

Critical Analysis of Recent Location Management Methods in Mobile Computing Environment

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ABSTRACT

Location management is a technique, managing various mobile services, mobile devices, predicating their position at time of reference to its base station operation. It helps to keep track of mobile device during agile environment which helps to communicate user while roaming. With location management one can access data at any place by requesting to respective base station. Location management technique changes as per need of the user with reference to the contents such as audio, video, text and graphics.

So, here performance evaluation of various location management methods with their application, advantages and limitations is taken into account. These methods can work very effective and efficient in particular conditions with certain constraints. Speed is main factor which affect the communication.

This paper presents the critical analysis of various methods of location management based on various methodologies for mobile devices. It describes various techniques for location prediction and management. Some of the limitations in earlier techniques are tried to overcome in next subsequent method by another author. This study analyses all these methods with their pro and cons. But still they have some limitation of position prediction and speed of access during location management.

KEYWORDS

MA Mobile Agent, VLR, HLR, MANET, GSM, GPRS.

1. INTRODUCTION :

Mobile communication and computing are becoming a very popular platform for people centric computing. A variety of applications are arisen, in this field which utilize at various places with their location at agile device. Use of emerging technology, is building block of information systems which can be used at any place and at any time through mobile phones and wireless devices through networks[1][2]. Mobile-wireless systems are beneficial for organizations: e.g., productivity improvement processes and procedures flexibility, customer services improvement and information correctness for decision makers, which together stress competitive strategy, lower operation costs and improved business and subscribers processes[1]. As mobile ad hoc networks consist of wireless mobile hosts that communicate with each other, in the absence of a fixed infrastructure. Routes between two hosts in a Mobile Ad hoc Network (MANET) may consist of hops through other hosts in the network connection[6].

With the revolution in mobile technology leads mobile devices including smart phones, PDAs (Personal Digital Assistants) and smart sensors, there is an opportunity to perform significantly useful data analysis tasks in an ad hoc computing environment. This can be realized with the help of several established areas of

study including: (a) data stream mining ; (b) mobile software agents; and (c) embedded programming[1][3]. Mobility management in mobile computing environments covers the methods for storing and updating the location information of mobile users who are served by the system[2].As it includes various task of computation.

A computational task would be initiated by one of these devices firing a number of mobile software agents roaming an ad hoc formed network but for that exact location of a device should be detected.

2. LOCATION MANAGEMENT IN MOBILE COMMUNICATION :

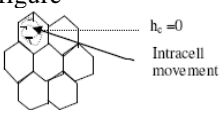
The location management is vital area for working on mobile devices in agile environment. There were various work had been done in last decade, but it still needs work to get fast access and pointing exact location. In recent few years location management in mobile devices fast growing and emerging techniques are there like GSM and GPRS, so various work has been done till now. All the work done on basis of location predication with reference to longitude and latitude. The Home Registration Location or Horizontal Registration Location (HLR) and Vertical Registration Location (VLR) i.e longitude and latitude. These uses logical data to be feed at base station and mined it when it connected with client (Mobile Device). It helps to predict position of device, but it has some limitation. If the device is under the area of base station or cell then we can able to find it position, if device is move to inter cell than linking is needed with intra cell which is discussed below as it also done if cell is nearer cell . To overcome this Markov method is used to predicate location with changing position, in which it refer with earlier position and current position. So, all these various method are analyzed in tabularized format here.

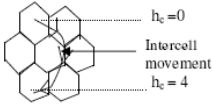
3. ANALYSIS OF LOCATION MANAGEMENT OF MOBILE COMMUNICATION METHODS:

Analysis is done here for various methods used currently for location management in mobile computing. Now a days, various location prediction techniques like GSM, GSP, Cell trajectory, Distance , Gauss-Markova are used for broad casting the signals, signal catching and to predict the location of mobile devices.

As every method considered the two basic components, which are mobile terminal and base stations in the wireless network of a mobile computing. This is used for the convent of communication between mobile agent irr-espct of location and position.

This analysis can be shown very well in following tabular format-

Methods	Author	Year	Technique Used	Parameter Used	Advantages	Limitations
HLR and VLR Broadly Classified	N. Mallikharjuna Rao	2010	First the location is classified in horizontal and vertical location; it can be determine with help of latitude and longitude. As home location registration (HLR) i.e base station and vertical location registration (VLR) i.e mobile device in agile environment. These are discuss as follows	Horizontal Registration Location and Vertical Registration Location value logical are entered in data base at base station	As there are various method are there for locating the mobile device in space or given geographical area . This help agile format to communication is done anywhere.	This Based on longitude and latitude purely. So have limitation in values
Horizontal (Latitude)	N. Mallikharjuna Rao	2010	Horizontal location is find through latitude which can be determine with help of home location registration (HLR) data base at server. It can be mine with mobile miner(MM)	Home registration location or horizontal location at latitude are used with logical calculation with respect to point of initiation.	HLR is base station registered, every mobile device, when it call to another device first time it enters registration in it database registry. It helps next time when enter same base station .	In this method broadly horizontal 366 degree value is used only.
Vertical (Longitude)	N. Mallikharjuna Rao	2010	Vertical location is find through longitude which can be determine with help of mobile device sensor. It registered through vertical location registration (VLR).	Vertical registration location at longitude are used with logical calculation with respect to point of initiation	VLR is used by mobile device to mine its registry if it already present. If mobile miner mines it then it able to call another mobile device.	In this method broadly vertical 360 degree value is used only
Intra Cell	Suparna Biswas	2010	Movement Pattern of mobile host (MH) moves only within a single cell movement pattern is intracell. This can be shown in figure- 	The range of area is given with crossing point of latitude and longitude. which used to predicate position of a device	In this the cell divided on the basis of respective base station as one cell. If it travel within same range than it is intra cell. This keeps continue link as no mining or registration needed for same cell.	The area covered by base station for registry is used as cell with limitation. If device goes out of it doesn't recognized.
Inter Cell	Suparna Biswas	2010	Movement pattern of a mobile host	The range of area is given	If mobile device travel from one	As every base station has

			<p>(MH) moves across cells, movement pattern is intercell. This is shown in figuer</p> 	<p>with cross -ing point of latit-ude and longitude .nearer to each other making number of cell then which used to predicate position of a device when travel.</p>	<p>cell to another or neighbored cell means enter in range of another base station then it is called inter cell traveling of mobile device.</p>	<p>limitation so other adjacent cell or base station are hold next value. But it able to hold only adjacent value only not long distance.</p>
Distance Based	<p>Sini Anna Alex (Distance based with deviation of angular form)</p> <p>Aman Kansal (Distance based with cross point)</p>	<p>2011</p> <p>2007</p>	<p>This strategy graph can be plotted with considering initial point for 'N' number of travelling and we can position it for every i^{th} position[6]. As it is considered here for two dimension, longitude as x-axis and latitude as y-axis. As initial position coordinate is 'X0' and 'Y0' and for i^{th} position coordinate is X_i and Y_i respectively[5][6]. Equation for positioning mobile device can be given as-</p> $\text{Distance}(D_i^{th})=(X_i-X_0)^2+(Y_i-Y_0)^2$	<p>The device some time lies on exact crossing point of latitude and longitude then it exact point distance. If it deviated from it than by angle deviation theorem is used in logical form to calculate distance</p>	<p>As movement of mobile device other than nearer cell , if it travel at long distance cell, suppose at 'k^{th}' position then equation become-Distance(D_k^{th})=$(X_k-X_i)^2+(Y_k-Y_i)^2$</p> <p>This shows general distance determination of any object with respect to origin as base station here taken.</p>	<p>In this angular distance deviation is used by locating 2D with help of Pythagoras theorem on it which gives angular deviation of $90^\circ, 30^\circ, 45^\circ, 60^\circ$, angle only.</p>
Check Point	Parveen Kumar	2010	<p>By checking the position we can predict the possibility of location in a current cell or moved cell. The possibility equation of prediction can be given by Christine Cheng et al in their work as</p> $pS > A + (1-p) F$	<p>Check point is position the device at definite point if it is in cell range . the cell range value is used to locate the device.</p>	<p>In this method exact point of mobile device is tried to determine with help of check point algorithm . This algorithm can work within the same cell very well. But when position change it efficiency decreases.</p>	<p>In this method position of current location and previous location is predicated if device travel from one position to another. If it continuously moving and leave the cell than it is unable to predicate.</p>
Pushed Based Broad Cast	Smriti Pandey	2010	<p>Push Based Approach:- Data broadcasting is done according to predefine user</p>	<p>In this the data is saved at base station when mobile device is access in</p>	<p>Push approach is used by server to push data requested by client whenever</p>	<p>In this method registered location data from a data base is pushed from base station</p>

			profile. This approach does not consider the current client request, it continuously deliver data through information band .	network . This data of location is accessed when it again communicate with base station. Data in pocket form is send.	connected to mobile client.	to client i.e mobile device. If it losses in traveling than unable to predicate exact location.
Pull Based Broadcast	Smriti Pandey	2010	Pull Based Approach:- Data which is broadcasted is server to client as per request by client –server paradigm is cached by client.	In this the data is saved at base station when mobile device is access in network . This data of loca-tion is accessed when it again com-municate with base station. Data in pocket form is accessed	Pull is done by mobile client to server at agile nature.	In this method registered location data from a data base is pulled from base station to client i.e mobile device. If it losses in traveling than unable to predicate exact location.
Gauss Markov Method	Amar Pratap Singh	2012	The 1-D discrete version of the Gauss-Markov mobility model can be described as- $v_n = \alpha v_{n-1} + (1 - \alpha)\mu + \sigma \sqrt{1 - \alpha^2} w_{n-1}$	In this every point is considered with linear line position ning method and pointed ever point of device on that location during agile nature.	The Gauss Markov mobility model uses traveling in given cell and nearer cell.	In this method distance with changing position equation is given but it can predicate only when device is at fixed position not in continuous.
Obfuscation Operators	Claudio A. Ardagna	2011	Obfuscation operator:- Let M be positioning points and be the set of circular areas. An obfuscation operator op:M(0,1)x(0,1) A takes a circular area Mi position and two relevance Values Ri and Rf as input, where Ri is the relevance associated with Mi and Rf < Ri is the final relevance to be satisfied, and produces as output an obfuscated area Mf such that: 1. Mf has relevance Rf ; 2. $M_f \cap M_i \neq \emptyset$.	In this radius of considered circular area is used with relevance correction. As global part is convex so correction needed. Taking each set an than predicating it can done by Obfuscation.	It try to point out perfectly device while considering concentric circles around that device but it can cover only circular point only. If set is in circular form only.	Set of point only placed with circular form only which unable to detect any deviation. The point of location an interaction cannot done in elliptical form.
Snapshot Positionin	Zheng Yao	2010	Snapshot Positioning do its	Snapshot method is used	This method can work at offline	This only work when device is in

g Mode			calculation data offline and only when user request for fixed position value. It uses GNSS global navigation system service is used by snapshot	for mobile device is at fix position it gives exact value for it.	also to predicate the position of mobile devices. This also GNSS method is used for it which is very much beneficial.	fixed position. It receive all tracking information by GNSS but work only when it at fixed position only.
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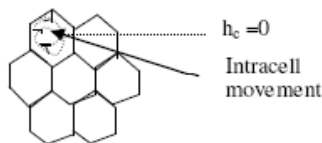
4. PERFORMANCE EVALUATION AND DISCUSSION:

Various methods are studied and analyzed for locating agile devices as well as predicting their location as shown in above table. It has some limitations which need to be analyzed. As every method uses logical location on the basis of longitude and latitude for positioning, but this technique is not sufficient for accurate results [1][2].

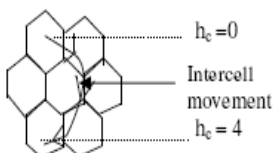
The basic method for this is HLR (horizontal location registration) and VLR (vertical location registration). It is also known as home location registration or HLR and VLR. This method is very efficient for limited area of home location [3], but if range of traveling mobile device increases it is unable to locate the perfect position of mobile devices as it is agile in nature. It is only located, if it is in its degree and its range of latitude and longitude.

The new proposed method tries to remove the drawback of earlier methods by giving the concept of intra-cell and inter-cell methods. In intra-cell and inter-cell methods, every home station has its area range for mobile devices and if it travels within the allotted range, it is in the cell while if other cells are arranged beside it and mobile devices travel to adjacent cells, then that movement is called as inter-cell. But if the agile device goes out of the allotted range for inter as well as intra-cell, then it is unable to connect HLR[6][7]. This is the main limitation of both methods. Logical diagrams for inter-cell and intra-cell are shown here to help clear the idea.

Intra-Cell



Inter-Cell



In the above two methods, a broad area is considered for predicting the location of mobile devices, but the next method overcomes the problem of the earlier one. It locates exact location by the checkpoint method. But in this method, it also uses the cell pattern for pointing devices in a network [7][10]. So, again there is a limitation for moving pattern devices in continuous, as it only indicates position when mobile devices are fixed position for a while.

In the same way, other methods give the communication pattern in which it uses logical data for communication based on pushed and pulled techniques. Logical data are location based, and this data is used to determine location by sending it with a pushed technique effectively from the base station in the form of packets. On the other hand, the pulled technique is used to catch the logical data, i.e., information of mobile devices. This technique uses queries to position logical information of mobile devices. Both techniques are only applicable if logical data registration is available at the base station [11]. Also, during sending packets, if any packet is lost, there will be a tracking error for the mobile device. This is the drawback of this method [12].

The Gauss Markov method, in which the location of the device is tried to be positioned with the moving pattern of devices. But every instance of information should be updated in the database at the base station, only if it is within the cell. Again, field limitation comes to this technique also [7][15]. The obfuscation technique tries to overcome the limitation of the above techniques by giving another concept of searching with already registered mobile agents [16][17].

These are some limitations to all the above studied methods discussed here.

5. CONCLUSION

This paper gives a critical analysis of mobile device management methods with the pros and cons of the current mobile system of location management with respect to its position. As in these methods, only longitude and latitude methods are encountered, which are insufficient for predicting location. The cell gives position, but not an exact one. As exact positioning is a key feature for location management, it also needs to continue predicting the position of a mobile device with distance during roaming from one cell to another cell. This is given by general accessing methods. As well as changing position continuously is also unable to predicate; the location of mobile devices in an agile environment. So, this field needs more research and new techniques of location management in mobile computing. LMD requires future research because current methods are not sufficient enough for predicting accurate positions of mobile devices.

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