

IPR2024-00153

Patent 8,170,583

Samsung Electronics Co., Ltd., Petitioner
v.
Broadphone LLC, Patent Owner

Patent Owner's Demonstratives

Served January 14, 2025
Presented January 21, 2025

Patent 8,170,583

U.S. Patent 8,170,583 (Ex. 1001)



US008170583B2

(12) United States Patent Shkedi

(10) Patent No.: US 8,170,583 B2
(45) Date of Patent: *May 1, 2012

(54) **SIGNAL COMPARISON-BASED LOCATION DETERMINING METHOD**
(75) Inventor: Roy Shkedi, New York, NY (US)
(73) Assignee: Broadphone, LLC, New York, NY (US)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.
This patent is subject to a terminal disclaimer.

7,057,556 B2 6/2006 Hall
7,305,245 B2 12/2007 Alizadeh-Shabiz
7,403,762 B2 7/2008 Morgan
7,414,988 B2 8/2008 Jones
7,433,694 B2 10/2008 Morgan
7,471,954 B2 12/2008 Brachet
7,474,897 B2 1/2009 Morgan
7,493,127 B2 2/2009 Morgan
7,502,629 B2 3/2009 Morgan
7,515,578 B2 4/2009 Alizadeh-Shabiz
7,551,579 B2 6/2009 Alizadeh-Shabiz
(Continued)

FOREIGN PATENT DOCUMENTS

EP 12419093 9/2002

OTHER PUBLICATIONS

Motorola, Inc., Overview of 2G LCS Technologies and Standards (GPP TSG SA2 LCS Workshop LCS-010019—London, UK, Jan. 11-12, 2001).

(Continued)

(21) Appl. No.: 12/720,362

(22) Filed: Mar. 9, 2010

(65) Prior Publication Data

US 2010/0159951 A1 Jun. 24, 2010

Related U.S. Application Data

(63) Continuation of application No. 11/533,238, filed on Sep. 19, 2006, now Pat. No. 7,706,811.

(51) Int. Cl. H04W 24/00 (2009.01)

(52) U.S. Cl. 455/456.1; 455/404.1; 455/404.2; 455/433; 455/440; 455/457; 370/328; 370/331; 370/332; 370/333; 370/334

(58) Field of Classification Search 455/432.1-442; 455/456.1-456.3
See application file for complete search history.

(56) References Cited

U.S. PATENT DOCUMENTS

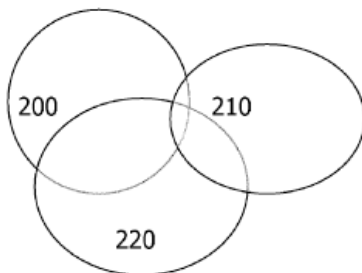
6,674,403 B2 1/2004 Gray
6,972,717 B2 12/2005 Sollenberger
7,050,786 B2 5/2006 Caci

31 Claims, 1 Drawing Sheet

Related U.S. Application Data

(63) Continuation of application No. 11/533,238, filed on Sep. 19, 2006, now Pat. No. 7,706,811.

“The ’583 patent issued from an application filed 9/19/2006, which Petitioner assumes (without conceding such entitlement) is the effective date of the ’583 patent.”



U.S. Patent 8,170,583 (Ex. 1001)



US008170583B2

(12) **United States Patent**
Shkedi

(10) **Patent No.:** **US 8,170,583 B2**
(45) **Date of Patent:** ***May 1, 2012**

(54) **SIGNAL COMPARISON-BASED LOCATION DETERMINING METHOD**

(75) Inventor: **Roy Shkedi**, New York, NY (US)

(73) Assignee: **Broadphone, LLC**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/720,362**

(22) Filed: **Mar. 9, 2010**

(65) **Prior Publication Data**

US 2010/0159951 A1 Jun. 24, 2010

Related U.S. Application Data

(63) Continuation of application No. 11/533,238, filed on Sep. 19, 2006, now Pat. No. 7,706,811.

(51) **Int. Cl.**
H04W 24/00 (2009.01)

(52) **U.S. Cl.** **455/456.1; 455/404.1; 455/404.2; 455/433; 455/440; 455/457; 370/328; 370/331; 370/332; 370/333; 370/334**

(58) **Field of Classification Search** **455/432.1-442; 455/456.1-456.3**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,674,403 B2 1/2004 Gray
6,972,717 B2 12/2005 Sollenberger
7,050,786 B2 5/2006 Caci

7,057,556 B2 6/2006 Hall
7,305,245 B2 12/2007 Alizadeh-Shabiz
7,403,762 B2 7/2008 Morgan
7,414,988 B2 8/2008 Jones
7,433,694 B2 10/2008 Morgan
7,471,954 B2 12/2008 Brachet
7,474,897 B2 1/2009 Morgan
7,493,127 B2 2/2009 Morgan
7,502,620 B2 3/2009 Morgan
7,515,578 B2 4/2009 Alizadeh-Shabiz
7,551,579 B2 6/2009 Alizadeh-Shabiz
(Continued)

FOREIGN PATENT DOCUMENTS

EP 1241993 9/2002

OTHER PUBLICATIONS

Motorola, Inc., Overview of 2G LCS Technologies and Standards (OGPP TSG SA2 LCS Workshop LCS-010019—London, UK, Jan. 11-12, 2001).

(Continued)

Primary Examiner—Dai A Phuong

(74) *Attorney, Agent, or Firm*—Louis J. Hoffman

(57) **ABSTRACT**

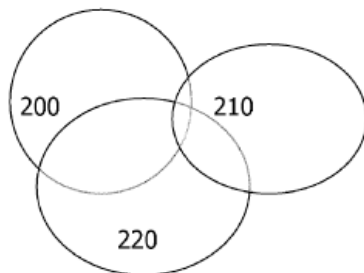
At least one portable RF communications device in conjunction with at least two fixed-location service-area antenna stations respectively capable of RF communication with the at least one device performs the steps of: (I) using a portable device at a selected location to measure RF communications signals from the plurality of local fixed-location service-area antenna stations and electronically storing at least two of the respective reception signal strength measurements; and (II) monitoring a portable device location by causing the device to measure reception signal strength associated with local fixed-location service-area antenna stations signals, and to electronically compare these measurements with the stored at least two measurements.

31 Claims, 1 Drawing Sheet

(57)

ABSTRACT

At least one portable RF communications device in conjunction with at least two fixed-location service-area antenna stations respectively capable of RF communication with the at least one device performs the steps of: (I) using a portable device at a selected location to measure RF communications signals from the plurality of local fixed-location service-area antenna stations and electronically storing at least two of the respective reception signal strength measurements; and (II) monitoring a portable device location by causing the device to measure reception signal strength associated with local fixed-location service-area antenna stations signals, and to electronically compare these measurements with the stored at least two measurements.



Claims 1, 3–5

1. A signal-comparison based location-determining method, **operable by a first portable RF communications device** in conjunction with a plurality of fixed-location service-area antenna stations capable of RF communication with the first portable RF communications device wherein the antenna stations are substantially continuously operating, the method comprising:

(a) **the first portable RF communications device monitoring** its location by (i) **receiving** communications signals from a first plurality of the antenna stations, (ii) **identifying** at least one ID within at least one of the received communications signals, and (iii) **measuring** the signal strengths associated with a received communications signal from the first plurality of antenna stations; and

(b) **the first portable RF communication device determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least

one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, and (ii) **determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

3. The method of claim 1 wherein the chosen location signal strengths were measured by a second portable RF communication device, different from the first portable RF communication device.

4. The method of claim 1 wherein the chosen location signal strengths and at least one ID originated from a database of geographic locations and corresponding signal strengths and IDs.

5. The method of claim 4 **wherein the database is stored remotely**, and not on the first portable RF communication device.

Construction - Claim 1

1. A location-determining method, operable by a first portable RF communications device, the method comprising:

(b) **the first portable RF communication device determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, and (ii) **determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

10 The claim does not require that any
11 particular portion of step B must take place at
12 the first portable RF communication device,
13 correct?

14 MR. CONKLE: Objection. Form.

15 A So the question is that claim 1 does
16 not require that any particular step recited in
17 part B takes place on the mobile device?

18 Q Correct. On the first portable RF
19 communication device --

20 A Well, I think the answer is --

21 Q -- do you agree with that?

22 A No, I don't agree. I think that's
1 wrong.

Petitioner: “There is no language in Claim 1 restricting the entirety of the location determination to actions performed at the claimed first portable RF communication device”

Construction - Claim 1

1. A location-determining method, operable by a first portable RF communications device, the method comprising:

(b) **the first portable RF communication device determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, and (ii) **determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

2 And the reason is that if we look at
3 part B, part B says "the first portable RF
4 communication device determining." So right here,
5 right here is the device is doing the determining.
6 The device determining if a monitored location is
7 within proximity of a location chosen by a user of
8 the first portable RF communication device as a
9 result of. And then, electronically comparing,
10 that's the first step, and then determining if the
11 difference between the signal strengths, and
12 that's another thing.

Construction - Claim 1

1. A location-determining method, operable by a first portable RF communications device, the method comprising:

(b) **the first portable RF communication device determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, and (ii) **determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

13 And so, it seems to me that the first
14 portable RF communication device is doing the
15 determining here. It is determining, and it's
16 determining because the result of first
17 electronically comparing, and then determining if
18 the difference is less than a predetermined
19 threshold.

20 So I think that they are done on the
21 first portable RF communication device.

Proposed Combinations

Ground	Claim(s)	References
1	1-10, 26	<i>Spain-I</i> in view of <i>Hunzinger</i> and <i>Nanda</i>
2	3, 5-6	<i>Spain-I</i> in view of <i>Hunzinger</i> , <i>Nanda</i> , and <i>Damarla</i>
3	7-10	<i>Spain-I</i> in view of <i>Hunzinger</i> , <i>Nanda</i> , and <i>Houri</i>
4	17-20, 24-25	<i>Spain-I</i> in view of <i>Hunzinger</i> , <i>Nanda</i> , and <i>Blomqvist</i>

Petitioner's Theory for *Spain-I*

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,170,583

Spain-I teaches everything done by MU only

“*Spain-I* discloses a mobile unit (MU) that . . . is operable to perform location-determining based on signal characteristic comparison

“At selected location(s), the MU collects/measures identifier information . . . and generates/stores fingerprint(s) based on that information.”

“‘When a location estimate of the MU is desired’ at a current location, the MU captures information from signals . . . and creates a fingerprint.”

“The MU compares the fingerprint information for the monitored location with the stored fingerprint location for selected locations in a database to determine whether it is ‘at a particular location or not.’ . . . the MU determines the MU is in proximity of the matching fingerprint location”

Petitioner's Theory for *Spain-I*

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,170,583

Spain-I teaches everything done by MU only

“*Spain-I*’s MU determines whether it is currently ‘at a particular location or not.’”

“*Spain-I* (including as modified herein) discloses . . . The MU monitors its location by receiving signals

“the MU ‘capture[s]’ predetermined information”

“The MU creates a fingerprint”

Petitioner's Theory for *Spain-I*

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,170,583

Petition admits: Otherwise, the server both maintains the database and performs fingerprint matching

“*Spain-I* discloses configurations where a user can initiate a request that causes ‘the MU [to] capture[] the fingerprint of its current location.’ (Ex-1011, FIG. 3, 6:9-30, 6:43-47; Ex-1005, 6:43-47; Ex-1002, ¶¶118-120.) While such teachings relate to **location server 30 maintaining the fingerprint database and performing fingerprint matching process**, they also suggested to a POSITA that the MU may be configured to receive user requests to measure/collect other fingerprint locations.”

Petitioner's Theory for *Spain-I*

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,170,583

Alternative Embodiment in *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

“*Spain-I* discloses configurations where a user can initiate a request that causes ‘the MU [to] capture[] the fingerprint of its current location.’ (Ex-1011, FIG. 3, 6:9-30, 6:43-47; Ex-1005, 6:43-47; Ex-1002, ¶¶118-120.) While such teachings relate to **location server 30 maintaining the fingerprint database and performing fingerprint matching process**, they also suggested to a POSITA that the MU may be configured to receive user requests to measure/collect other fingerprint locations.”

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

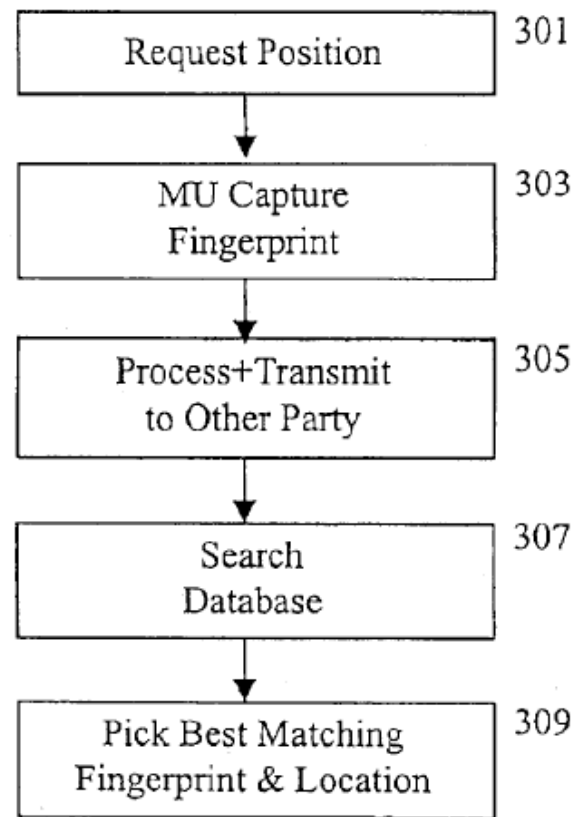
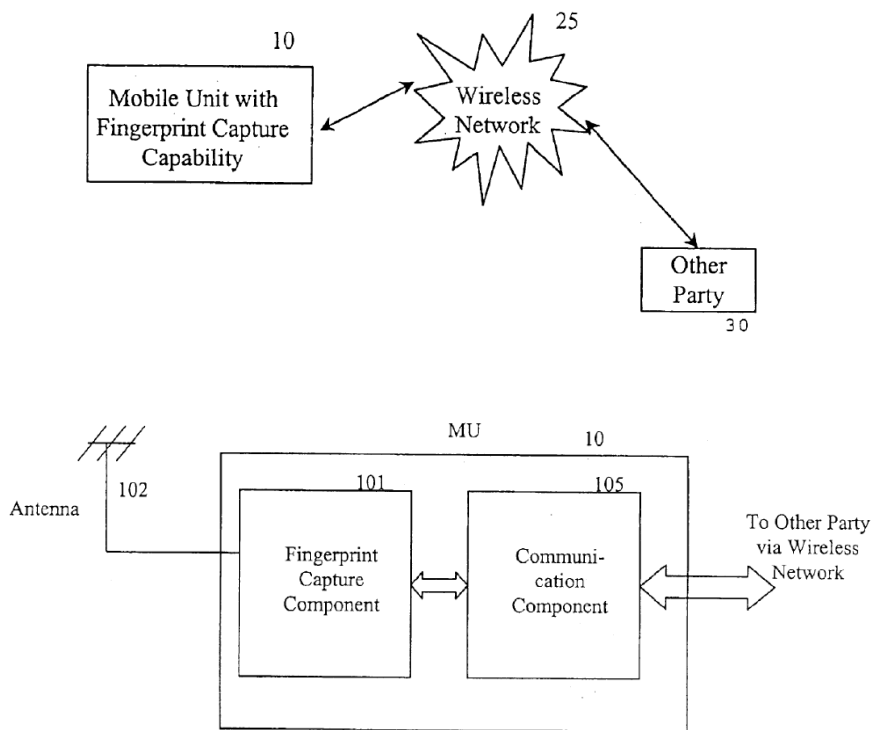


Fig. 2

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

400	Fingerprint Structure					
401	Time of Capture:					
403	Station ID:	I1	I2	I3	...	In
405	Frequency:	F1	F2	F3	...	Fn
407	Tuning Parameters:	P1	P2	P3	...	Pn
409	Transmitter Location:	L1	L2	L3	...	Ln
411	Signal Strength 1:	S11	S12	S13	...	S1n
413	Signal Strength 2:	S21	S22	S23	...	S2n
415	...	...	...	...	...	...
417	Signal Strength m:	Sm1	Sm2	Sm3	...	Smn

Fig. 9

501

Fingerprint Database					
No.	Lat.	Long.	Time	Fingerprint	Description
1					
2					
3					
4					
5					
6					
...					
L					

Fig. 10

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

Once the fingerprint is generated, its association with a certain location has to be determined. According to this invention this is done by utilizing a fingerprint database that contains a number of fingerprints along with their corresponding location identities. In one embodiment the database is stored in the mobile unit. The generated fingerprint is compared with the fingerprints in the database and the fingerprint in the database that is closest to the generated fingerprint is selected as the match. The corresponding location in the database is then chosen as the location of the mobile unit. In one embodiment, the search algorithm takes more than one fingerprint from the database that are closest to the generated fingerprint and interpolates the most plausible location for the mobile unit from the locations of the chosen fingerprints.

Petitioner's Theory for *Spain-I*

(b) **the first portable RF communication device** **determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, **and (ii) determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

Once the fingerprint is generated, its association with a certain location has to be determined. According to this invention this is done by utilizing a fingerprint database that contains a number of fingerprints along with their corresponding location identities. In one embodiment the database is stored in the mobile unit. The generated fingerprint is compared with the fingerprints in the database and the fingerprint in the database that is closest to the generated fingerprint is selected as the match. The corresponding location in the database is then chosen as the location of the mobile unit. In one embodiment, the search algorithm takes more than one fingerprint from the database that are closest to the generated fingerprint and interpolates the most plausible location for the mobile unit from the locations of the chosen fingerprints.

Petitioner's Theory for *Spain-I*

Spain-I discloses configurations where a user can initiate a request that causes ‘the MU [to] capture[] the fingerprint of its current location.’ (Ex-1011, FIG. 3, 6:9-30, 6:43-47; Ex-1005, 6:43-47; Ex-1002, ¶¶118-120.) While such teachings relate to **location server 30 maintaining the fingerprint database and performing fingerprint matching process**

In another embodiment, the fingerprint database is stored at the location server and the generated fingerprint (in the mobile unit) is transmitted to the location server over the wireless link. The search for the closest fingerprint is then done in the location server from which it determines the location of the mobile unit.

Petitioner's Inconsistent Theory for *Spain-I*

In another embodiment, the fingerprint database is stored at the location server and the generated fingerprint (in the mobile unit) is transmitted to the location server over the wireless link. The search for the closest fingerprint is then done in the location server from which it determines the location of the mobile unit.

(b) the first portable RF communication device

determining if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of **(i) electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, **and (ii) determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

Missing Evidence

None of Spain-I, Nanda, Hunzinger, nor Damarla teach the technique of remotely storing a database of locations per claim 5 while locally performing the determining/comparing by the portable RF communication device

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

According to one implementation, the fingerprint database is designed to take into account any dynamic, but predetermined, variations in the RF signal characteristics. For example, it is not uncommon that some AM radio broadcast stations lower their transmitter power at night to minimize interference with other stations. In some countries this is mandated by law. If signal strength is one of the parameters used for generating the fingerprint, then it is essential that the dynamic change in transmitted power be taken into consideration before any decision is made.

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

As the number of possible locations to search increases, the length of time to complete the search also increases. Analogously, as the number of possible locations to search decreases, the length of time to complete the search also decreases. Therefore, the illustrative embodiment seeks to reduce the length of time it takes to complete the search by reducing the number of possible locations that must be searched.

TABLE 1

Database of Possible Locations of Mobile Unit					
Location	Latitude	Longitude	Fingerprint	Possible Serving Cell Site(s)	Possible Neighbor Cell Site(s)
1	47° 10' 23.12" N.	127° 23' 41.73" W.	F ₁	A, B	B, A
...	...	...	...	...	...
60,000	47° 13' 46.33" N.	127° 26' 44.53" W.	F _{60,000}	C	A, C

In accordance with the illustrative example, and as shown in Table 1, the mobile unit is at one of sixty thousand (60,000) possible locations. It will be clear to those skilled in the art, however, after reading this specification, that other systems might comprise a different number of locations. Although the location server could compare the RF fingerprints received from the mobile unit to all 60,000 possible locations, the method depicted in FIG. 12 eliminates some of the 60,000 possible locations based on which signals the mobile unit is able to receive and the relative strength of those signals in every location.

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

In one embodiment, the database is built by taking off-line snapshots of fingerprints at various locations. The fingerprint information along with the coordinates of the location are entered into the database. The more the locations, the richer the database. The resolution of location determination is also controlled by how far apart the fingerprint samples are taken. The closer they are, the higher the resolution. Of course, a person skilled in the art can appreciate that the resolution of the database is limited by the sensitivity of the fingerprint measuring device. In one embodiment the fingerprints are taken using very sensitive signal measuring devices that enable locations that are very close to each other to have distinct fingerprints.

In another embodiment, the database is built by taking fingerprint measurements at predetermined locations and using intelligent algorithms that interpolate the fingerprints at all locations in between the sampled locations. This method has the advantage of not requiring a great many physical measurements to be made, however, it does suffer from some loss in accuracy. This is because, however clever, the interpolating algorithms will not be as accurate as making the actual measurements.

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

choosing as an estimate of said position of said mobile unit one of said plurality of possible positions by comparing the fingerprint associated with each of said plurality of possible positions against a fingerprint received from said mobile unit.

Petitioner's Analysis of Claim 3

Spain-I explains that the MU communicates with location server 30 through a wireless infrastructure (Ex-1011, 3:8-12, 4:7-22) and describes configurations where the fingerprint database may be stored at server 30. (§§IX.A.1(a)-(b); Ex-1011, FIG. 3, 6:9-14, 6:15-30; Ex-1005, FIG. 3, 4:28-58; Ex-1009, 5:22-42; Ex-1010, 5:20-41.) Likewise, *Nanda* teaches/suggests similar features where a mobile device creates/sends fingerprint(s) to a remote database (Ex-1006, 12:14-31) and where such a remote database “receiv[es] fingerprints from multiple mobiles devices” to allow for a “much larger database of available access points than would be found in a single mobile device.” (*Id.*) (Ex-1002, ¶186.)

Petitioner's Analysis of Claim 5

5. Claim 5

- a) **The method of claim 4 wherein the database is stored remotely, and not on the first portable RF communication device.**

The *Spain-I-Hunzinger-Nanda* combination discloses and/or suggests this limitation. (Ex-1002, ¶¶195-202; §§IX.A.1, IX.A.3-4.) *Spain-I* describes configurations where the fingerprint database may be stored at the location server remotely from the MU. (*Supra* §§IX.A.1(b); IX.A.3; Ex-1011, FIG. 3, 6:9-14, 6:15-30; Ex-1005, FIG. 3, 4:28-58; Ex-1009, 5:22-42; Ex-1010, 5:20-41.) Likewise, *Nanda* teaches/suggests similar features. (Ex-1006, 12:14-31.) (Ex-1002, ¶195.)

The *Spain-I* Teaching Being Combined, 6:9–14, 6:15–30

In another embodiment, the fingerprint database is stored at the location server and the generated fingerprint (in the mobile unit) is transmitted to the location server over the wireless link. The search for the closest fingerprint is then done in the location server from which it determines the location of the mobile unit.

FIG. 3 depicts the flow of events in this case. A request for position of the mobile unit is generated, as shown in box 301. The request may be generated by the user carrying the mobile unit, or remotely by the location server. On receipt of the request the mobile unit captures the fingerprint of its current location (box 303). The captured fingerprint is processed appropriately. Processing may include filtering the fingerprint data and reformatting it to reduce its storage space. Subsequently the fingerprint is transmitted over the wireless link to the location server as shown in box 305. The location server has a database into which it executes a search for the closest matching fingerprint, as shown in box 307. Box 309 shows the process culminating in the retrieval of the best matching fingerprint along with its corresponding location. In one embodiment the search also returns a confidence measure that depicts the closeness of the match.

The *Nanda* Teaching Being Combined, 12:14–31

In the above examples, the mobile device generates the fingerprints and stores a fingerprint database. However, some or all of the fingerprints may alternatively be stored somewhere further up the wide area wireless communication network such as a database 111 accessible by the MSC 110. In this instance, the processing requirements and storage requirements may be reduced for the mobile device. In operation, the mobile device would create a current fingerprint and transmit that fingerprint to the MSC (or BSC possibly if the database was there). The MSC would then perform the fingerprint comparison and instruct the mobile device whether or not to search for an access point beacon signal. In this arrangement, the MSC could receive fingerprints from multiple mobile devices and have a much larger database of available access points than would be found in a single mobile device. Alternatively, a personalized fingerprint database may be created for each user of the wide area wireless communication network and stored at their home system.

The Resulting Combination

Spain-I discloses: “the search for the closest fingerprint is then done on the server”

in combination with

Nanda’s teaching of: “the MSC would then perform the fingerprint comparison”

Results in: the **server/MSC** does the comparison.

(b) **the first portable RF communication device determining** if a monitored location is within proximity of a location chosen by a user of the first portable RF communication device, as a result of (i) **electronically comparing** the at least one ID and at least one figure based on the signal strengths of the first plurality of antenna stations at the monitored location with the at least one ID and the at least one figure based on signal strengths of the first plurality of antenna stations at the location chosen by the user, **and (ii) determining** if the difference between the signal strengths measured at the monitored location and the signal strengths at the location chosen by the user is less than a predetermined threshold.

Ground 2: Adding *Damarla*

2. Claims 5-6

Damarla further discloses configurations where “a server that hosts the” fingerprint database, which “could send the appropriate reference RF fingerprints to a MU” “for use at run-time” (Ex-1028, 16:42-57, 5:57-62), consistent with those from *Spain* and *Nanda*. (Ex-1002, ¶245; Ex-1011, 4:43-46).

The additional teachings of *Damarla* would have complemented the rationale for modifying/configuring *Spain-I-Hunzinger-Nanda* system/processes as discussed in §§IX.A.1, IX.A.5-IX.A.6. (Ex-1002, ¶¶244-245.) Thus, *Spain-I-Hunzinger-Nanda-Damarla* discloses/suggests claims 5-6 for reasons in §§IX.A.1, IX.A.4-6, IX.B.1. (*Id.*, ¶246.) A POSITA would have had similar rationale/skills/knowledge and expectation of success as respectively discussed above for claims 5-6 (§IX.A.5-6) (and in §IX.B.1) to configure/implement features like those in claims 5-6 in light of *Damarla*, *Spain-I*, and *Nanda*. (Ex-1002, ¶¶246-247.)

Reference RF fingerprints must be stored in some form of database. They are most likely stored in the infrastructure, but could be stored on the MUs themselves. Considerations include whether the same MUs are always used in the same physical environment, how much data must be stored vs. how much storage capacity MUs have, and how often the data changes.

Damarla's Disclosure at 5:57-62

When satisfied with the results of the analysis, the reference RF fingerprints are deployed **500** to the computing infrastructure used to support location determination in the environment. This infrastructure could be a server that delivers reference RF fingerprint information to MUs, or it could be the MUs themselves.

The Resulting Combination

Spain-I discloses: “the search for the closest fingerprint is then done on the server”

in combination with

Nanda's teaching of: “the MSC would then perform the fingerprint comparison”

in combination with

Damarla's teaching of “RF fingerprints are deployed 500 to the computing infrastructure”

results in:

deploy fingerprints to the computer infrastructure, where the *server/MSC* does the comparison

The Inapplicable Motivation

1011, 6:9-31 (FIG. 3 configuration)) and *Nanda* (Ex-1006, 12:14-31), a POSITA would have likewise been motivated and found benefit in allowing the MU to perform the determination processes as discussed for claims 1 and 3-4 using signal strength/ID information stored at a remote database, consistent with that known in the art. (Ex-1002, ¶199; §IX.A.1(b), IX.A.3-IX.A.4; Ex-1028, 5:1-62, 6:34-37, 16:42-63; Ex-1032, 1:15-31, 2:48-52, 3:59-4:7.) A POSITA would have recognized advantages in conserving memory/processing resources in the MU that would have otherwise been used to maintain the fingerprint database locally. (Ex-1002, ¶200.)

Petitioner's Theory for *Spain-I*

“*Spain-I* also discloses various ways to build the database . . . (Ex-1011, FIGS. 1-3, 9-10, 5:61-6:8, 7:58-67, 8:1-13:15, 14:10-31, 17:15-19”

As the number of possible locations to search increases, the length of time to complete the search also increases. Analogously, as the number of possible locations to search decreases, the length of time to complete the search also decreases. Therefore, the illustrative embodiment seeks to reduce the length of time it takes to complete the search by reducing the number of possible locations that must be searched.

TABLE 1

Database of Possible Locations of Mobile Unit					
Location	Latitude	Longitude	Fingerprint	Possible Serving Cell Site(s)	Possible Neighbor Cell Site(s)
1	47° 10' 23.12" N.	127° 23' 41.73" W.	F ₁	A, B	B, A
...	...	...	...	...	...
60,000	47° 13' 46.33" N.	127° 26' 44.53" W.	F _{60,000}	C	A, C

In accordance with the illustrative example, and as shown in Table 1, the mobile unit is at one of sixty thousand (60,000) possible locations. It will be clear to those skilled in the art, however, after reading this specification, that other systems might comprise a different number of locations. Although the location server could compare the RF fingerprints received from the mobile unit to all 60,000 possible locations, the method depicted in FIG. 12 eliminates some of the 60,000 possible locations based on which signals the mobile unit is able to receive and the relative strength of those signals in every location.

The Only Reason: Privacy

From a privacy perspective, having the cellular network constantly monitor a user's location is problematic to many people. For example, the user asked to receive coupons for merchandise on sale when he is in the shopping area next to his home. However, that same user is troubled by a prospect that, in order for the coupons to be sent, the user's location must be constantly monitored so as to find out when he enters the shopping area.

Obviously the privacy problem could be solved by having the cell phone itself monitor its position, and activate an application when the cell phone concludes that the user has entered the shopping area, etc. This class of solution is also amenable for adaptation to ubiquitous computing situations—since it simply makes the location monitoring logic part of a distributed computing architecture.