

Claims

1. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a method of estimating an expected error of a position estimate of the WLAN-enabled device, the method comprising:
the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access point in range of the WLAN-enabled device, the plurality of WLAN access point having an estimated geographic location; and
estimating an expected error, in terms of distance, of a position estimate that would result if the received signals from the plurality of WLAN access point were used in a position estimation determination based on a spatial spread associated with the estimated geographic location of the plurality of WLAN access point in range of the WLAN enabled device with respect to other WLAN access points, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.
2. The method of claim 1, the estimating the expected error of the position estimate that would result if the received signals from the plurality of WLAN access point were used in a position estimation determination being further based on the estimated geographic location of the plurality of WLAN access point.
3. The method of claim 1, the estimating the expected error of the position estimate being based on spatial spread associated with more than one WLAN access point in range of the WLAN-enabled device with respect to other WLAN access points.
4. The method of claim 1, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, and estimating the expected error that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination.
5. The method of claim 1, further comprising estimating the position of the WLAN-enabled device based on signals received from the plurality of WLAN access point in

range of the WLAN enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

6. The method of claim 1, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

7. The method of claim 1, the WLAN positioning system using public and private WLAN access points that are deployed over a wide area relative to an indoor positioning system.

8. The method of claim 1, the estimating the expected error of the position estimate that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination being based on a weighted average of estimated error based on spatial spread combined with an estimated error determined using another error estimation method.

9. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a method of estimating an expected error of a position estimate of the WLAN-enabled device, the method comprising:

the WLAN-enabled device receiving signals transmitted by at least one WLAN access point in range of the WLAN-enabled device, the at least one WLAN access point having an estimated signal coverage area; and
estimating an expected error, in terms of distance, of a position estimate that would result if the received signals from the at least one WLAN access point were used in a position estimation determination based on the estimated signal coverage area of the at least one WLAN access point in range of the WLAN enabled device, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.

10. The method of claim 9, the estimated signal coverage area for the at least one WLAN access point being estimated based on systematically scanning a target geographical area and recording received signal strength samples at known geographic locations.

11. The method of claim 10, the estimated signal coverage area being based on a subset of the received strength samples recorded at known geographic locations.
12. The method of claim 11, further comprising determining members of the subset based on a value of the received strength sample.
13. The method of claim 12, the members of the subset including only those received strength samples having a value above a predetermined threshold value.
14. The method of claim 11, the estimated signal coverage area being based on statistics associated with the subset of the received strength samples recorded at known geographic locations.
15. The method of claim 9, the estimated signal coverage area for the at least one WLAN access point being estimated based on a power profile associated with the at least one WLAN access point, the power profile representing a power value of a signal from the at least one WLAN access point at various geographic locations.
16. The method of claim 9, the estimating the expected error of the position estimate being based on characteristics from more than one WLAN access point in range of the WLAN-enabled device.
17. The method of claim 9, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, , and estimating the expected error that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination.
18. The method of claim 9, further comprising estimating the position of the WLAN-enabled device based on signals received from the at least one WLAN access point in range of the WLAN enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

19. The method of claim 9, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

20. The method of claim 9, the WLAN positioning system using public and private WLAN access points that are deployed over a wide area relative to an indoor positioning system.

21. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a system for estimating an expected error of a position estimate of the WLAN-enabled device, the system for estimating the expected error comprising:

signal receiving logic for causing the WLAN-enabled device to receive signals transmitted by a plurality of WLAN access point in range of the WLAN-enabled device, the plurality of WLAN access point having an estimated geographic location; and

error estimating logic for estimating an expected error, in terms of distance, of a position estimate that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination based on a spatial spread associated with the estimated geographic location of the plurality of WLAN access point in range of the WLAN enabled device with respect to other WLAN access points, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.

22. The system of claim 21, the estimating the expected error of the position estimate that would result if the received signals from the plurality of WLAN access point were used in a position estimation determination being further based on the estimated geographic location of the plurality of WLAN access point.

23. The system of claim 21, the estimating the expected error of the position estimate being based on expected errors associated with more than one WLAN access point in range of the WLAN-enabled device.

24. The system of claim 21, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, , and estimating the expected error that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination.

25. The system of claim 21, further comprising position estimating logic for estimating the position of the WLAN-enabled device based on signals received from the plurality of WLAN access point in range of the WLAN enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

26. The system of claim 21, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

27. The system of claim 21, the WLAN positioning system using public and private WLAN access points that are deployed over a wide area relative to an indoor positioning system.

28. The system of claim 21, the estimating the expected error of the position estimate that would result if the received signals from the plurality of WLAN access point were used in a position estimation determination being based on a weighted average of estimated error based on spatial spread combined with an estimated error determined using another error estimation method.

29. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a system for estimating an expected error of a position estimate of the WLAN-enabled device, the system for estimating the expected error comprising:

signal receiving logic for causing the WLAN-enabled device to receive signals transmitted by at least one WLAN access point in range of the WLAN-enabled device, the at least one WLAN access point having an estimated signal coverage area; and

error estimating logic for estimating an expected error, in terms of distance, of a position estimate that would result if the received signals from the at least one WLAN access point were used in a position estimation determination based on the estimated signal coverage area of the at least one WLAN access point in range of the WLAN enabled device, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.

30. The system of claim 29, the estimated signal coverage area for the at least one WLAN access point being estimated based on systematically scanning a target geographical area and recording received signal strength samples at known geographic locations.

31. The system of claim 29, the estimated signal coverage area being based on a subset of the received strength samples recorded at known geographic locations.

32. The system of claim 31, further comprising logic for determining members of the subset based on a value of the received strength sample.

33. The system of claim 32, the members of the subset including only those received strength samples having a value above a predetermined threshold value.

34. The system of claim 31, the estimated signal coverage area being based on statistics associated with the subset of the received strength samples recorded at known geographic locations.

35. The system of claim 29, the estimated signal coverage area for the at least one WLAN access point being estimated based on a power profile associated with the at least one WLAN access point, the power profile representing a power value of a signal from the at least one WLAN access point at various geographic locations.

36. The system of claim 29, the estimating the expected error of the position estimate being based on characteristics from more than one WLAN access point in range of the WLAN- enabled device.

37. The system of claim 29, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, , and estimating the expected error that would result if the received signals from the plurality of WLAN access points were used in a position estimation determination.

38. The system of claim 29, further comprising position estimating logic for estimating the position of the WLAN-enabled device based on signals received from the at least one WLAN access point in range of the WLAN enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

39. The system of claim 29, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

40. The system of claim 29, the WLAN positioning system using public and private WLAN access points that are deployed over a wide area relative to an indoor positioning system.

What is Claimed is:

1. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a method of estimating an expected error of a position estimate of the WLAN-enabled device, the method comprising:

the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, the plurality of WLAN access points having an estimated geographic location;

estimating a position of the WLAN-enabled device based on the signals;

estimating an expected error, in terms of distance, of the position estimate based on a spatial spread associated with the estimated geographic location of the plurality of WLAN access points in range of the WLAN enabled device, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate; and

based on the expected error, weighting the position estimate when combined with one or more other position estimates or excluding the position estimate from use with one or more other position estimates.

2. The method of claim 1, the estimating the expected error of the position estimate being further based on the estimated geographic locations of the plurality of WLAN access points.

3. The method of claim 1, further comprising using the position estimate of the WLAN-enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

4. The method of claim 1, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.
5. The method of claim 1, the WLAN positioning system using public and private WLAN access points that are deployed over a metropolitan area.
6. The method of claim 1, the estimating the expected error of the position estimate being based on a weighted average of estimated error based on spatial spread combined with an estimated error determined using another error estimation method.
7. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a method of estimating an expected error of a position estimate of the WLAN-enabled device, the method comprising:
 - the WLAN-enabled device receiving signals transmitted by at least one WLAN access point in range of the WLAN-enabled device, the at least one WLAN access point having an estimated signal coverage area;
 - estimating a position of the WLAN-enabled device based on the signals;
 - estimating an expected error, in terms of distance, of the position estimate based on the estimated signal coverage area of the at least one WLAN access point in range of the WLAN enabled device, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate; and
 - based on the expected error, weighting the position estimate when combined with one or more other position estimates or excluding the position estimate from use with one or more other position estimates.
8. The method of claim 7, the estimated signal coverage area for the at least one WLAN access point being estimated based on systematically scanning a target geographical area and recording received signal strength samples at known geographic locations.

9. The method of claim 8, the estimated signal coverage area being based on a subset of the received strength samples recorded at known geographic locations.
10. The method of claim 9, further comprising determining members of the subset based on a value of the received strength sample.
11. The method of claim 10, the members of the subset including only those received strength samples having a value above a predetermined threshold value.
12. The method of claim 9, the estimated signal coverage area being based on statistics associated with the subset of the received strength samples recorded at known geographic locations.
13. The method of claim 7, the estimated signal coverage area for the at least one WLAN access point being estimated based on a power profile associated with the at least one WLAN access point, the power profile representing a power value of a signal from the at least one WLAN access point at various geographic locations.
14. The method of claim 7, the estimating the expected error of the position estimate being based on characteristics from more than one WLAN access point in range of the WLAN-enabled device.
15. The method of claim 7, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, and estimating the expected error from using the received signals from the plurality of WLAN access points in a position estimation determination.
16. The method of claim 7, further comprising using the position estimate of the

WLAN-enabled device only if the expected error of the position estimate is lower than a predetermined threshold.

17. The method of claim 7, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

18. The method of claim 7, the WLAN positioning system using public and private WLAN access points that are deployed over a metropolitan area.

19. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a system for estimating an expected error of a position estimate of the WLAN-enabled device, the system for estimating the expected error comprising:

signal receiving logic for causing the WLAN-enabled device to receive signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, the plurality of WLAN access point having an estimated geographic location;

position estimating logic for estimating a position of the WLAN-enabled device based on the signals; and

error estimating logic for estimating an expected error, in terms of distance, of the position estimate based on a spatial spread associated with the estimated geographic locations of the plurality of WLAN access points in range of the WLAN enabled device, and to cause the position estimate to be weighted when combined with one or more other position estimates or excluded from use with one or more other position estimates, based on the expected error, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.

20. The system of claim 19, the estimating the expected error of the position estimate being further based on the estimated geographic location of the plurality of WLAN access points.

21. The system of claim 19, further comprising the position estimating logic to cause the position estimate of the WLAN-enabled device to be used only if the expected error of the position estimate is lower than a predetermined threshold.

22. The system of claim 19, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

23. The system of claim 19, the WLAN positioning system using public and private WLAN access points that are deployed over a metropolitan area.

24. The system of claim 19, the estimating the expected error of the position estimate being based on a weighted average of estimated error based on spatial spread combined with an estimated error determined using another error estimation method.

25. In a Wireless Local Area Network (WLAN) positioning system for estimating the position of a WLAN-enabled device, a system for estimating an expected error of a position estimate of the WLAN-enabled device, the system for estimating the expected error comprising:

signal receiving logic for causing the WLAN-enabled device to receive signals transmitted by at least one WLAN access point in range of the WLAN-enabled device, the at least one WLAN access point having an estimated signal coverage area; position estimating logic for estimating a position of the WLAN-enabled device based on the signals; and

error estimating logic for estimating an expected error, in terms of distance, of the position estimate based on the estimated signal coverage area of the at least one WLAN access point in range of the WLAN enabled device, and to cause the position estimate to be weighted when combined with one or more other position estimates or excluded from use with one or more other position estimates, based on the expected

error, wherein the expected error of the position estimate predicts a relative accuracy of the position estimate.

26. The system of claim 25, the estimated signal coverage area for the at least one WLAN access point being estimated based on systematically scanning a target geographical area and recording received signal strength samples at known geographic locations.

27. The system of claim 25, the estimated signal coverage area being based on a subset of the received strength samples recorded at known geographic locations.

28. The system of claim 27, further comprising logic for determining members of the subset based on a value of the received strength sample.

29. The system of claim 28, the members of the subset including only those received strength samples having a value above a predetermined threshold value.

30. The system of claim 27, the estimated signal coverage area being based on statistics associated with the subset of the received strength samples recorded at known geographic locations.

31. The system of claim 25, the estimated signal coverage area for the at least one WLAN access point being estimated based on a power profile associated with the at least one WLAN access point, the power profile representing a power value of a signal from the at least one WLAN access point at various geographic locations.

32. The system of claim 25, the estimating the expected error of the position estimate being based on characteristics from more than one WLAN access point in range of the WLAN-enabled device.

33. The system of claim 25, the WLAN-enabled device receiving signals transmitted by a plurality of WLAN access points in range of the WLAN-enabled device, and estimating the expected error from using the received signals from the plurality of WLAN access points in a position estimation determination.

34. The system of claim 25, further comprising position estimating logic to cause the position of the WLAN-enabled device to be used only if the expected error of the position estimate is lower than a predetermined threshold.

35. The system of claim 25, the WLAN positioning system using public and private WLAN access points for estimating the position of the WLAN-enabled device.

36. The system of claim 25, the WLAN positioning system using public and private WLAN access points that are deployed over a metropolitan area.