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Abstract

The present paper details a technique for adjusting in a smart manner the position estimates of any user equipment given by different geolocation/positioning methods in a wireless radiofrequency communication network based on different strategies (observed time difference of arrival, angle of arrivals, propagation delay. . .). The main advantage of our proposal is to improve in a remarkable way the accuracy and to mitigate the adverse effect of multipath and other sources of errors that induce to inaccuracy in the terminals position estimates. Accordingly, the estimation of the geographical positions associated to all reported mobile terminals will be remarkable improved independent on the geolocation technique employed. The proposed method will move each position estimate towards a previously calculated area of confidence in a smart manner. This reduced area of confidence is generated to guarantee that the real position of any mobile terminal is inside it with a 95 % of probability of certainty.

Keywords

Confidence radius Certainty
area Multilateration Geolocation UMTS LTE OTDOA Angle of
arrival Propagation delay Timing advance RTD Sufficient statistics

References

1. Ericsson, A. B. *WCDMA access transport network design*. L2T 123 6194 R4A.

2. Technical Specification Group, Radio Access Network. (1999). Liaison statement from ITU-R TG 8/1. CSELT, TSGR#3(99) 189
3. Lin, H., Juang, R., & Lin, D. (2005). Validation of an improved location-based handover algorithm using GSM measurement data. *IEEE Transactions on Mobile Computing*, 4(5), 530–536.
CrossRef (<http://dx.doi.org/10.1109/TMC.2005.70>)
4. Schiller, J., & Voisard, A. (2004). *Location-based services*. Burlington: Morgan Kaufmann.
5. Laitinen, H., Ahonen, S., Kyriazakos, S., Lahteenmaki, J., Menolascino, R., & Parkkila, S. (2001). *Cellular location technology*. CELLO Consortium Tech. Rep., Project IST-2000-25382-CELLO.
https://lyle.smu.edu/rajand/courses/8377/papers/e911_recent
(<https://lyle.smu.edu/rajand/courses/8377/papers/e911%5frecent>). Accessed August 2, 2015.
6. Gustafsson, F., & Gunnarsson, F. (2005). Mobile positioning using wireless networks. *IEEE Signal Processing Magazine*, 22(4), 41–53.
CrossRef (<http://dx.doi.org/10.1109/MSP.2005.1458284>)
7. Roxin, A., Gaber, J., Wack, M., & Nait-Sidi-Moh, A. (2007). *Survey of wireless geolocation techniques*. IEEE Globecom Workshops, pp. 1–9.
8. 3GPP TS 25.305 V3.11.0 (2003-12) Stage 2 functional specification of User Equipment (UE) positioning in UTRAN (Release 1999).
9. Zhao, Y. (2002). Standardization of mobile phone positioning for 3G systems. *IEEE Communications Magazine*, 40(7), 108–116.
CrossRef (<http://dx.doi.org/10.1109/MCOM.2002.1018015>)
10. Kenington, P., Chepstow, M., Randell, N., & Alton, H. (2013). *Method and apparatus for geolocating a wireless communication unit*. European Patent Application EP 2 626 719 A2, August 14, 2013.
11. Dupray, D., Goldberg, S. F., LeBlanc, F. W., & Karr, C. L. (2013). *Locating a mobile station and applications therefor*. U.S. Patent 2013/0288692 A1, March 15, (2013).
12. Karr, C. L., LeBlanc, F. W., Dupray, D. J. (2005). *Locating a mobile station using a plurality of wireless networks and applications therefor*. U.S. Patent US 6,952,181 B2, October 4, 2005.
13. Flanagan, M. J. (2010). *Determining differences between base station timing offset for pairs of base stations in asynchronous networks using location estimates*. Patent WO 2010083943 A1, July 29, 2010.
14. Soma, P., Boyer, P. A., Mia, R. S. (2014). *Time and power based wireless location and method of selecting location estimate solution*. U.S. Patent US 8,718,676 B2, May 6, 2014.
15. Thomson, M., Winterbottom, J. (2012). *Location measurement acquisition adaptive optimization*. U.S. Patent US 8,289,210 B2, October 16, 2012.
16. Weisstein, E. W. (2015). *Student's T distribution*.
<http://mathworld.wolfram.com/Studentst-Distribution.html>. Accessed August 2, 2015.

17. Úbeda, C., Romero, J., & Ramiro, J. (2010). Evaluation of a time-delay based geolocation algorithm in real UMTS networks. In *Fifth international conference on broadband and biomedical communications (IB2Com)*, pp. 1–4.
18. Kallenberg, O. (1997). *Foundations of modern probability*. New York: Springer. **MATH** (<http://www.emis.de/MATH-item?0892.60001>).
19. Standard Normal Distribution Table. <http://www.stat.tamu.edu/lzhou/stat302/standardnormaltable> (<http://www.stat.tamu.edu/lzhou/stat302/standardnormaltable>).
20. 3GPP TS 36.355 V9.0.0 (2013) LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP) (Release 9, 2013).
21. Jurado-Navas, A., García-Fernández, J.A., Fernández-Navarro, M., Úbeda, C. (2014). *Location of terminals in a communications network*. European Patent PCT/EP2014/054875, March 12, 2014.
22. García-Fernández, J. A., Jurado-Navas, A., Fernández-Navarro, M., & Ubeda, C. (2015). Efficient star-topology solving local minima for geolocation in real UMTS networks: An experimental assessment with real data. *Wireless Personal Communications*. [10.1007/s11277-015-2895-z](https://doi.org/10.1007/s11277-015-2895-z) (<http://dx.doi.org/10.1007/s11277-015-2895-z>).
23. García-Fernández, J. A., Jurado-Navas, A., Fernández-Navarro, M., & Úbeda, C. (2015). Experimental assesment of a novel geolocation algorithm base don OTDOA technique in real UMTS networks. *Journal of Automation and Control Engineering*, 3(5), 435–441. **CrossRef** (<http://dx.doi.org/10.12720/joace.3.5.435-441>).
24. García-Fernández, J. A., Jurado-Navas, A., Fernández-Navarro, M., & Úbeda, C. (2015). A comparative study between iterative algorithms for TDOA based geolocation techniques in real UMTS networks. Submitted for publication.

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