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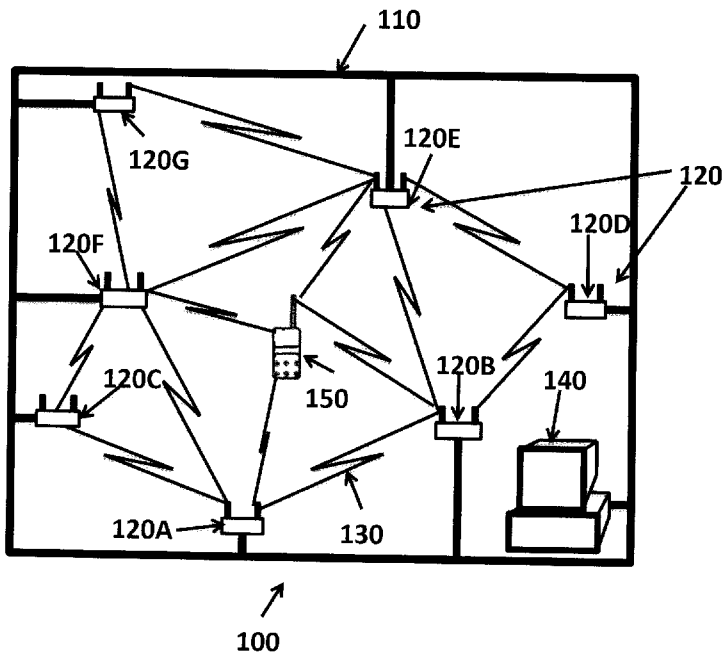
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[Continued on next page]

(54) Title: AN IMPROVED SYSTEM AND METHOD FOR WIRELESS POSITIONING IN WIRELESS NETWORK-ENABLED ENVIRONMENTS

FIGURE 1



(57) Abstract: A system and method for providing wireless positioning and an accuracy measure thereof, using a probabilistic approach alone or in combination with other models, is provided, for wireless-network-enabled areas. Further means of ranking "base-stations" in a wireless network area according to position discrimination significance and using this ranking to provide an accuracy measure of positioning is provided. Further means of determining the locations of "base-stations" of a wireless network in unknown area without the need for any absolute reference based positioning system is provided.

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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AMENDED CLAIMS
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WHAT IS CLAIMED IS:

1. A system that builds an automatic, online, dynamic model for predicting the received signal strength of a signal transmitted by at least one transceiver means at any location within a wireless network area, the system comprising:
    a. At least one transceiver means capable of transmitting a power pattern comprising:
        i. information that identifies the at least one transmitting transceiver means, and information that identifies any other transceiver means in the area and visible by the at least one transmitting transceiver means,
        ii. transmitting power information at which the at least one transmitting transceiver means transmits its signal, and
        iii. received signal strength information of signals transmitted by the any other transceiver means in the area and visible by the at least one transmitting transceiver means, and
    b. At least one processor capable of receiving the power pattern(s) transmitted from the at least one transceiver means and
        i. processing the information that identifies the at least one transceiver means to locate the at least one transceiver means, and
        ii. building the model for predicting the received signal strength of a signal transmitted by the at least one transceiver means at any location within the area.

2. The system of claim 1, wherein the at least one processor is programmed to build one of the following models to predict the signal strength of the at least one transceiver means at any location within the wireless network area:
    a. an online propagation model of the at least one transceiver means, wherein the propagation model relates the received signal strength from the at least

one transceiver means to a distance from the at least one transceiver means,

b. an online power profile of the at least one transceiver means, wherein the power profile relates the received signal strength from the at least one transceiver means to a location in the wireless network area, or

c. a combination of the propagation model and the online power profile of the at least one transceiver means.

3. The system of claim 2, wherein the online models for predicting the signal strength of the at least one transceiver means are built using an adaptive, calibrated best-fit mathematical formula calibrated dynamically online based on the information in the power patterns.

4. The system of claim 2, wherein the online models for predicting the signal strength of the at least one transceiver means are built using an adaptive, calibrated conditional probabilistic approach where the prediction of the signal strength at any distance from the at least one transceiver means or at any location in the wireless network area is modeled as the probability of the signal strength conditioned on, or given, the signal strength information in the power patterns.

5. The system of claim 2, wherein the online models for predicting the signal strength of the at least one transceiver means are built using the combination of an adaptive, calibrated hybrid approach that combines a best fit mathematical model to dynamically estimate a general pattern of the received signal strength and a conditional probabilistic approach to estimate the residual signal strength errors that cannot be modeled using the best fit mathematical model.

6. The system of any one of claims 1 to 5 wherein the online models for predicting the signal strength of the at least one transceiver means undergo online,

automatic, dynamic, and adaptive verification and correction to adapt to any change in the wireless network area.

7. The system of claim 6 wherein the verification and the correction of the models occurs periodically.

8. The system of any one of claims 1 to 7, wherein the at least one processor is further programmed to calculate an accuracy measure of the predicted signal strength.

9. The system of claim 8, wherein the at least one processor is further programmed to calculate the accuracy measure of the predicted signal strength by:
    a. calculating a conditional probability of the signal strength conditioned on, or given, the information in the power patterns,
    b. calculating a variance of the conditional probability, and
    c. converting the variance into an accuracy measure of the predicted received signal strength.

10. The system of any one of the claims 1 to 9 wherein the at least one processor is further programmed to determine the location(s) of the at least one transceiver means using:
    a. a table containing the location(s) of the at least one transceiver means indexed by the information that identifies the at least one transceiver means, or
    b. by encoding the location(s) of the at least one transceiver means in the power patterns transmitted by the at least one transceiver means.

11. The system of any one of claims 1 to 9 wherein the power patterns transmitted by the at least on transceiver means are broadcasted wirelessly or transmitted through a wired network to the at least one processor.

12. The system of any one of claims 1 to 10 wherein the at least one processor is further capable of positioning at least one wireless-enabled device differently from the at least one transceiver means that constitutes the infrastructure of the wireless network, the system comprising:
    a. At least one wireless-enabled device capable of receiving the signal(s) from the at least one transceiver means and producing a power fingerprint output indicative thereof comprising:
        i. information that identifies the at least one transceiver means visible by the at least one wireless-enabled device, and
        ii. received signal strength information about the at least one transceiver means visible by the at least one wireless-enabled device,

    wherein the at least one processor compares the signal strength predicted by the online models with the power fingerprint received from the wireless-enabled device to calculate a position of the wireless-enabled device.

13. The system of claim 11 wherein the online models for predicting the signal strength of the at least one transceiver means at any location within the wireless network comprise:
    a. an online propagation model of the at least one transceiver means, wherein the propagation model relates the received signal strength from the at least one transceiver means to a distance from the at least one transceiver means,
    b. an online power profile of the at least one transceiver means wherein the power profile relates the received signal strength from the at least one transceiver means to a location in the wireless network area, or
    c. a combination of an online propagation model and an online power profile of the at least one transceiver means.

14. The system of claims 11 or 12 wherein the at least one wireless-enabled device receives the position calculated by the at least one processor through one of the following options:
    a. through a wireless communication between the at least one processor and the at least one wireless-enabled device,
    b. through a wired communication between the at least one processor and the at least one wireless-enabled device, or
    c. by embedding the at least one processor inside the at least one wireless-enabled device in a single device.

15. The system of any one of claims 12, 13, or 14, wherein the at least one processor is programmed to dynamically calculate a position of the at least one wireless-enabled device by:
    a. using the online models for predicting signal strength of the at least one transceiver means at any location within the wireless network area and the power fingerprint of the at least one wireless-enabled device to estimate a distance between the wireless enabled device and the at least one known location transceiver means, and
    b. performing a trilateration operation to calculate a position of the at least one wireless-enabled device.

16. The system of any one of claims 12, 13, or 14, wherein the at least one processor is programmed to dynamically calculate a position of the at least one wireless-enabled device by:
    a. using the online models for predicting the signal strength of the at least one transceiver means at any location within the wireless network area and the power fingerprint of the at least one wireless enabled device,
    b. searching for the location at which the predicted signal strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device, and

c. providing this best-matched location as the calculated position of the wireless-enabled device.

17. The system of any one of claims 15 or 16, wherein the at least one processor is programmed to dynamically calculate a position of the at least one wireless-enabled device by using a hybrid positioning technique which combines the trilateration method and the best-matched signal strength method.

18. The system of any one of claims 12 to 17, wherein the at least one processor is further programmed to calculate an accuracy measure of the calculated position of the at least one wireless-enabled device.

19. The system of claim 18, wherein the at least one processor is programmed to calculate an accuracy measure of the calculated position of the wireless-enabled device by:

a. calculating a conditional probability variance of the predicted signal strength that matches the received signal strength contained in the power fingerprint of the at least one wireless-enabled device,
b. converting the variance into a distance accuracy measure using a mathematical formula,
c. forming a covariance matrix of the estimated distances between the at least one wireless-enabled device and the at least one transceiver means, wherein the covariance matrix is a diagonal matrix having diagonal elements containing the calculated distance accuracy measures, and
d. calculating an accuracy measure of the positioning using the trilateration method.

20. The system of claim 18, wherein the at least one processor is programmed to calculate an accuracy measure of the calculated position of the wireless-enabled device by:

a. calculating a conditional probability variance of the predicted signal strength that matches the received signal strength contained in the power fingerprint,
b. converting the variance it into a location accuracy measure,
c. searching for the location at which the predicted signal strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device, and
d. calculating an accuracy measure of the calculated positioning using the calculated accuracy measure of the locations at which the predicted signal strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device.

21. The system of claim 18, wherein the at least one processor is programmed to calculate an accuracy measure of the calculated position of the wireless-enabled device by ranking the at least one transceiver means according to the positioning discrimination significance by:
    a. obtaining a power profile of the at least one transceiver means,
    b. merging all power profiles of all of the at least one transceiver means to construct a radio-map of the area,
    c. applying a principle component analysis to the constructed radio map,
    d. ranking the at least one transceiver means according to the positioning discrimination significance of each, and
    e. using this calculated ranking to calculate an accuracy measure of the calculated position of the wireless-enabled device calculated using the received signals strength from the at least one transceiver means.

22. The system of any one of the claims 1 to 21 wherein the at least one processor is further programmed to calculate the location(s) of the at least one transceiver means.

23. The system of claim 22, wherein the at least one processor is further programmed to calculate the location information about the at least one transceiver means in the wireless network area which is needed to start the online dynamic automatic prediction of signal strength of the at least one transceiver means, the system comprising:

a. the at least one wireless network-enabled device capable of:

i. surveying the area by receiving transmitted signals from the at least one transceiver means at different known locations with respect to any local coordinate system in the wireless network area, the signal comprising identification information of the at least one transceiver means, and

ii. producing a power profile indicative thereof, the power profile output comprising information linking the received signal strength and the known location of the device when the signal is received by the device, and

b. at least one processor further capable of utilizing the power profile output to determine the location of the at least one transceiver means with respect to the any local coordinate system by:

i. determining the location with respect to any local coordinate system of the at least one transceiver means as the location at which the resolution of the received signal strength of the at least one transceiver means is maximum,

ii. re-surveying the area around the determined location having the maximum resolution,

iii. determining the location of the at least one transceiver means as the location at which the received signal strength of the at least one transceiver means is maximum, and

iv. repeating steps b.i to b.ii until accepted location resolution is obtained.

24. The system of claim 23 wherein the location information about the at least one transceiver means in the wireless network area is calculated with respect to an absolute global coordinate system without having any absolute positioning system by:
    a. considering the calculated local-coordinate locations of the at least one transceiver means as initial local-coordinated locations,
    b. converting the initial local-coordinated locations into an absolute positioning coordinate system using a map having estimated initial map border coordinates with respect to the absolute coordinate system,
    c. visually comparing the calculated absolute position and the true visual position of the at least one transceiver means,
    d. changing the initial map border coordinates, and
    e. repeating steps a, b, and c until the calculated absolute position and the true visual position of the at least one transceiver means on a map coincides visually on the map.

25. The system of claim 22, wherein the location information with respect to an absolute positioning system about the at least one transceiver means in the wireless network area for commencing the dynamic online automatic prediction of the signal strength and positioning of the at least one wireless-enabled device is determined, the system comprises:
    a. at least one absolute positioning system accessible only from the borders of the wireless network area, and
    b. the at least one processor is capable of:
        i. calculating the locations of the at least one transceiver means located at the borders of the wireless network area where the absolute positioning system is accessible using the absolute positioning system,

ii. using the calculated locations of the at least one transceiver means located at the borders of the wireless network area to predict the received signal strength of the at least one transceiver means located at the borders of the wireless network area at any location in the wireless network area,

iii. comparing the received signal strength of signals transmitted by the at least one transceiver means located at the borders of the wireless network area and received by the at least one transceiver means located inside the borders of the wireless network area with the predicted signal, and

iv. calculating the position of the at least one transceiver means located inside the borders of the wireless network area using trilateration or signal strength best match positioning methods.

26. The system of any one of claims 1 to 25 wherein the at least one processor is further capable of ranking the at least one transceiver means according to the positioning discrimination significance by:

a. obtaining a power profile of the at least one transceiver means,

b. merging all power profiles of all the at least one transceiver means to construct a radio-map of the area,

c. applying a principle component analysis to the constructed radio map, and

d. ranking the at least one transceiver means according to the positioning discrimination significance of each.

27. The system of claim 26 wherein the ranking of the plurality of transceivers means in the wireless area network is calculated by:

a. obtaining the principle component analysis transformation matrix, wherein the matrix comprises columns and each column has a number of elements equal to the number of the plurality of transceivers means in the wireless area network, and

b. ranking, for each column in the principle component analysis transformation matrix, the plurality of transceivers according to their corresponding absolute numerical values in that column of the principle component analysis transformation matrix.

28. The system of claim 26 or 27 wherein the ranking of the at least one transceiver means is used to calculate an accuracy measure of a position of a wireless-enabled device calculated using received signals strength from the at least one transceiver means.

29. A system for ranking a plurality of transmitting means in a wireless network area according to the positioning discrimination significance of each transmitter in the plurality of transmitting means, the system comprising:
    a. At least one processor capable of:
        i. obtaining a table of received signal strength information at a plurality of different locations in the area,
        ii. applying a principle component analysis to the table of received signal strength information, and
        iii. ranking the plurality of transmitting means according to the positioning discrimination significance of each.

30. The system of claim 29 wherein the ranking of the plurality of transceivers means in the wireless area network is calculated by:
    a. obtaining the principle component analysis transformation matrix, wherein the matrix comprises columns and each column has a number of elements equal to the number of the plurality of transceivers means in the wireless area network, and
    b. ranking, for each column in the principle component analysis transformation matrix, the plurality of transceivers according to their

corresponding absolute numerical values in that column of the principle component analysis transformation matrix.

31. The system of claim 29 or 30, wherein the table of received signal strength information is obtained by an offline manual or automated survey.

32. The system of claim 29 or 30, wherein the table of received signal strength information is obtained by online measurements of signal strength values at different locations in the area.

33. The system of claim 29 or 30, wherein the table of received signal strength information is predicted by an online or offline process using any mathematical or probabilistic approach.

34. The system of claim 29 or 30, wherein the ranking is used to provide an accuracy measure of a position calculated using the plurality of transmitting means.

35. A system for determining the location(s) of at least one transmitting means in a wireless network having no access to an absolute positioning system, the system comprising:
    a. at least one wireless network-enabled device capable of:
        i. surveying the area by receiving transmitted signals from the at least one transmitting means at different known locations with respect to any local coordinate system in the wireless network area, the signal comprising identification information of the at least one transceiver means, and
        ii. producing a power profile indicative thereof, the power profile comprising information linking the received signal strength and the known location of the device when the signal is received by the device, and

b. at least one processor further capable of utilizing the power profile output to determine the location(s) of the at least one transmitting means with respect to the any local coordinate system by:
    i. determining the location with respect to any local coordinate system of the at least one transmitting means as the location at which the received signal strength of the at least one transmitting means is maximum,
    ii. re-surveying the area around the location with higher resolution,
    iii. determining the location of the at least one transmitting means as the location at which the received signal strength of the at least one transmitting means is maximum, and
    iv. repeating steps b.i to b.ii until accepted location resolution is obtained.

36. The system of claim 35 wherein the location information about the at least one transceiver means in the wireless network area is calculated with respect to an absolute global coordinate system without having any absolute positioning system by:
    a. considering the calculated local-coordinate location(s) of the at least one transceiver means as initial local-coordinated location(s),
    b. converting the initial local-coordinated into an absolute positioning coordinate system using a map having estimated border coordinates with respect to the absolute coordinate system,
    c. visually comparing the calculated absolute position and the true visual position of the at least one transceiver means,
    d. changing the initial map border coordinates, and
    e. repeating steps a, b, and c until the calculated absolute position and the true visual position of the at least one transceiver means on a map coincides visually on the map.

37. A system for determining the location(s) of at least one transceiver means in a wireless network having access to an absolute positioning system only on the borders of the wireless network area, the system comprising:
    a. at least one absolute positioning system accessible only from the borders of the wireless network area, and
    b. at least one processor capable of:
        i. calculating the locations of the at least one transceiver means located at the borders of the wireless network area where the absolute positioning system is accessible using the absolute positioning system,
        ii. using the calculated locations of the at least one transceiver means located at the borders of the wireless network area to predict the received signal strength of the at least one transceiver means located at the borders of the wireless network area at any location in the wireless network area,
        iii. comparing the received signal strength of signals transmitted by the at least one transceiver means located at the borders of the wireless network area and received by the at least one transceiver means located inside the borders of the wireless network area with the predicted signal, and
        iv. calculating the position of the at least one transceiver means located inside the borders of the wireless network area using a trilateration and signal strength best match positioning method.

38. A method that builds an automatic, online, dynamic model for predicting the received signal strength of a signal transmitted by at least one transceiver means at any location within a wireless network area, the method comprising:
    a. obtaining an online power pattern from the at least one transceiver means, the power pattern comprises:

i. information that identifies the at least one transmitting transceiver means, and information that identifies any other transceiver means in the area and visible by the at least one transmitting transceiver means,

ii. transmitting power information at which the at least one transmitting transceiver means transmits its signal, and

iii. received signal strength information of signal transmitted by the any other transceiver means in the area and visible by the at least one transmitting transceiver means, and

b. receiving the power pattern(s) transmitted from the at least one transceiver means and,

i. processing the information that identifies the at least one transceiver means to locate the at least one transceiver means, and

ii. building the model for predicting the received signal strength of a signal transmitted by the at least one transceiver means at any location within the area.

39. The method of claim 38, wherein the method further comprises building one of the following models to predict the signal strength of the at least one transceiver means at any location within the wireless network area:

a. an online propagation model of the at least one transceiver means wherein the propagation model relates the received signal strength from the at least one transceiver means to a distance from the at least one transceiver means.

b. an online power profile of the at least one transceiver means wherein the power profile relates the received signal strength from the at least one transceiver means to a location in the wireless network area, or

c. a combination of the propagation model and the online power profile of the at least one transceiver means.

40. The method of claim 39, wherein the online models for predicting the signal strength of the at least one transceiver means are built using an adaptive, calibrated, best-fit mathematical formula calibrated dynamically online based on the information in the power patterns.

41. The method of claim 39, wherein the online models for predicting the signal strength of the at least one transceiver means are built using an adaptive, calibrated conditional probabilistic approach where the prediction of the signal strength at any distance from the at least one transceiver means or at any location in the wireless network area is modeled as the probability of the signal strength conditioned on, or given, the signal strength information in the power patterns.

42. The method of claim 39, wherein the online models for predicting the signal strength of the at least one transceiver means are built using the combination of an adaptive, calibrated hybrid approach that combines a best fit mathematical model to dynamically estimate a general pattern of the received signal strength and a conditional probabilistic approach to estimate the residual signal strength errors that cannot be modeled using the best fit mathematical model.

43. The method of any of claims from 38 to 42, wherein the online models for predicting the signal strength of the at least one transceiver means undergo online, automatic, dynamic, and adaptive verification and correction to adapt to any change in the wireless network area.

44. The method of claim 43, wherein the verification and the correction of the models occurs periodically.

45. The method of any one of claims 37 to 44, wherein the method further comprises calculating an accuracy measure of the predicted signal strength.

46. The method of claim 45, wherein the at least one processor is further programmed to calculate the accuracy measure of the predicted signal strength by:
    a. calculating a conditional probability of the signal strength conditioned on, or given, the information in the power patterns,
    b. calculating a variance of the conditional probability, and
    c. converting the variance into an accuracy measure of the predicted received signal strength.

47. The method of any one of the claims 37 to 46, wherein the at least one processor is further programmed to determine the location(s) of the at least one transceiver means using:
    a. a table containing the location(s) of the at least one transceiver means indexed by the information that identifies the at least one transceiver means, or
    b. by encoding the location(s) of the at least one transceiver means in the power patterns transmitted by the at least one transceiver means.

48. The method of any one of the claims 37 to 47, wherein the power patterns transmitted by the at least on transceiver means are broadcasted wirelessly or transmitted through a wired network to the at least one processor.

49. The method of any one of claims 37 to 48 wherein the method further comprises positioning at least one wireless-enabled device differently from the at least one transceiver means that constitutes the infrastructure of the wireless network, the method comprising:
    a. at least one wireless-enabled device capable of receiving the signal(s) from the at least one transceiver means and producing a power fingerprint output indicative thereof comprising:
        i. information that identifies the at least one transceiver means visible by the at least one wireless-enabled device, and

ii. received signal strength information about the at least one transceiver means visible by the at least one wireless-enabled device,

comparing the signal strength predicted by the online models with the power fingerprint received from the wireless-enabled device to calculate a position of the wireless-enabled device.

50. The method of claim 49, wherein the online models for predicting the signal strength of the at least one transceiver means at any location within the wireless network is one of the following models:
    a. an online propagation model of the at least one transceiver means, wherein the propagation model relates the received signal strength from the at least one transceiver means to a distance from the at least one transceiver means,
    b. an online power profile of the at least one transceiver means wherein the power profile relates the received signal strength from the at least one transceiver means to a location in the wireless network area, or
    a. a combination of an online propagation model and an online power profile of the at least one transceiver means.

51. The method of claim 49 or 50 where the at least one wireless-enabled device receives the calculated position calculated through one of the following options:
    a. through a wireless communication between the at least one processor and the at least one wireless-enabled device,
    b. through a wired communication between the at least one processor and the at least one wireless-enabled device, or
    c. by embedding the at least one processor inside the at least one wireless-enabled device in a single device.

52. The method of any one of claims 49, 50, or 51, wherein the method further comprises dynamically calculating a position of the at least one wireless-enabled device by:
    a. using the online models for predicting signal strength of the at least one transceiver means at any location within the wireless network area and the power fingerprint of the at least one wireless-enabled device to estimate a distance between the wireless enabled device and the at least one known location transceiver means, and
    a. performing a trilateration operation to calculate a position of the at least one wireless-enabled device.

53. The method of any one of claims 49, 50, or 51, wherein the method further comprises dynamically calculating a position of the at least one wireless-enabled device by:
    a. using the online models for predicting the signal strength of the at least one transceiver means at any location within the wireless network area and the power fingerprint of the at least one wireless enabled device,
    b. searching for the location at which the predicted signal strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device, and
    a. providing this best-matched location as the calculated position of the wireless-enabled device.

54. The method of any one of claims 49, 50, or 51, wherein the method further comprises dynamically calculating a position of the at least one wireless-enabled device by using a hybrid positioning technique which combines the trilateration method and the best-matched signal strength method.

55. The method of any one of claims 49 to 54, wherein the method further comprises calculating an accuracy measure of the calculated position of the at least one wireless-enabled device.

56. The method of claim 55, wherein the method further comprises calculating an accuracy measure of the calculated position of the wireless-enabled device by:
    a. calculating a conditional probability variance of the predicted signal strength that matches the received signal strength contained in the power fingerprint of the at least one wireless-enabled device,
    b. converting this variance it into a distance accuracy measure using a mathematical formula,
    c. forming a covariance matrix of the estimated distances between the at least one wireless-enabled device and the at least one transceiver means, this covariance matrix is diagonal matrix where diagonal elements contains the said calculated distance accuracy measures, and
    d. calculating an accuracy measure of the positioning using the trilateration method.

57. The method of claim 55, wherein the method further comprises calculating an accuracy measure of the calculated position of the wireless-enabled device by:
    a. calculating a conditional probability variance of the predicted signal strength that matches the received signal strength contained in the power fingerprint,
    b. converting this variance it into a location accuracy measure,
    c. searching for the location at which the predicted signal strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device, and
    d. calculating an accuracy measure of the calculated positioning using the calculated accuracy measure of the locations at which the predicted signal

strength is best-matched with the signal strength in the power fingerprint of the at least one wireless-enabled device.

58. The method of claim 55, wherein the method further comprises calculating an accuracy measure of the calculated position of the wireless-enabled device by ranking the at least one transceiver means according to the positioning discrimination significance by:
    a. obtaining a power profile of the at least one transceiver means,
    b. merging all power profiles of all the at least one transceiver means to construct a radio-map of the area,
    c. applying a principle component analysis to the constructed radio map,
    d. ranking the at least one transceiver means according to the positioning discrimination significance of each and,
    e. using this calculated ranking to calculate an accuracy measure of the calculated position of the wireless-enabled device calculated using received signals strength from the at least one transceiver means.

59. The method of any one of the claims 37 to 58 wherein the method further comprises calculating the location(s) of the at least one transceiver means.

60. The method of any one of claims 37 to 58 wherein the location information about the at least one transceiver means in the wireless network area which is needed to start the dynamic online automatic prediction of signal strength of the at least one transceiver means is calculated, the method comprises:
    a. the at least one wireless network-enabled device doing the following:
        i. surveying the area by receiving transmitted signals from the at least one transceiver means at different known locations with respect to any local coordinate system in the wireless network area, the signal comprising identification information of the at least one transceiver means, and

ii. producing an power profile indicative thereof, the power profile output comprising information linking the received signal strength and the known location of the device when the signal is received by the device, and

b. utilizing the power profile output to determine the location of the at least one transceiver means with respect to the any local coordinate system by:

i. determining the location with respect to any local coordinate system of the at least one transceiver means as the location at which the received signal strength of the at least one transceiver means is maximum,

ii. re-survey the area around the said determined location with higher resolution,

iii. determining the location of the at least one transceiver means as the location at which the received signal strength of the at least one transceiver means is maximum, and

iv. repeating steps b.i to b.ii as needed until accepted location resolution is obtained.

61. The method of claim 60, wherein the location information about the at least one transceiver means in the wireless network area is calculated with respect to an absolute global coordinate system without having any absolute positioning system by:

a. considering the calculated local-coordinate locations of the at least one transceiver means as initial local-coordinated locations,

b. converting the said initial local-coordinated into an absolute positioning coordinate system using a tool with a map of the area with initial map border coordinates are estimated with respect to the absolute coordinate system,

c. comparing visually on the map the calculated absolute position and the true visual position of the at least one transceiver means,

d. changing the initial map border coordinates, and
e. repeating steps a, b, and c until the calculated absolute position and the true visual position of the at least one transceiver means on a map coincides visually on the map.

62. The method of any one of claims 37 to 58 wherein the location information with respect to an absolute positioning system about the at least one transceiver means in the wireless network area which is needed to start the dynamic online automatic prediction of signal strength and positioning of the at least one wireless-enabled device is determined, the method comprises:
    a. having at least one absolute positioning system accessible only from the borders of the wireless network area,
    b. calculating the locations of the at least one transceiver means located at the borders of the wireless network area where the absolute positioning system is accessible using the absolute positioning system,
    c. using the calculated locations of the at least one transceiver means located at the borders of the wireless network area to predict the received signal strength of the said at least one transceiver means located at the borders of the wireless network area at any location in the wireless network area,
    d. comparing the received signal strength of signals transmitted by the at least one transceiver means located at the borders of the wireless network area and received by the at least one transceiver means located inside the borders of the wireless network area with the predicted signal, and
    e. calculating the position of the at least one transceiver means located inside the borders of the wireless network area using trilateration or signal strength best match positioning methods.

63. The method of any one of claims 37 to 62, wherein the method further comprises ranking the at least one transceiver means according to the positioning discrimination significance by:

a. obtaining a power profile of the at least one transceiver means,
b. merging all power profiles of all the at least one transceiver means to construct a radio-map of the area,
c. applying a principle component analysis to the constructed radio map, and
d. ranking the at least one transceiver means according to the positioning discrimination significance of each.

64. The method of claim 63, wherein the ranking of the plurality of transceivers means in the wireless area network is calculated by:
    a. obtaining the principle component analysis transformation matrix, wherein the matrix comprises columns and each column has a number of elements equal to the number of the plurality of transceivers means in the wireless area network, and
    a. ranking, for each column in the principle component analysis transformation matrix, the plurality of transceivers according to their corresponding absolute numerical values in that column of the principle component analysis transformation matrix.

65. The method of claim 63 or 64, wherein the ranking of the at least one transceiver means is used to calculate an accuracy measure of a position of a wireless-enabled device calculated using received signals strength from the at least one transceiver means.

66. A method for ranking a plurality of transmitting means in a wireless network area according to the positioning discrimination significance of each transmitter in the plurality of transmitting means, the method comprising:
    a. obtaining a table of received signal strength information at a plurality of different locations in the area,
    b. applying a principle component analysis to the table of received signal strength information, and

c. ranking the plurality of transmitting means according to the positioning discrimination significance of each.

67. The method of claim 66, wherein the ranking of the plurality of transceivers means in the wireless area network is calculated by:
    a. obtaining the principle component analysis transformation matrix, wherein the matrix comprises columns and each column has a number of elements equal to the number of the plurality of transceivers means in the wireless area network, and
    b. ranking, for each column in the principle component analysis transformation matrix, the plurality of transceivers according to their corresponding absolute numerical values in that column of the principle component analysis transformation matrix.

68. The method of claim 66 or 67, wherein the table of received signal strength information is obtained by an offline manual or automated survey.

69. The method of claim 66 or 67, wherein the table of received signal strength information is obtained by online measurements of signal strength values at different locations in the area.

70. The method of claim 66 or 67, wherein the table of received signal strength information is predicted by an online or offline process using any mathematical or probabilistic approach.

71. The method of claim 66 or 67, wherein the ranking is used to provide an accuracy measure of a position calculated using the plurality of transmitting means.

72. A method for determining the location(s) of at least one transmitting means in a wireless network having no access to an absolute positioning system, the method comprising:

a. surveying the area by receiving transmitted signals from the at least one transmitting means at different known locations with respect to any local coordinate system in the wireless network area, the signal comprising identification information of the at least one transceiver means,

b. producing a power profile indicative thereof, the power profile comprising information linking the received signal strength and the known location of the device when the signal is received by the device,

c. utilizing the power profile output to determine the location of the at least one transmitting means with respect to the any local coordinate system by:

i. determining the location with respect to any local coordinate system of the at least one transmitting means as the location at which the received signal strength of the at least one transmitting means is maximum,

ii. re-surveying the area around the location with higher resolution and,

iii. determining the location of the at least one transmitting means as the location at which the received signal strength of the at least one transmitting means is maximum, and

iv. repeating steps c.i to c.ii until accepted location resolution is obtained.

73. The method of claim 72, wherein the location information about the at least one transceiver means in the wireless network area is calculated with respect to an absolute global coordinate system without having any absolute positioning system by:

a. considering the calculated local-coordinate location(s) of the at least one transceiver means as initial local-coordinated location(s),
b. converting the initial local-coordinated into an absolute positioning coordinate system using a map having estimated border coordinates with respect to the absolute coordinate system,
c. Comparing visually comparing the calculated absolute position and the true visual position of the at least one transceiver means,
d. changing the initial map border coordinates, and
e. repeating steps a, b, and c until the calculated absolute position and the true visual position of the at least one transceiver means on a map coincides visually on the map.

74. A method for determining the location(s) of at least one transceiver means in a wireless network having access to an absolute positioning system only on the borders of the wireless network area, the method comprising:
    a. having at least one absolute positioning system accessible only from the borders of the wireless network area,
    b. calculating the locations of the at least one transceiver means located at the borders of the wireless network area where the absolute positioning system is accessible using the absolute positioning system,
    c. using the calculated locations of the at least one transceiver means located at the borders of the wireless network area to predict the received signal strength of the at least one transceiver means located at the borders of the wireless network area at any location in the wireless network area,
    d. comparing the received signal strength of signals transmitted by the at least one transceiver means located at the borders of the wireless network area and received by the at least one transceiver means located inside the borders of the wireless network area with the predicted signal, and

e. calculating the position of the at least one transceiver means located inside the borders of the wireless network area using trilateration or signal strength best match positioning methods.