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(54) **GPS-BASED CE DEVICE WIRELESS ACCESS POINT MAPPING**

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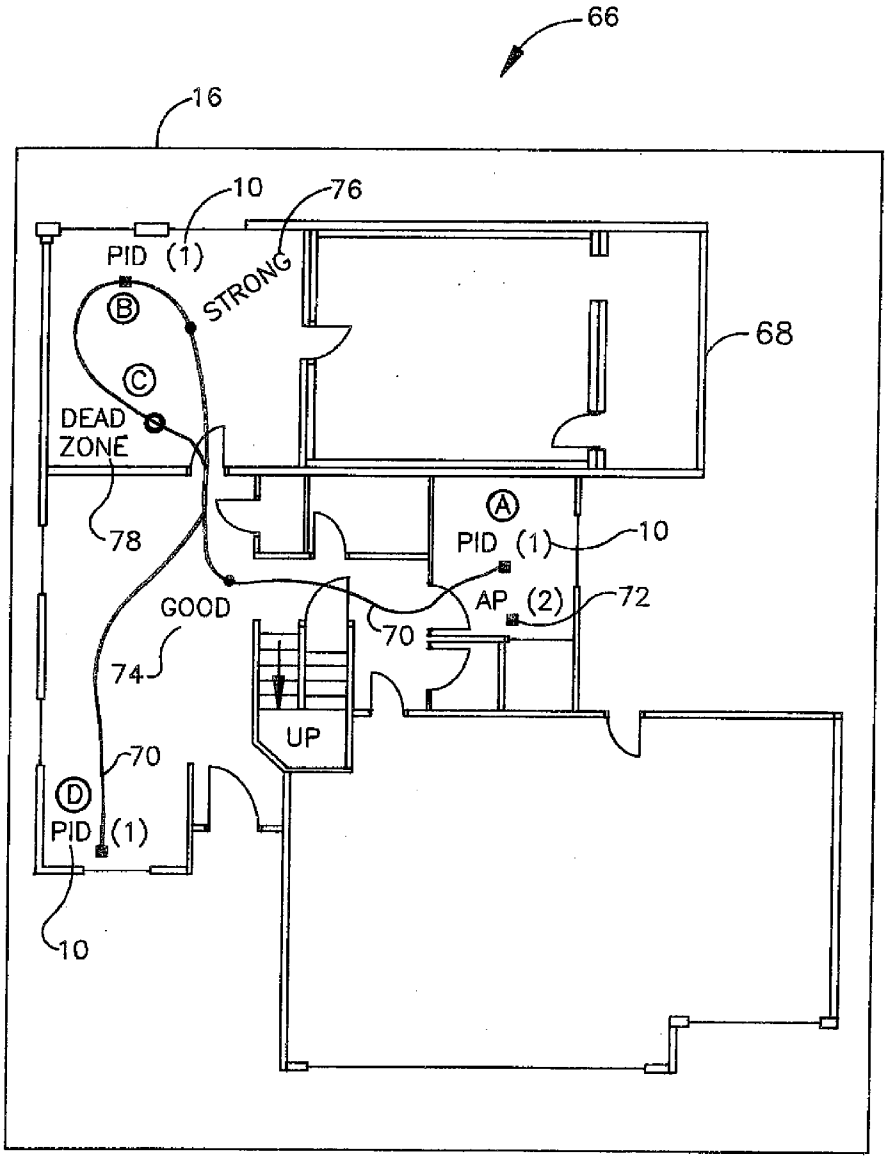
(57) **ABSTRACT**

A CE device can incorporate a GPS receiver and can be moved around a building with wireless access point (AP) signal strengths recorded at various locations. The optimum AP location is selected on the basis of the location-to-signal strength correlations.



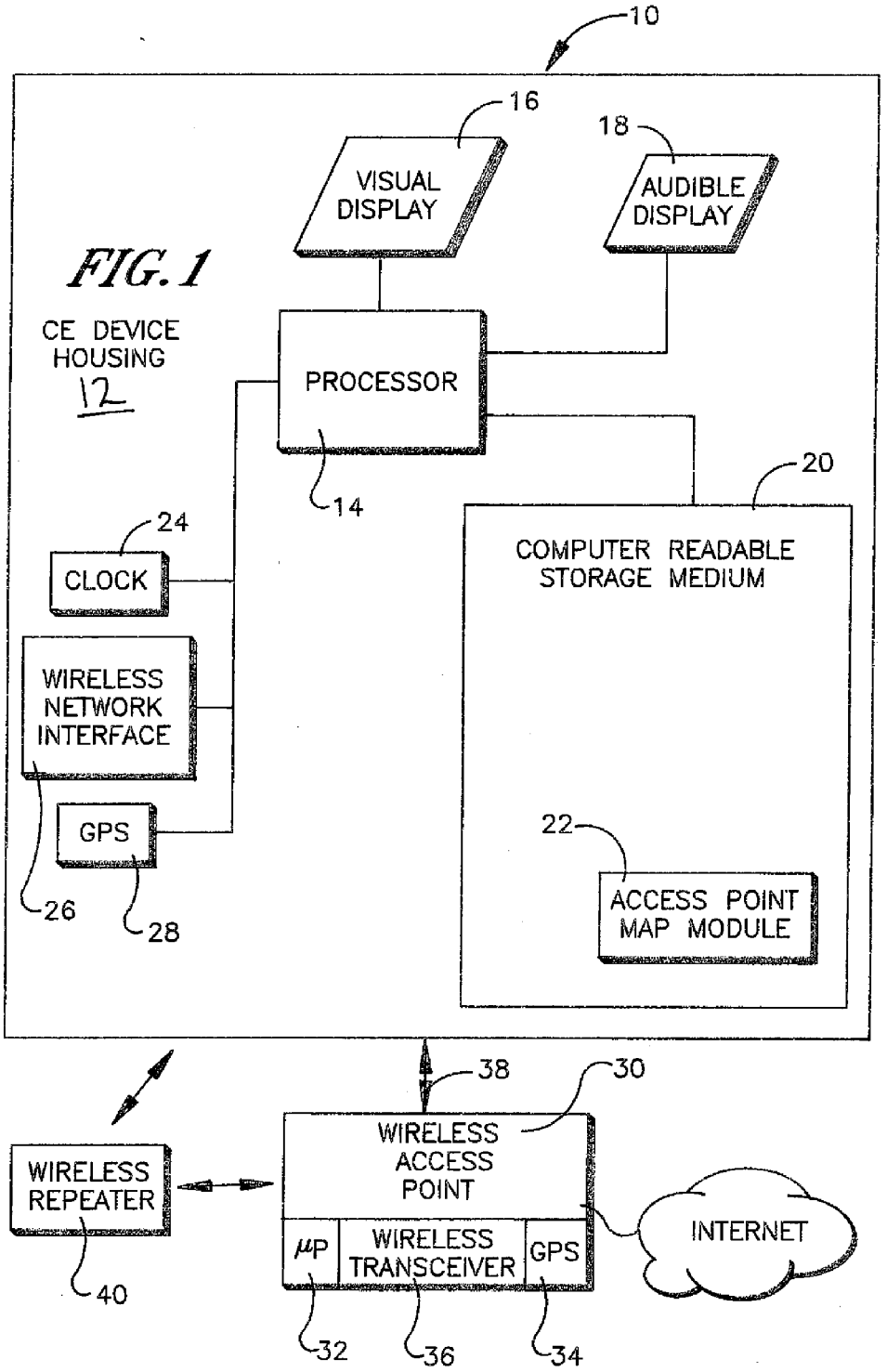

10
16
18
VISUAL DISPLAY
AUDIBLE DISPLAY
CE DEVICE HOUSING
12
PROCESSOR
14
20
24
CLOCK
COMPUTER READABLE STORAGE MEDIUM
WIRELESS NETWORK INTERFACE
GPS
22
ACCESS POINT MAP MODULE
26
28
38
30
WIRELESS REPEATER
WIRELESS ACCESS POINT
INTERNET
μP
WIRELESS TRANSCEIVER
GPS
40
32
36
34

FIG. 1

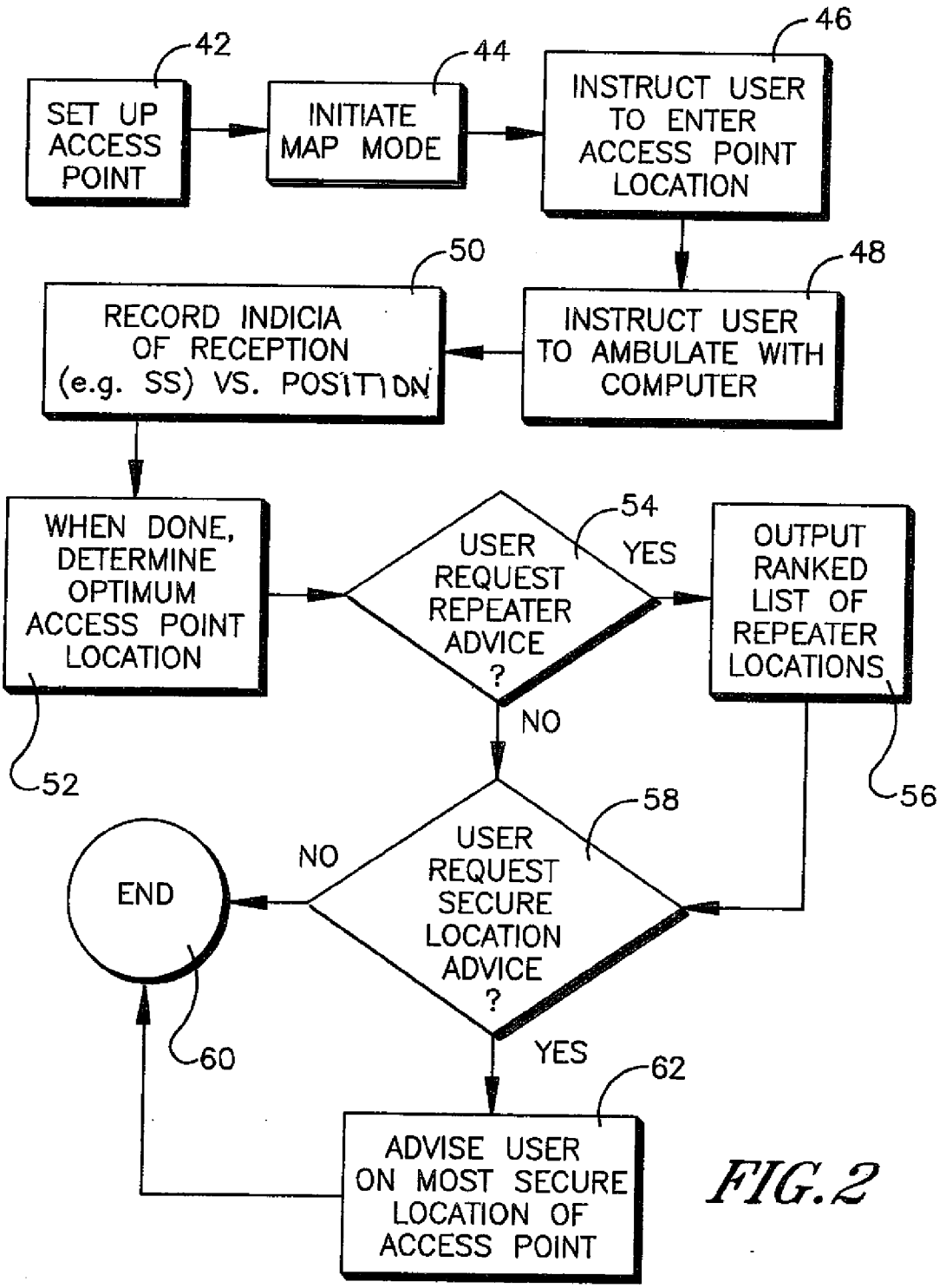
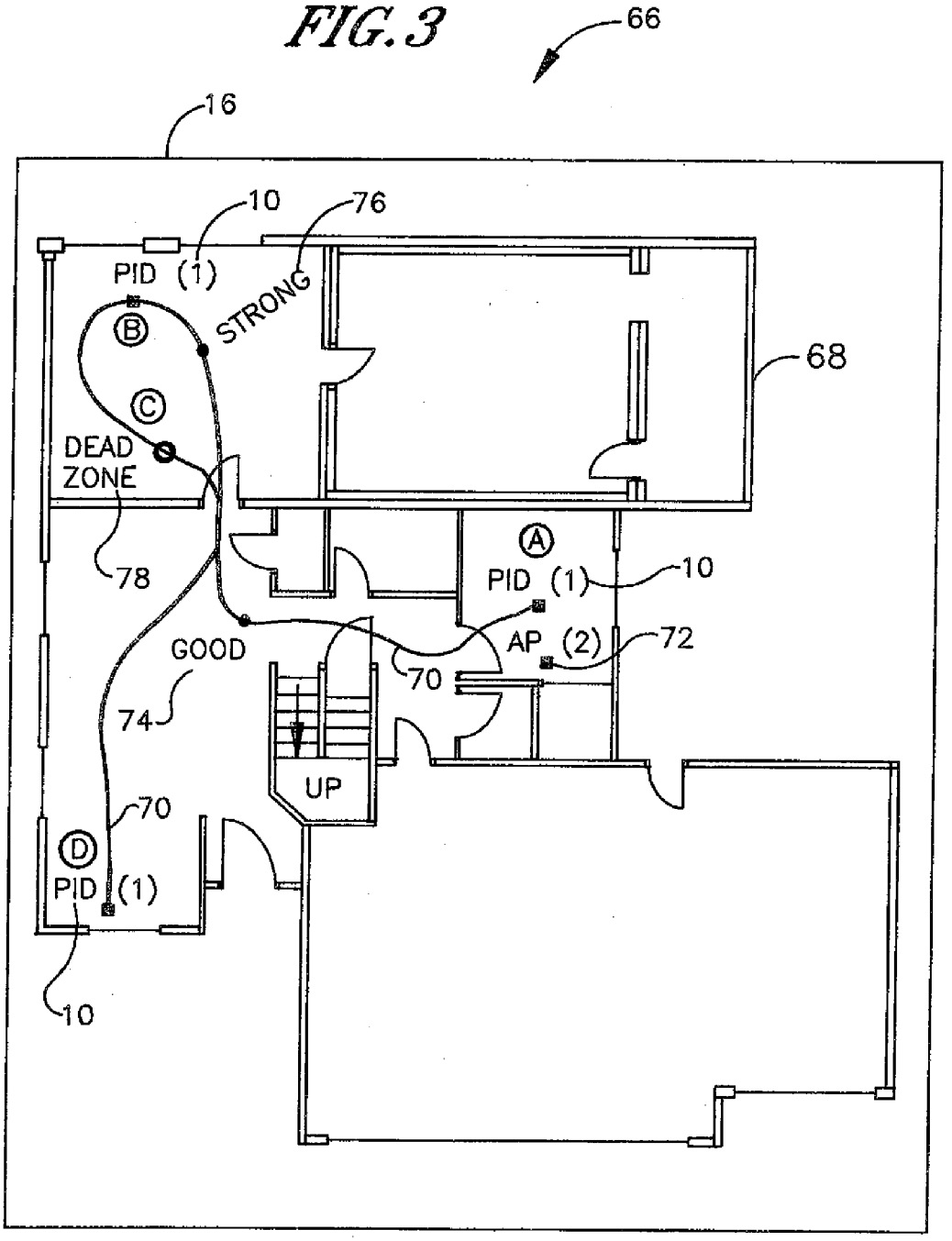

42
SET UP ACCESS POINT
44
INITIATE MAP MODE
46
INSTRUCT USER TO ENTER ACCESS POINT LOCATION
48
INSTRUCT USER TO AMBULATE WITH COMPUTER
50
RECORD INDICIA OF RECEPTION (e.g. SS) VS. POSITION
52
WHEN DONE, DETERMINE OPTIMUM ACCESS POINT LOCATION
54
USER REQUEST REPEATER ADVICE ?
YES
NO
56
OUTPUT RANKED LIST OF REPEATER LOCATIONS
58
USER REQUEST SECURE LOCATION ADVICE ?
NO
YES
60
END
62
ADVISE USER ON MOST SECURE LOCATION OF ACCESS POINT

FIG. 2

FIG. 3


66
16
10
76
PID (1)
STRONG
B
68
C
DEAD
ZONE
78
A
PID (1)
10
AP (2)
72
GOOD
70
74
UP
70
D
PID (1)
10

GPS-BASED CE DEVICE WIRELESS ACCESS POINT MAPPING

I. FIELD OF THE INVENTION

[0001] The present application is directed to using global positioning satellite (GPS) signals to map optimal wireless access point (AP) coverage for a CE device.

II. BACKGROUND OF THE INVENTION

[0002] A wide variety of CE devices such as wireless telephones, personal digital assistants (PDAs), laptop computers, etc. have been provided that leverage digital processing to provide a multiplicity of useful features to users. Such devices typically connect to wide area networks such as the Internet and many such devices do so using wireless links. When wireless links are used, the CE device ordinarily communicates with a so-called wireless "access point" (AP), essentially a wireless transceiver, which in turn is connected via a wired path to the Internet.

[0003] As understood herein, use of a CE device's wireless network connectivity can be limited in a business or home environment depending on the wireless Internet coverage. A CE device cannot be used to access a network in areas where it inadequately receives signals from the wireless AP. This problem may be addressed by improving the wireless range of the AP and/or CE device but as understood herein, power consumption concerns counterbalance this approach. Or, wireless repeaters may be added, e.g., inside a home to improve connectivity with the AP, but as recognized herein use of such repeaters cascades costs. In such cases, however, a user typically has little good idea where to locate a repeater.

SUMMARY OF THE INVENTION

[0004] Accordingly, a consumer electronics (CE) device includes a housing bearing a processor and a visual display controlled by the processor. A position sensor is in the housing and generates geographic position signals. Also, a wireless receiver is in the housing and receives signals from a wireless access point (AP) configured to communicate with a wide area network and located at a current AP location. The processor uses the signals from the position sensor and wireless receiver to generate a correlation of wireless access point (AP) communication conditions with respective locations in a building. The processor further presents an indication on the display of a suggested location of the AP that is different from the current AP location.

[0005] In some implementations, the processor presents on the display a map illustrating communication conditions as a function of position in the building. The communication condition can include signal strength (SS).

[0006] The suggested location of the AP can be a location with a highest communication condition, or a location that is geographically between plural positions of equally good communication conditions, or a furthest location from the current AP location having a corresponding communication condition that meets or exceeds a minimum threshold. Yet again, the suggested location of the AP can be a location having a lowest communication index.

[0007] In example embodiments, the device instructs a user to enter locations of wireless AP physical connections to a network, with a respective communication condition being recorded for each wireless AP physical connection location entered. The suggested location of the AP can then be a wireless AP physical connection location with a higher communication index than communication indices associated with other wireless AP physical connection locations.

[0008] In other examples, the processor presents on the display a suggested location for disposing a wireless AP repeater communicating wirelessly with the wireless AP. If desired, the processor presents on the display a suggested most secure wireless AP location using the correlation of wireless access point (AP) communication conditions with respective locations.

[0009] In another aspect, a method includes receiving, in a computing device, location information indicating location of the device. The method also includes receiving, in the computing device, signals from a wireless access point (AP), moving the computing device relative to the AP, and correlating first and second locations of the computing device to first and second AP communication indices. Based on the correlating act, a suggested location of the AP that is different from a current location of the AP is output.

[0010] In another aspect, a system includes a computing device including a position receiver and a wireless transceiver. The system also includes a wireless access point (AP) communicating with the computing device. The computing device determines communication indicia for respective locations of the computing device relative to the AP and based thereon outputs to a user a suggested best AP location, a suggested most secure AP location, and a suggested AP repeater location. The details of the present invention, both as to its structure and operation, can best be understood in reference to the accompanying drawings, in which like reference numerals refer to like parts, and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIG. **1** is a block diagram of an example system in accordance with present principles;

[0012] FIG. **2** is a flow chart of example logic for mapping wireless access point (AP) signal strengths; and

[0013] FIG. **3** is a schematic plan view illustrating the mapping of AP signal strengths.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Referring initially to FIG. **1**, a CE device **10** is shown that includes a housing **12** bearing a digital processor **14**. The CE device **10** may be, e.g., a personal computer (PC) or laptop computer or notebook computer, although other digital processing apparatus are envisioned.

[0015] The processor **14** can control a visual display **16** and an audible display **18** such as one or more speakers. The visual display **16** may be, e.g., a capacitive touchscreen display, although other display types may be used.

[0016] To undertake present principles, the processor **14** may access one or more computer readable storage media **20** such as but not limited to disk-based or solid state storage. In example non-limiting embodiments, the media **20** may store various software modules, including, for example, a wireless access point (AP) map module **22**.

[0017] The left portion of FIG. **1** shows that in addition to the processor **14**, displays **16**, **18**, and media **20**, the housing **12** may hold a computer clock **24** to output a time of day signal to the processor **14** for, e.g., display of the time on the visual display **16** and for, e.g., the sounding of a time-based alarm on the audible display **18**. If desired, a wireless network

interface **26** may be in the housing **12** and may communicate with the processor **14** to permit the processor **14** to communicate with a wide area computer network such as the Internet. The interface **26** may be, without limitation, a WiFi interface. A position receiver **28** such as a global positioning satellite (GPS) receiver may be provided in the housing **12** and may communicate signals to the processor **14** representative of the terrestrial position of the housing **12**.

[0018] As also shown in FIG. **1**, the CE device **10** communicates with a wireless access point (AP) **30** including an AP processor **32** receiving position signals from a position receiver **34** and communicating wirelessly with the CE device **10** using a wireless transceiver **36** over a wireless link **38**. In cases where the wireless link **38** is insufficient, the CE device **10** may communicate with the AP **30** via a wireless repeater **40**. Without limitation, the AP **30** may be implemented by a wireless router.

[0019] FIG. **2** shows example logic in accordance with present principles. Commencing at block **42** the user sets up the AP **30** in a convenient part of a dwelling such as a home, e.g. nearby a telephone jack for connecting the AP to the wireless telephony network (and, hence, the Internet). At block **44** the map module **22** may then be invoked on the device **10** from, e.g., a setup screen or other location.

[0020] Proceeding to block **46**, the device **10** executing the map module **22** instructs the user to enter the location of the AP by, e.g., standing next to the AP and inputting an "enter" signal using a keypad or point-and-click device associated with device **10**. This signals the device **10** to record the position indicated by the position receiver **28** as the AP position. The instruction to enter the AP position may be presented on the visual display **16** and/or audible display **18**.

[0021] Then, at block **48** the device **10** executing the map module **22** instructs the user to ambulate around the dwelling in which the AP is located, recording, as the user does so, indicia of signal reception from the AP at the device **10** at block **50**. One or more indicia of AP communication conditions may be used, such as signal strength (SS) or signal-to-noise ratio (SNR) or bit error rate (BER) or other parameter or parameters. The one or more indicia are recorded on the medium **20** and correlated to the position indicated by the position sensor **28** at the time a signal characterized by the indicia is received. In this way, a map (which may be implemented on the medium **20** in any suitable format such as a table) is generated that correlates various geographic positions of the device **10** to respective AP communication conditions, e.g., to SS.

[0022] After creating this signal strength map, the device **10** executing the map module **22** can determine an optimum AP location using the map at block **52**. In one implementation, the location with the highest communication index is selected. In another implementation, the location that is geographically between plural positions of equally good communication indices is selected. In another implementation, the furthest location from the AP position recorded at block **46** whose corresponding communication index meets or exceeds a minimum threshold is selected. In another implementation, the location having the lowest communication index is selected.

[0023] Other heuristics may be used. For example, the device **10** executing the map module **22** may instruct the user to enter the locations not just of the initial AP set up but also of the telephone jacks in the dwelling using above principles as the user ambulates with the device **10** at block **48**. At each jack location, the communication index is recorded, and the jack location with the highest communication index is selected at block **52**.

[0024] Regardless of how selected, the device **10** executing the map module **22** can present the "best" location to the user on, e.g., the visual display **16**. This may be done by presenting an image of a map on the display and highlighting as in green the "best" location. An example map is further discussed below.

[0025] Additionally, if a user requests advice (by, e.g., selecting a user interface element presented on the display **16** indicating "repeater location optimization") at decision diamond **54**, repeater location advice can be presented to the user on the display **16** and/or **18** at block **56**. In one example, the repeater location advice may be a ranked list of locations, e.g., an image of the map discussed below, with position rankings indicated alpha-numerically and/or by color. The order of the list may be established to be: location with lowest communication first, location with second-lowest communication index second, and so on.

[0026] Moreover, a user may be enabled to select, at decision diamond **58**, whether to be provided secure location advice. Selection of this option may be effected by selecting a user interface element presented on the display **16** indicating "show me the most secure AP location". At block **62** a secure location may be presented to the user by, e.g., presenting the map and showing a color-coded or alpha-numerically designated "secure" location on the display **16**. In one example, the secure location output at block **62** is the map location with the lowest corresponding communication index. The process ends at state **60**.

[0027] Other potential uses of above principles are to create a service in which technicians execute the logic of FIG. **2** on the behalf of a customer.

[0028] FIG. **3** illustrates a map **66** that may be presented on the visual display **16** in accordance with above principles. The map **66** may include wall and door boundaries **68** derived from a computer-stored floor plan of the user's home that is downloaded via, e.g., the network interface **26** and stored on the media **20**, although in some embodiments no boundaries **68** need be presented.

[0029] In FIG. **3**, "PID (**1**)" represents the CE device **10**, and a track **70** representing the user's movement at blocks **48** and **50** in FIG. **2** may be presented on the map. The map can present an image or icon **72** of the wireless AP at the position indicated by the user to be the origin of the map. Indications of AP SS can be presented on the track **70** as recorded at block **50** for various locations on the track. The indications may be color coded (e.g., green for "good", orange for "marginal", red for "poor") or, as shown at **74**, **76**, and **78** in FIG. **3**, may be textual, e.g., "good", "strong", and "dead zone", respectively.

[0030] While the particular GPS-BASED CE DEVICE WIRELESS ACCESS POINT MAPPING is herein shown and described in detail, it is to be understood that the subject matter which is encompassed by the present invention is limited only by the claims.

1. Consumer electronics (CE) device comprising:

housing bearing a processor and a visual display, the processor controlling the display;

position sensor in the housing and generating geographic position signals;

wireless receiver in the housing and receiving signals from a wireless access point (AP) configured to communicate with a wide area network and located at a current AP location;

the processor using the signals from the position sensor and wireless receiver to generate a correlation of wireless access point (AP) communication conditions with respective locations in a building, the processor presenting an indication on the display of a suggested location of the AP that is different from the current AP location, wherein the suggested location of the AP is a location that is geographically between plural positions of equally good communication conditions, or wherein the suggested location of the AP is a furthest location from the current AP location having a corresponding communication condition that meets or exceeds a minimum threshold.

2-3. (canceled)

4. The CE device of claim **1**, wherein the suggested location of the AP is a location with a highest communication condition.

5-6. (canceled)

7. (canceled)

8. The CE device of claim **1**, wherein the device instructs a user to enter locations of wireless AP physical connections to a network, a respective communication condition being recorded for each wireless AP physical connection location entered, the suggested location of the AP being a wireless AP physical connection location with a higher communication index than communication indices associated with other wireless AP physical connection locations.

9. The CE device of claim **1**, wherein the processor presents on the display a suggested location for disposing a wireless AP repeater communicating wirelessly with the wireless AP.

10. The CE device of claim **1**, wherein the processor presents on the display a suggested most secure wireless AP location using the correlation of wireless access point (AP) communication conditions with respective locations.

11. Method comprising:

receiving, in a computing device, location information indicating location of the device;

receiving, in the computing device, signals from a wireless access point (AP);

moving the computing device relative to the AP;

correlating at least first and second locations of the computing device to first and second AP communication indices; and

based on the correlating act, outputting a suggested location of the AP that is different from a current location of the AP, further comprising presenting indication of the first and second locations along with the first and second AP communication indices.

12. (canceled)

13. The method of claim **11**, wherein the suggested location of the AP is a location with a highest communication condition.

14-16. (canceled)

17. The method of claim **11**, comprising instructing a user to enter locations of wireless AP physical connections to a network, recording a respective communication condition for each wireless AP physical connection location entered, the suggested location of the AP being a wireless AP physical connection location with a higher communication index than communication indices associated with other wireless AP physical connection locations.

18. The method of claim **11**, comprising presenting a suggested location for disposing a wireless AP repeater communicating wirelessly with the wireless AP.

19. The method of claim **11**, comprising presenting a suggested most secure wireless AP location using a correlation of wireless access point (AP) communication conditions with respective locations.

20. System comprising:

computing device including a position receiver and a wireless transceiver; and

wireless access point (AP) communicating with the computing device, the computing device determining communication indicia for respective locations of the computing device relative to the AP and based thereon outputting to a user a suggested best AP location, a suggested most secure AP location, and a suggested AP repeater location.

* * * * *