ISSN: 2277-3754
ISO 9001:2008 Certified
International Journal of Engineering and Innovative Technology (IJEIT)
Volume 3, Issue 2, August 2013

Tracking in Wireless Networks Depending On Available Network Information and Resources

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***Abstract*— Recently, Tracking or localization in wireless networks has gained a lot of interest and the researchers are continuously seeking new methods and techniques aiming at improving the localization accuracy which plays the main role in improving the quality of service as well as providing new services., locating users in a cheap way that depends on the available network resources is becoming more and more interesting and an active topic for researchers.**

In this paper, we focused on tracking vehicles on highway environment depending on the available information provided by the network, such as Received Signal Strength (RSS).

RSS means measuring the strength of signal between Base Station (BS) & Mobile station (MS) and using the Suitable Propagation model (PM) the distance can be measure

***Index Terms*— positioning, propagation models, RSSI, TOA.**

I. INTRODUCTION

Location tracking and positioning systems can be classified by the measurement techniques they employ to determine mobile device location (*localization*). These approaches differ in terms of the specific technique used to sense and measure the position of the mobile device in the target environment under observation.

Different technologies can be used for tracking vehicles on highways. Global Positioning System (GPS) is the most popular way; it provides an accuracy which allows providing LBS with excellent quality of service including navigation and mapping [1]. The main problems with GPS despite that the user's terminal must be GPS enabled are the battery high consumption, the limited coverage and the latency. The battery high consumption means that the user can be positioned during a short period of time. Also GPS performs poorly in urban areas near the high risings and inside tunnels, i.e. it has a poor performance when it is needed the most. And it needs about 4 minutes (cold start) before the first position fix is available [2].

Another way to position a user is to depend on the wireless network itself by using the available information such as RSS, time of arrival (TOA), time difference of arrival (TDOA).

Reference [3], the author present a new methodology by which the RSS technique can provide the optimal system features. The main advantage of the proposed technique is about the accuracy.

Reference [4], the author focus lies on making the available Terminal-based measurements study the possibility of using these measurements in positioning and provide a comparison between these measurements depending on the accuracy achieved and the difficulty to obtain them.

The Received Signal Strength Indication (RSSI) is used to find distance between base station and mobile using outdoor propagation models, where there is no need for TOA [5].

II. POSITIONING TECHNIQUE

Traditionally the MS should lie in the coverage area of at least three BSs in order to determine its location as shown in Fig. 1 Where the coverage of the BS's are represented by a circles centered at the BS. The distance between the MS and the three BSs will be used to solve the following three equations (1):

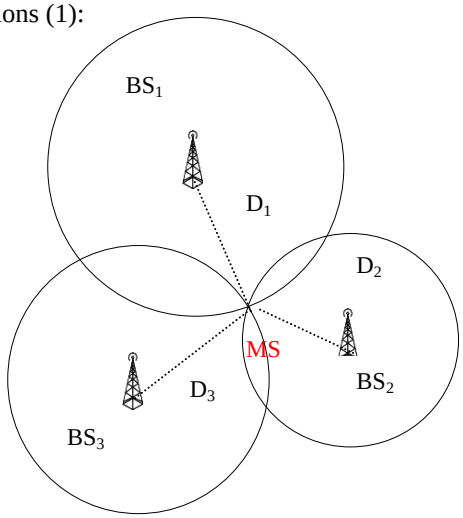

Fig. 1 Three BS's intersect in one point

$$\begin{aligned} \sqrt[2]{(x-x1)2+(y-y1)2} &= d1 \\ \sqrt[2]{(x-x2)2+(y-y2)2} &= d2 \\ \sqrt[2]{(x-x3)2+(y-y3)2} &= d3 \end{aligned} \quad \ldots. (1)$$

Where (x, y) is the mobile's location; (x1,y1), (x2,y2) and (x3,y3) are the coordinates of BS1, BS2 and BS3 respectively. d1, d2 and d3 are the distances from BS1, BS2 and BS3 to the mobile station MS respectively, as shown in Fig. 1, where intersection of three circles represent the location of the MS.

When a vehicle has to be located, the ID number is retrieved from the data base and the central unit sends a message to all MSs in the coverage area. Just one is intended, which will reply and respond to the location request service, then MS will determine the location after measuring the received signal from nearest BS. The MS will choose the highest three signals, and then calculate the distance from MS to each one of the BSs. After calculation, the MS will send the

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location to BS then to the central unit to find location of the vehicle.

III. PROPOSAL

In this paper the proposal discussed in ideal condition which mean no unexpected losses or errors. Suppose we have a highway with or without brunching, the road consists of two sides, these roads extends for a distance of hundreds of kilometers. At any time any place on the road, we need a 3-BS at least to locate the vehicle. Is cost-effective and difficult to implement and maintenance. We propose an algorithm for tracking the vehicles using one BS at a time. Suppose a highway R and one base station BS and a vehicle moving along the road. We need to locate the vehicle at the road as in Fig. 2.

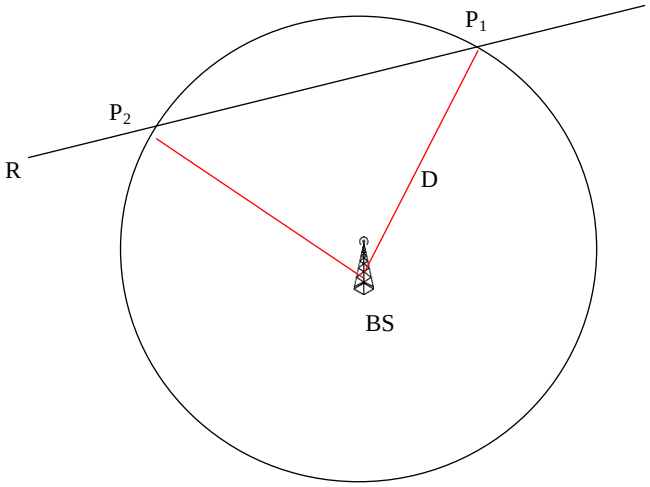

Fig. 2 BS and vehicle moving on high way

Each MS has its one ID number. So, the central unit broadcast the number of the desired MS using the available BS to all MSs in the coverage area. Just one is intended, which will reply and respond to the location request service, then MS will determine the location after measuring the received signal from BS, The MS will choose the highest signals, and then calculate the distance D from MS to the BS. After calculation, the MS will send the distance D and the direction of movement M (each MS can determine its direction by electronic compass and represented by set of bits) to BS then to the central unit to find location of the vehicle.

Actually, direction of the movement M defines which side of the road the vehicle is take. After deciding which side of the road that the vehicle takes, for example from right to left.

It's clear that with a given distance D, circle with radius D and center BS can be draw. This circle intersects with the road in two points P_1 and P_2, so these two points is possible location of the intended MS.

To decide which one of these points is the real location; we must make use of the previous values of D which had been sent from the intended MS, by comparing these values:

D_c: current distance sent from MS

D_p: previous distance sent from MS

If $D_c > D_p$ that mean P_1 is the real location

If $D_c < D_p$ that mean P_2 is the real location

If $D_c = D_p$ try another value of D_p till finding an effective different.

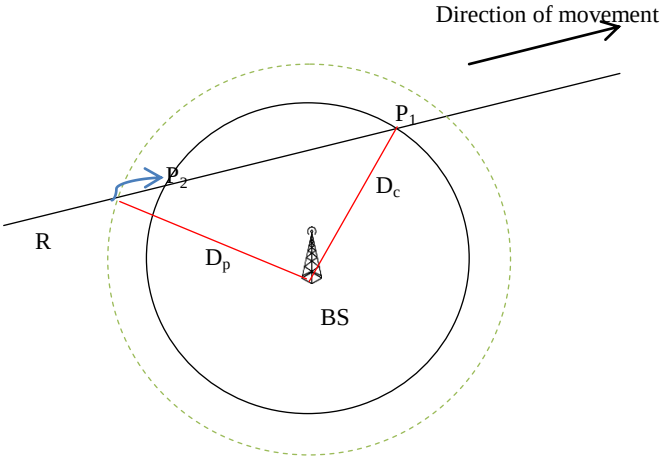

Fig. 3 Describe the case $D_c < D_p$

It's clear in Fig. 3, while the distance D decreases ($D_c < D_p$) gradually the MS entering the coverage of BS. Once the MS is located, tracking becomes is an update operation. Fig. 4 shows the flowchart of the Location finding algorithm.

IV. CONCLUSION AND DISCUSSION

The cost of additional systems and wages for maintenance and operation has become a very important factor to determine the efficiency of the system as a whole. As mentioned above, in highway environment It's very expensive to insurance availability at least 3-BS for any possible position, Assuming extending highways for hundreds of kilometers. Depending on the available resources, one BS can locate the position of MS in its coverage area, in this paper we doesn't discuss the technology used to determine the distances like RSS or TOA …, we discussed the Technique used to determine the possible positions in a specific environment (highway). 20 vehicles per kilometer maximum may possible exist at the road, the Concentration of MS's is very low, existing more than one BS at the same coverage area just for ensure tracking or positioning service represents wasting for money and resources.

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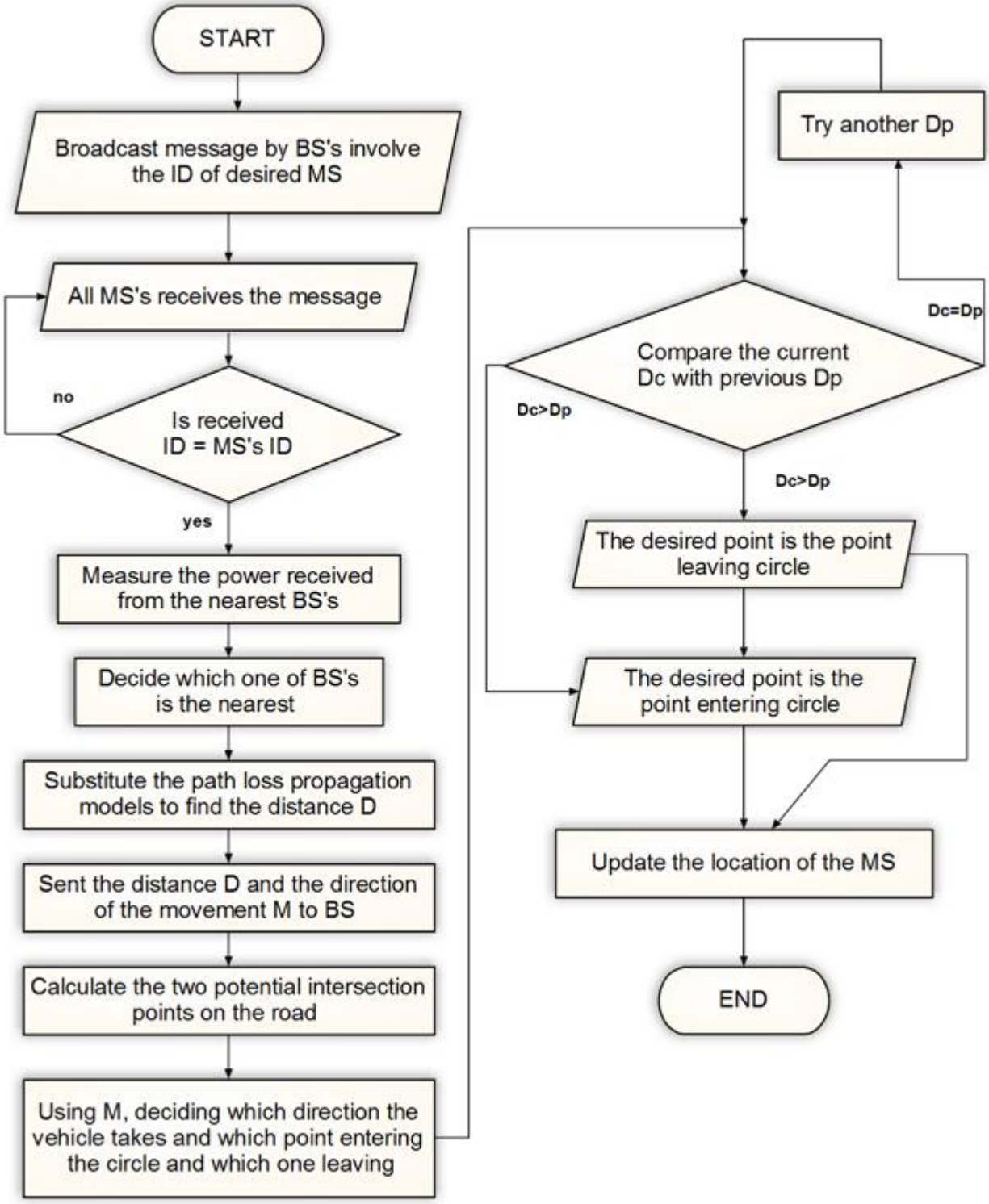

Fig.4 The flowchart of the location finding algorithm