (UML) structure for data support of LBS by specifying the use cases, related classes, and activities in the application of vehicle tracking.

3. MODELING OF VEHICLE TRACKING SYSTEM

In the current working environment, the competitiveness is emerging in logistics sector; changes are reflected in used technologies and platforms rapidly. Various new things can be observed in logistics sector; hence it is adopting new concepts and technology to improve their business & to win the satisfaction of their customers [8]. The customers and the service providers are driving critical forces which are responsible for the survival of logistics industries in the competitive environment and it broadly depends on delivering quality of services and delivery of quality service in logistics sector is very important and profitable. Vehicle tracking system and UML concepts are going to plays a pivotal role in improving the quality of services in the logistics sector. The various services in logistics sector [9] are RMS (Route Monitoring Services), RTVT (Real Time Vehicle Tracking), FMS (Fuel Monitoring Service), EMS (Emergency Messaging Service, some other real time services. These services use object oriented concepts in location database to return more effective and efficient output [10]. The analysis of the Vehicle Tracking System operations with relational backend is a new idea. This analysis was done using service providers manuals and then by observing view points of clients. We will model Vehicle Tracking System with the object oriented location database model by the use of UML. Information on entities and their attributes and relationships are approached into the Location database management system.

3.1. Use Case Diagram

A use case diagram consists of actors and the use cases. The actors are the direct external user of the system. In other words we can say that it is an object or the set of objects that communicates directly with the system but that is not the part of system. In below figure 3, Use Case Diagram of Vehicle Tracking System, two actors Location based service providers and users. The use case is a piece of functionality that the system can provide by interacting with the actors. The diagram involves a sequence of messages between the use cases and the actors.

![Figure 3: Use Case Diagram of Vehicle Tracking System](image-url)
3.2 Class Diagram

In class diagram, we handle the things that are used in the system. The classes can be related to each other in number of ways, like they can be associated, dependent, specialized or packaged. A system can have a number of class diagrams because not all classes participate in a single class diagram. In figure 4, class diagram involves the User; LBS service provider, tracking, fuel monitoring, route management, speed control, and temperature monitoring and one subclass diagram branch.

![Class Diagram of Vehicle Tracking System](image)

The user creates an account with the service provider and the concerning supervisor who handles all the activities related with tracking account checking like area and category of user, validity conditions for account and if the user is not eligible then inform to the for for not fulfilling the requirement of the account, only eligible user can get the tracking service application form for opening the account with service provider. After getting the application form from the user, the application is checked by the supervisor for completeness, verification of signature, and also the employee confirms the latest address which was filled by the user and the supervisor creates a separate file for each service account having different unique user number. After this the application is approved by the group supervisor. The entry of the applications should be done by using the interface software provided at the office of service provider. The user’s interface handled online through the same software at user`s office. The user’s data should be uploaded and distributed to the online through the same software and stored in the service provider database. The details of the tracking can be viewed via online by entering the user name and Password.

3.3 Sequence diagram

Tells how objects interact with each other i.e. how messages are being send and received between objects. This diagram has two axes: The vertical axis shows time and the horizontal axis shows the objects. Figure 5 presents the sequence diagram for the user’s operations of Tracking System.
As shown above this diagram shows that how an user handle the operations in the Online Tracking system. The sequence diagram shows the complete execution process of operations. The four main objects are represented at the top of diagram. The communications between two objects are shown by an arrow along with communication message. The vertical line shows the life line of the object. The Supervisor will be provided the account opening other relevant services for opening the tracking service account with service provider. Supervisor checks the form to verify the eligibility criteria for opening the account. If the form is complete in all aspects then supervisor sends the form to the service provider office. The SPO issues the Client number and sends the information to the user. The main purpose of this diagram is to reflect the execution user’s operations with tracking system and to check whether it is working properly or not.

3.4. State Diagram

State diagram is used to describe the behavior of a system. State diagrams describe all of the possible states of an object as events occur. Each diagram usually represents objects of a single class and tracks the different states of its objects through the system [11]. In below figure 6, state diagrams show the occurrence of tracking operations.
As shown above, state diagram shows the possible states of user tracking process to perform the operations in the online vehicle tracking system. The customer firstly search the location of service providers office by registering himself with filling the application form of opening an account, and then supervisor checks all the eligibility criteria of opening an account, if the user is eligible, then account is created. Now the user can perform any operation by entering the login id and password. Login id and password verified with the help of online service provider database and start the operations.

4. EXPERIMENTAL ANALYSIS

Experimental analysis has been done by using real time tracking software J-Track. For showing the exact tracking scenario of a vehicle an online Running online vehicle tracking system is used. Our approach is being justified by this analysis practically. J-Track solution for tracking provided the same short of results as framed in our approach. For running this online system Mozilla explorer is used as result extracting interface. The system uses an Intel Core i3 – 330 M Processor with 3 GB DDR3 RAM. Windows 2007 operating system was used. Rational Software Architect (RSA provided by IBM) is used for the designing of UML diagrams. The Following experimental results are shown by the running system J-Track. Figure 7 shows interface of this running S/W solution.

![Figure 7 Interface from one viewpoint of J-Track](image1)

The other prospective of interface provided by J-Track Solution is shown in Figure 8.

![Figure 8 Interface from second viewpoint of J-Track](image2)
4.1 Vehicle Tracking

Task of vehicle tracking through J-Track Solutions is shown in Figure 9. The result is shown in term of vehicle number, updating instance, exact location, nearest attachment point with service provider, current speed, travelled distance and distance covered in current month.

Figure 9 Result of Vehicle Tracking

4.2 Route Management

Route can be managed by using the information being reflecting in Figure 10 with titles vehicle number, Current location, Distance from Proximity and time of reaching on destination point. By using provided information, route of target vehicle can be management.

Figure: 10 Information for Route Management

4.3 Speed Monitoring

Speed of vehicle can also be monitored by accessing current information regarding speed of a target vehicle. By using Alert Messaging Service controlling of the speed may be done. This way speed is being monitored. Process is reflected in Figure 11.
5. CONCLUSION AND FUTURE WORK

From the reflected research works and explanation, we perceived that Location Based Services are having rich past, growing present and prosperous future. Therefore lot of space for research and innovations has been provided by working framework of LBS. In this paper we have discussed how the traditional vehicle tracking system is extended to innovative vehicle tracking system. The presented work can be easily extended by implementing this into a working scenario of tracking. The efficiency of data extraction can also enhanced so that one can easily extract the information in more efficient manner about the user and their service history along with the date of hiring services, date of service renewal. The same work can also be extended for the Cloud Aspect in Tracking, Agriculture yield tracking, Retail Banking and Data Mining.

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