Mobile Node Localization in Cellular Networks

N.Rohith kumar, C.Nikitha shree
MCA, Students,
Department of Computer science,
Vasireddy Venkatadari Institute of Technology, Guntur

Abstract

*Location information is the most important component in location based applications. This information is used unresponsive safety and service oriented applications to afford users with services according to their Geolocation.There are numerous approaches to locate mobile nodes in indoor and outdoor environment. In thispaper, we are fascinated in outdoor localization predominantly in cellular networks of mobile nodes and existing a localization method based on cell and user location information. Our localization method isbased on hello message delay that is sending and receiving time and coordinate information of **B**ase**T**ransceiver **S**tation (BTSs). To substantiate our method across cellular network, we implemented andsimulated our method in two scenarios i.e. maintaining database of base stations in centralize and distributed system. Simulation results show the efficiency of our approach and its implementation applicability in telecommunication systems.*

Keywords-*Cellular network, Mobile computing, Location base service, Network algorithm.*

I. INTRODUCTION

Current immense augmentation in wireless networks and associated technologies allows its user to be mobile and still get right of entry to information they need. This wandering freedom with the seamless mobility connecting neighbouring base stations facilitates its users to communicate anywhere. While the user is mobile it is very important for service providers to know the physical position of its users to provide services according to their location. For occurrence with the latest regulation by Federal Communications Commission (FCC) 1, it is required by all network providers to implement the E911 service2 which will help to get the exact physical position of users when the 911 service is requested. Subsequently the physical location data of the user is very imperative input for Location Base Services (LBS). The process of estimating the physical location of a wireless device is called localization. The core of the method lies in getting the location of the mobile device. There have been dissimilar mechanisms to find the location of mobile nodes; though these mechanisms are not good enough to carry the requirements of LBS in technologies like GSM and UMTS. Global Positioning System (GPS) is generally used for the location information to provide services with respect to physical location of user.

There are many mobile devices which are capable of with GPS and they work with networks such as GSM, UMTS etc, though these solutions leads to increase in cost, battery expenditure, etc. And often are not appropriate for urban area. In this paper we provide a resolution without using the GPS system, our solution is based on GSM/3G network and does not necessitate any special hardware. The location information is composed with the existing telecom infrastructure which makes it easier for the network operator to use the same network to establish nodes in network, and for users to use their devices without need any special hardware upgrades. Our come near of node localization is based on hello message delay and coordinate information of BTSs, and consequently locates the node location across the cellular network. We have hardened our approach in two scenarios i.e. federal and disseminated databases on each BTS and BSS. The rest of the paper is organized as follows. The next section briefly summarizes the state of the art focus on localization in cellular networks. Section 3 presents our localization advance in both scenarios along with respective algorithms.

II. RELATED WORK

Several models and methods have been accessible for location-based services systems in cellular indoor and outdoor networks. In this segment, we review some deterrent work that addresses localization in dissimilar cellular networks and associated technologies present in the domain. Sinha and Das accessible a

localization method where mobile node in a cellular network sends a special distress signal to casing base station which computes the localization coordinates of mobile node with the help of adjacent base station and exhaustive road map. Kiran and contemporaries proposed a localization system that finds the mobile node within a cell based on the cell-id, signal strength and hello packet delay. The estimated location of mobile node is found by using the signal strength which is received by the neighbour-receivers. Andreas Hartl in offered a lightweight solution that communicates the cell information to web services.

This solution is provider-independent and easily extensible. Authors in determined on the localization problem in out of reporting and non GPS equipped devices in UMTS networks and proposed to use a cooperative localization means based on ETSI/3GPP LCS architecture that enable devices to estimate their position by performing power measurements on signals emit by mobile phones with satellite navigation receivers and known-position. Comparable efforts have been presented where authors proposed to exploit additional information obtained from short-range links and later combine the time difference of arrival (TDOA) and received signal strength (RSS) in their simulation using advanced data mixture techniques for node localization. In a different effort, authors extended the Kalman Filter to merge the time distinction of arrival and the received signal strength retrieved from the long and short range. Authors in obtainable a lookup table correlation system that applies multiple positioning and locating technique to be used with advance proliferation model in conjunction with Kalman projecting filtering for node localization. Authors in accessible a zero-length technique based on received signal strength to work out node localization. This allows a less comprehensive path loss model to use without significant impact to the location estimation. For a comprehensive reading about localization techniques readers.

III. PROPOSED LOCALIZATION MECHANISM

To discover the exact location of the mobile node in cellular network, our move towards relies on time of sending and response of 'hello' messages, and also requires to maintain the database for all BTS. The major idea is that the Mobile Node (MN) sends a query to nearest BTS for location, that servicing BTS generate a hello message to the MN and MN respond to the BTS. As the same time servicing base posting also communicates to national BTS for MN location, on the basis of control messages exchange and time differentiation of sending and receiving these messages, the MN location is considered. For this purpose we design an algorithm that finds exact position of mobile node in a cellular network which is hardened and validated with two scenarios i.e. distributed and centralized databases on base stations. In the next sections, we portray our method for both scenarios. Our solution is based on the following assumptions.

1. We require to maintain a database on:
   - Each BTS about the location of base station
   - Each BSC about the location of all base stations present in BSS
2. Channels are kept reserved at each base station for lookup services
3. The mobile remains stationary during the whole process

A. Distributed Data Base Approach (DDBA)

In the first approach we believe a cellular network where cells are subjective shaped and need to preserve a data base on each base posting about its adjoining base stations. The data base contains the coordinates of the adjacent base stations. The statistics of base stations are fewer; in case of hexagonal shape it will be maximum six. The portion base station is known as the master base station. The mobile node sends a demand for lookup services to nearest base station. The corresponding base station receives the request and tracks the mobile node *M* by distribution a message and mobile node M acknowledges to equivalent BTS. Then the Euclidean distance between master base station and mobile node is considered using equation. Then Master base station sends messages to two neighbouring base stations known as slave base stations. The slave base stations locate the mobile node and recognize to master base station.

The master base station BTS calculate the coordinates of the mobile node and the end result is sent to the BSC where lookup military are implemented. The system flow chart illustrate announcement between BTS, mobile node and BSC and messages used for

communication is shown in Figure 1. The communication sequence between Master BTS and M is shown in Figure 2, and the communication sequence between Master BTS, Slave BTS and M is shown in Figure 3.

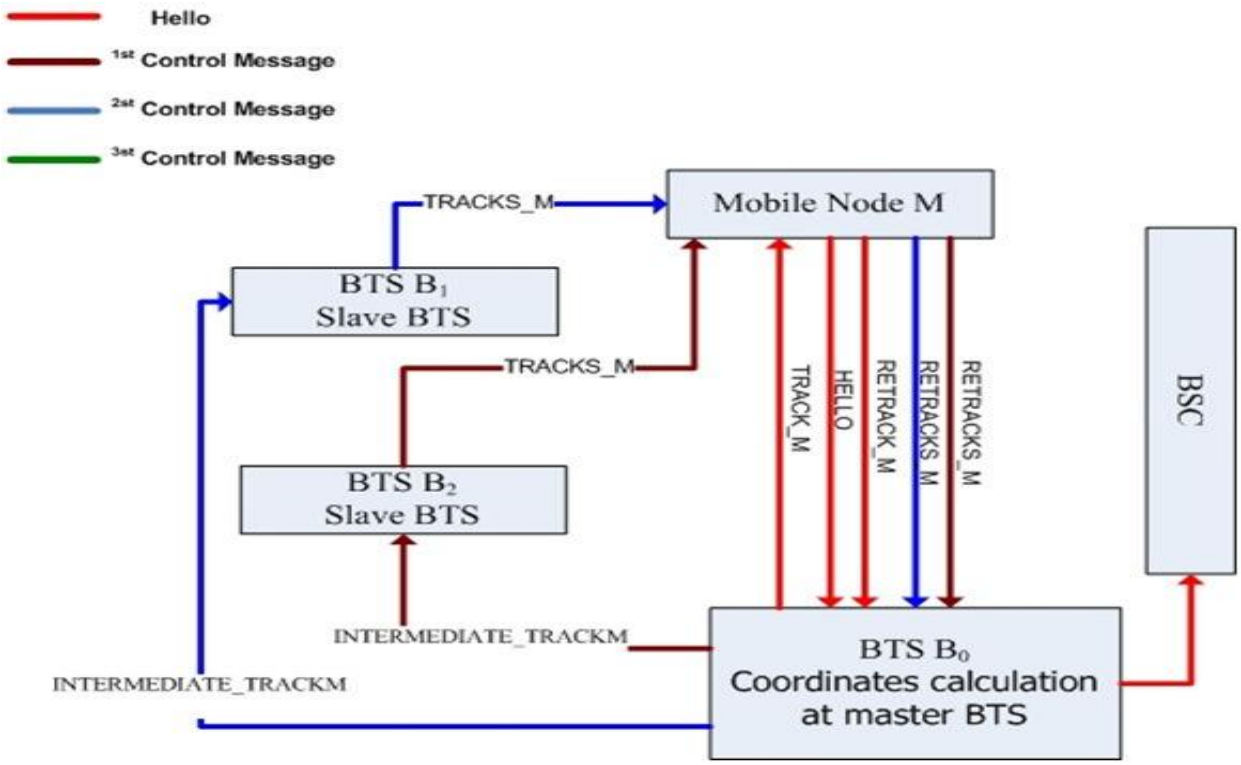

Figure 1.System Diagram of DDBA

B. Centralized Data Base Approach (Cdba)

In the Centralized Data Base Approach (CDBA) approach, we have the same cell surroundings as in DDBA though, in this scenario, we require to maintain a data base only on BSC about the coordinates of base stations. The mobile node sends a demand for lookup services (hello packet) to nearest base station. The analogous base station receives the request and forwards the request to the BSC, which track the mobile node *M* through servicing BTS by conveyance a message and mobile node *M* acknowledges to BSC. Then the distance between BSC and mobile node is calculated using the same equations as in DDBA approach. BSC sends messages to two bordering base stations known as slave base stations. The slave base stations locate the mobile node and acknowledge to BSC. The BTS compute the coordinate of the mobile node where lookup services are implemented. The system diagram illustrating communication between BTS, mobile node and BSC and messages used for communication is shown in Figure 2.

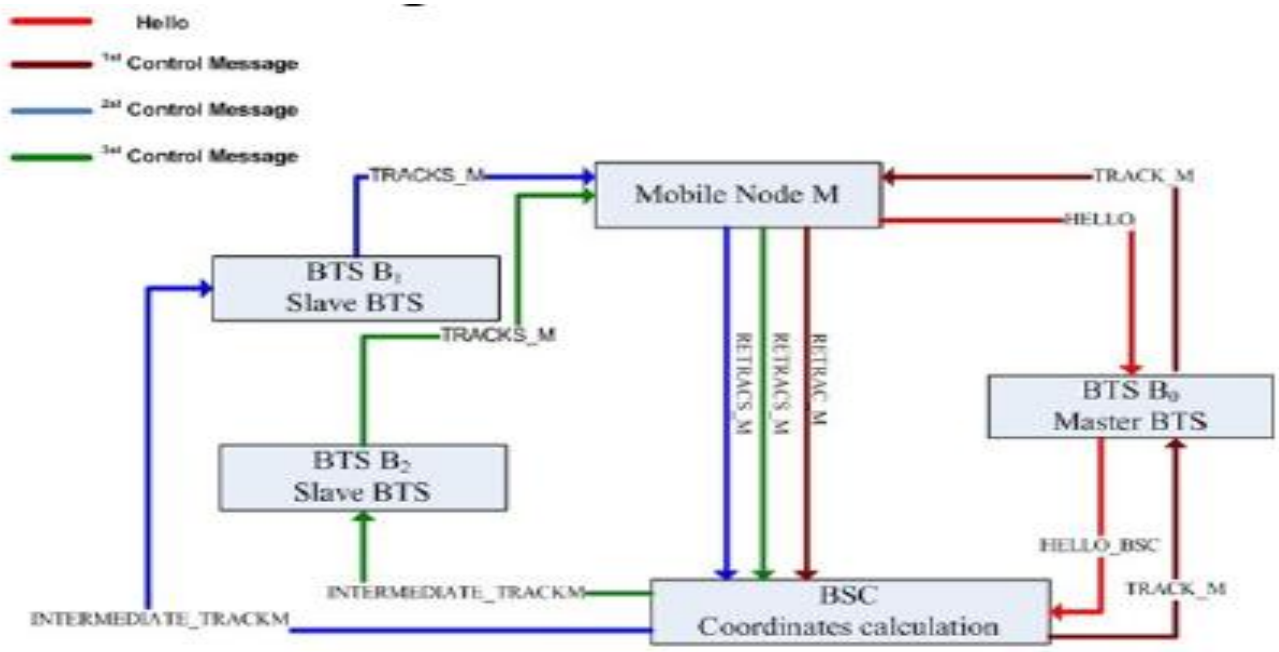

Figure 2. System Diagram of CDBA

IV. SIMULATION RESULTS

To authenticate the performance of proposed localization method, we implement the algorithm in NS-23. There are three base stations and mobile nodes. Mobile nodes begin the request for services they need in their environs. There are three control letters in both scenarios, and nine communication messages in DDBA and eleven in CDBA. The difficulty of localization algorithm is calculated with the sum of hello packet initialization and the node coldness calculation from nearest BTS. Suppose our mobile node *M1* is in the BSC whose ID is 111. *M1* establish a connection to base station BTS1 by sending a hello packet, this base station is named BTS1 (coordinates (1, 2)). When BTS1 communicates with its two nearest base stations named BTS2 (coordinates (4, 6)) and BTS3 (coordinates (9, 8)), for the mobile node's location. BTS1 sends all data to ID 111, which replies with the mobile node's coordinates (for this example M1 (coordinates (0.922827, 7.43964)) and distance of the mobile node (e.g. 5.129 km). The ordinary system time spent on localization of ten mobile nodes is 26.8 seconds as illustrate. The CDBA approach reduces the cost of database maintenance at each base station with little delay and two supplementary communication messages.

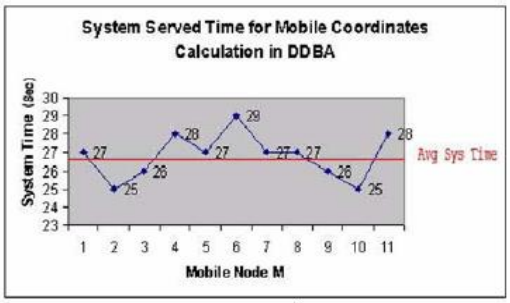

Fig 3.Distributed Data Base Approach (DDBA)

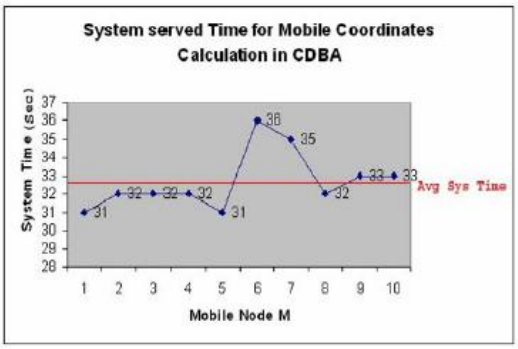

Fig 4.Centralized Data Base Approach (CDBA)

V. CONCLUSION

Location base services (LBS) are residential using the information specific to a location. With the enormous increase in the use of mobile phones, it would be a genuine advantage for a cellular company to supply LBS to their consumers. This has become the hottest issue today and many mobile companies are trying to find diverse ways to implement LBS in GSM network. To provide LBS, it is imperative

to find the exact location of mobile node in cellular network. In this paper us accessible the localization methods and simulated the in two scenarios. . Our move towards of node localization is based on hello message delay coordinates information of BTSs, and hence locates the node location across the cellular network.

The technique is evaluated in two poles apart scenarios. In the first scenario (DDBA) where the coordinates of bordering BTS of serving BTS are maintained on each BTS, while in the second scenario, the centralized data base approach (CDBA), the coordinates of all BTS are maintain in each BSC. The shows potential benefit of this approach is that user doesn't have to carry special devices; there is not special hardware upgrade for the service providers.

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