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[Continued on next page]

(54) Title: MOVEMENT BASED NETWORK SCAN

(57) Abstract: An apparatus having a movement based network scan. The apparatus is configured to monitor the movement of the apparatus. If a reason for periodical network scan emerges the apparatus monitors if the apparatus has been moved. If the apparatus has not been moved, the periodical scan is not repeated.

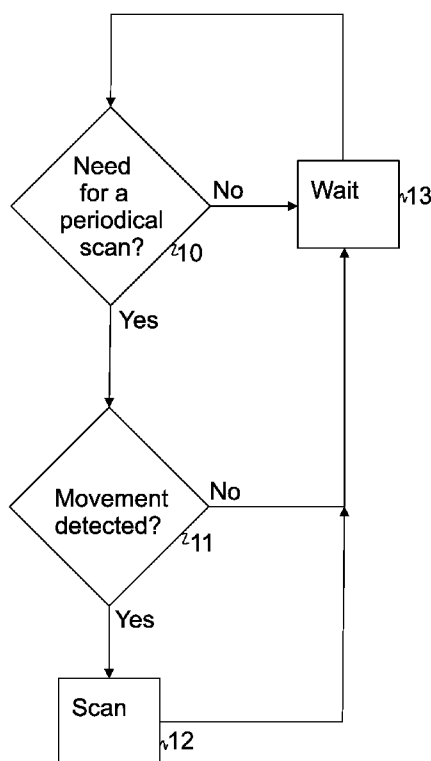


Figure 1



SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, ZA, ZM, ZW.

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— with international search report (Art. 21(3))

MOVEMENT BASED NETWORK SCAN**FIELD OF THE INVENTION**

The invention relates to wireless telecommunication.

BACKGROUND OF THE INVENTION

Wireless telecommunications allow mobile devices that can be used while the user of the device moves, for example, by walking or driving in the city. Typically are formed by various cells that have different coverage area. The coverage area depends on a plurality of parameters. Thus, there are places where the coverage is not very good and the mobile device is out of network.

In order to get connected again the mobile device will typically start periodical scans for the network. Each scan uses power, which is in some cases a lot of power, thus reducing the operating time the mobile device has left. All unnecessary scans should therefore be avoided. However, the terminal typically does not know which scans are necessary and which are not. For example, if the terminal has not moved, it still ends up scanning for networks without hope that anything is found. This is a typical case of unnecessary scan. The same applies also in the cases where the mobile device scans available networks for other reasons

SUMMARY

The invention discloses an apparatus, a method and a computer program for controlling an apparatus in accordance with the method. The apparatus according to the present invention comprises wireless telecommunication means and means for detecting move-

ment of the device. Wireless telecommunication means may be, for example, WLAN (Wireless Local Area Network), GSM (Global System for Mobile communications), UMTS (Universal Mobile Telecommunication System), or similar. Means for detecting movement of the device may be, for example, an acceleration sensor, accelerometer or other suitable movement sensor.

The method according to the present invention is configured to monitor the movement of the apparatus. The method comprises performing, in an apparatus, a first scan for a first beacon signal of a first base transceiver station, determining at least one movement vector from at least one movement sensor, analyzing from said at least one movement vector whether said apparatus has moved and performing a second scan for a second beacon signal of a second base transceiver station if said apparatus has moved.

In an embodiment a threshold value is defined for the accumulated movement. In most cases a small movement is not enough to move the apparatus from the non-coverage area to the coverage area. Thus, the scan is not needed and the unnecessary scan can be avoided.

In an embodiment a threshold timer value is defined, wherein a predetermined time interval causes the periodical scan even if the apparatus has not been moved. This solves the problem wherein the problem is in the network side, for example in the base station. Typically this threshold timer value is considerably longer period than the regular periodical scan so that the energy is saved. In a further embodiment the threshold timer value is increased after unsuccessful periodical scan.

In one embodiment of the invention, the analyzing step further comprises translating the at least one acceleration vector to at least one motion vector. The at least one motion vector is obtained by associating a time elapsed between at least one acceleration

vector determined from the at least one movement sensor. For example, the time elapsed between each acceleration vector determination from the at least one movement sensor is used to obtain the motion vectors indicating the motion of the apparatus. The movement sensor output may be sampled at periodic intervals by the apparatus or when a threshold for receiving an indication of acceleration to the apparatus from at least one movement sensor is exceeded. In one embodiment of the invention, the motion vectors obtained are summed to yield a net motion. If the net motion reveals that the motion vectors cancel each other out, it may be determined that the apparatus has not moved.

In one embodiment of the invention, it is determined that the apparatus has moved, if the length of at least one motion vector exceeds a predefined threshold. This embodiment avoids the calculation involved in the summing of the motion vectors.

In one embodiment of the invention, the movement sensor output may be sampled at periodic intervals by the apparatus or when a threshold for receiving an indication of acceleration to the apparatus from at least one movement sensor is exceeded. In one embodiment of the invention, a distinguishing movement vector is an movement vector which has a length exceeding a predefined threshold. In one embodiment of the invention, an acceleration vector may be a one-dimensional output pertaining to an movement sensor indicating acceleration in only one direction. In one embodiment of the invention, there may be multiple movement sensors. In one embodiment of the invention, there is a single movement sensor that provides acceleration of the apparatus in three dimensions.

In one embodiment of the invention, an movement sensor may provide motion vector output to the apparatus.

In one embodiment the present invention is implemented as a computer program arranged to perform the method of Figure 1 in a mobile device having timers, wireless connectivity means, processor and at least one movement sensor.

A person skilled in the art recognizes that the embodiments mentioned above may be combined depending on the need of the features for each application where the invention is used.

Benefit of the present invention is that it considerably reduces the number of unnecessary scans. This provides longer operation times and thus leads to better user experience. Thus, the invention is useful and applicable in wireless communication devices.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the drawings:

Fig. 1 is a flow chart of a method according to the present invention,

Fig. 2 is a block diagram of an example embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings. In figure 1 a flow chart of a method according to the present invention is disclosed. After the initiation the method is typically continuous process and it is repeated after predetermined periods. The method is

initiated by performing, in an apparatus, a first scan for a first beacon signal of a first base transceiver station. If the scan is not successful it is determined if there is a need of periodical scan, step 10. A person skilled in the art understands that it is also possible to start directly from the periodical scan. If there is a need for periodical scan, the method proceeds to step 11, wherein determining at least one movement vector from at least one movement sensor. Then it is determined from mentioned at least one movement vector whether said apparatus has moved. If the device has moved a second scan is performed for a second beacon signal of a second base transceiver station, step 12. If there is no need for periodical scan in step 10 or movement is not detected in step 11, the method waits for next periodical scan, step 13. A person skilled in the art understands that the device may perform also further functions during the waiting period and the waiting period is only an interval between periodical scans.

Figure 2 is a block diagram of a device and a system according to the present invention. The system comprises a device 20, a transceiver base station 25 and a wireless connection 26 between the device 20 and the transceiver base station 25. The device further comprises a timer 23, wireless connectivity means, 21, A processor 24 and at least one movement sensor 22.

Mentioned at least one movement sensor 22 is further configured to provide at least one movement signal. The processor is configured to determine at least one movement vector from said at least one movement signal, to analyze said at least one movement vector and to determine from said at least one movement vector whether said apparatus has moved. Connectivity means 21, such as a receiver, is configured to perform a first scan for a first beacon signal of a first base transceiver station and to perform a second

scan for a second beacon signal of a second base transceiver station if said apparatus has moved. Mentioned timer 23 is used to measure threshold timer values if such values are determined. Processor 24 is arranged to execute above mentioned functions according to the method discussed above. The components mentioned above may be shared with the other functionality of the host device.

In one embodiment the present invention is implemented as a computer program arranged to perform the method of Figure 1 in a mobile device having timers, wireless connectivity means, processor and at least one movement sensor.

It is obvious to a person skilled in the art that with the advancement of technology, the basic idea of the invention may be implemented in various ways. The invention and its embodiments are thus not limited to the examples described above; instead they may vary within the scope of the claims.

CLAIMS

1. A method, comprising:
determining at least one movement vector from at least one movement sensor;
analyzing from said at least one movement vector whether said apparatus has moved; and
performing a scan for a beacon signal of a base transceiver station if said apparatus has moved.

2. The method according to claim 1, wherein said analyzing step further comprises searching said at least one movement vector for at least one distinguishing movement vector, each said at least one distinguishing movement vector having an accumulated movement exceeding a predefined threshold movement.

3. The method according to claim 1, wherein said analyzing step further comprises searching said at least one movement vector for at least two mutually compensating movement vectors.

4. The method according to any of preceding claims 1 - 3, wherein said beacon signal comprises a predefined code division multiple access chip code.

5. The method according to any of preceding claim 1 - 4, wherein said beacon signal comprises a predefined transmission burst pattern.

6. An apparatus, comprising:
at least one movement sensor configured to provide at least one movement signal;
a processor configured to determine at least one movement vector from said at least one movement signal, to analyze said at least one movement vector and to determine from said at least one movement vector whether said apparatus has moved; and
a receiver configured to perform a scan for a beacon signal of a base transceiver station if said apparatus has moved.

7. The apparatus according to claim 6, wherein said processor is further configured to search said at least one movement vector for at least one distinguishing movement vector, each said at least one distinguishing movement vector having a movement exceeding a predefined threshold movement.

8. The apparatus according to claim 6 or 7, wherein said processor is further configured to search said at least one movement vector for at least two mutually compensating movement vectors.

9. The apparatus according to any of preceding claims 6 - 8, wherein said beacon signal comprises a predefined code division multiple access chip code.

10. The apparatus according to any of preceding claims 6 - 9, wherein said beacon signal comprises a predefined transmission burst pattern.

11. The apparatus according to any of preceding claims 6 - 9, wherein said apparatus is a mobile device.

12. A computer program embodied on a computer readable medium, the computer program comprising code for controlling a processor to execute a method comprising:

- performing, in an apparatus, a first scan for a first beacon signal of a first base transceiver station;

- determining at least one movement vector from at least one movement sensor;

- determining from said at least one movement vector whether said apparatus has moved; and

- performing a second scan for a second beacon signal of a second base transceiver station if said apparatus has moved.

13. The computer program according to claim 11, wherein said computer readable medium is a remov-

able memory card, a holographic memory, a magnetic disk or an optical disk.

IM : Please check in the description to have support for the software claim.

14. An apparatus, comprising:

means for providing at least one movement signal;

means for determining at least one movement vector from said at least one movement signal, for analyzing said at least one movement vector and for determining from said at least one movement vector whether said apparatus has moved; and

means for performing a scan for a beacon signal of a base transceiver station if said apparatus has moved.

15. A system, comprising:

at least one base transceiver station; and

an apparatus, wherein said apparatus further comprises:

at least one movement sensor configured to provide at least one movement signal;

a processor configured to determine at least one movement vector from said at least one movement signal, to analyze said at least one movement vector and to determine from said at least one movement vector whether said apparatus has moved; and

a receiver configured to perform a scan for a beacon signal of a base transceiver station if said apparatus has moved.

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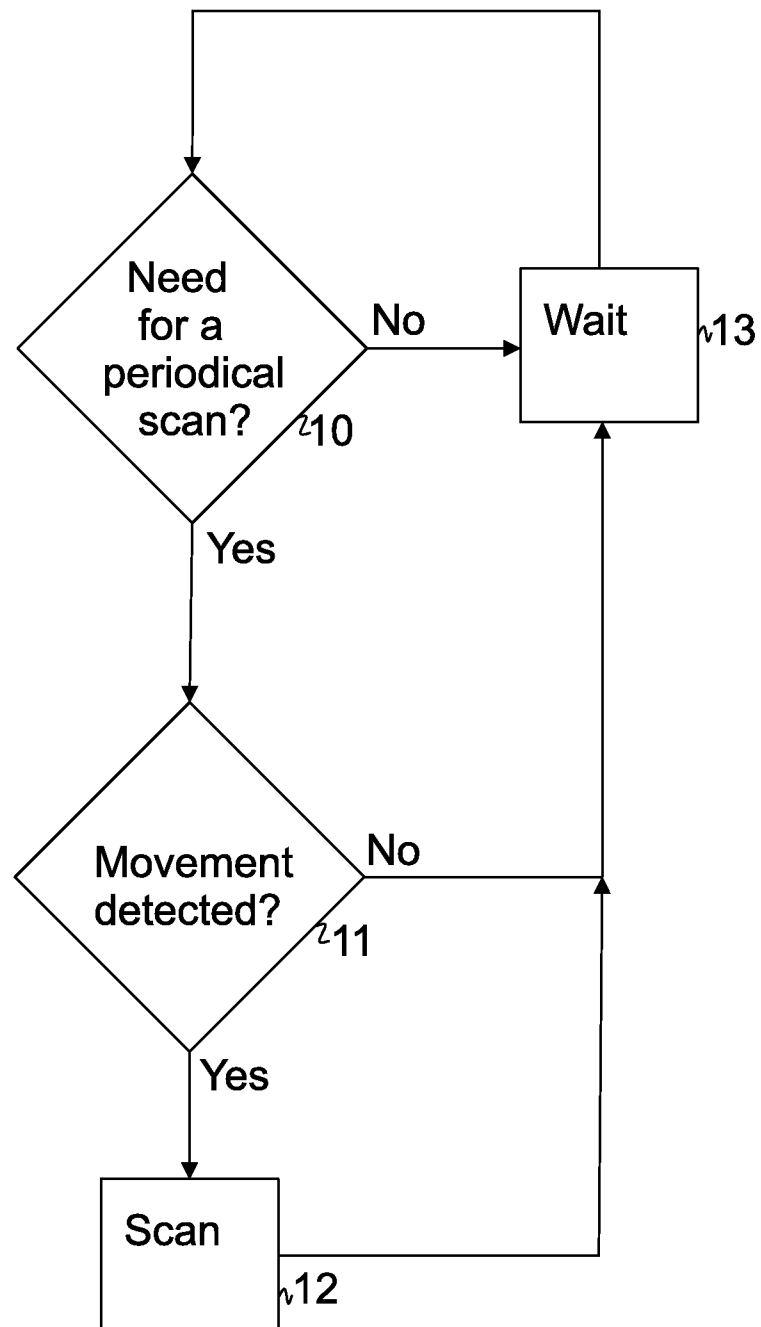


Figure 1

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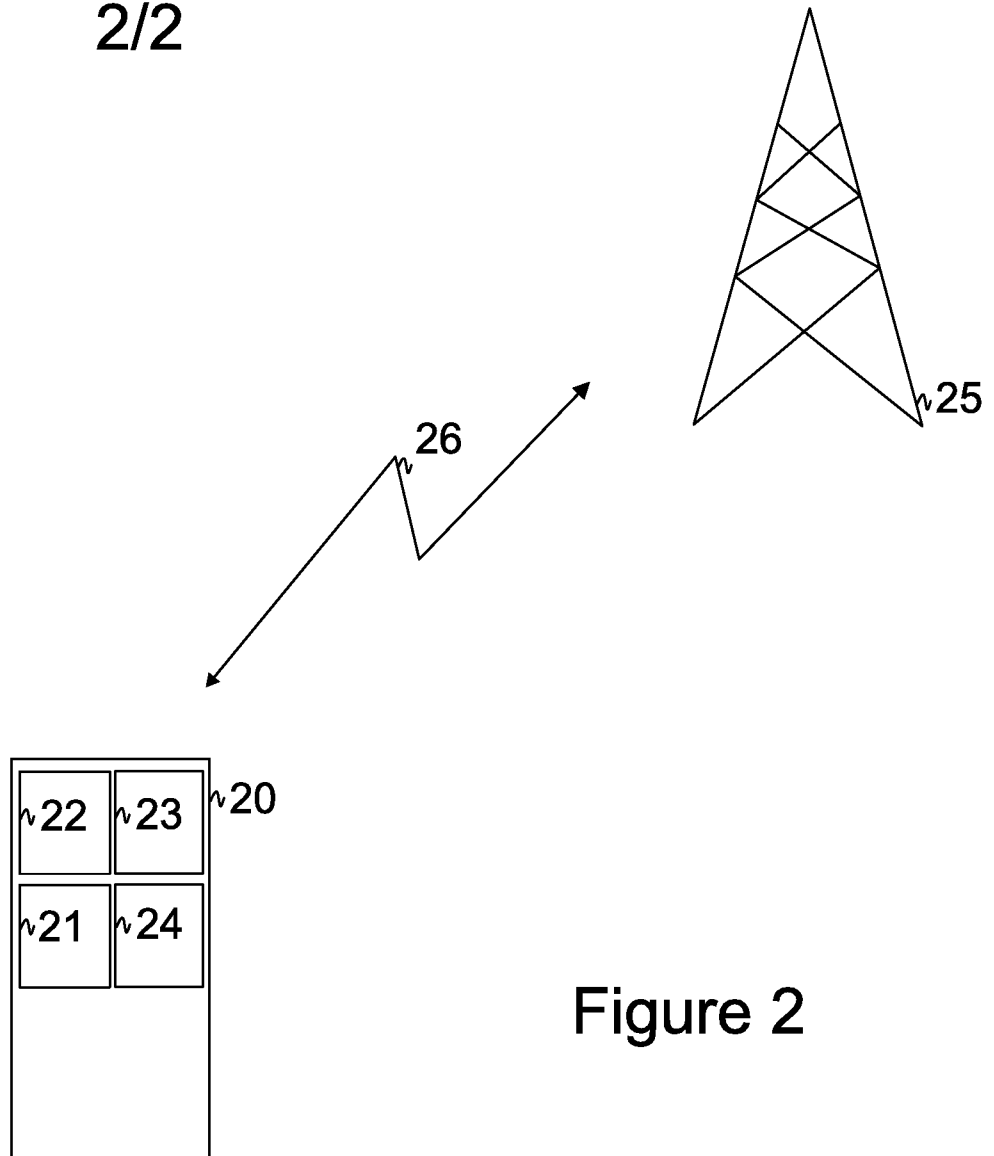


Figure 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2008/050794

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04W, H04L, H04B, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004110530 A1 (ALONE VIJAY B et al.) 10 June 2004 (10.06.2004), pars. [0003],[0018]-[0024],[0081],[0082],[0090], fig. 3	1-15
A	US 2007091847 A1 (LEE BYOUNG-CHUL) 26 April 2007 (26.04.2007)	1-15
A	US 2005107038 A1 (COUTTS DARYL D) 19 May 2005 (19.05.2005)	1-15
A	US 2007008941 A1 (NARASIMHA MURALI et al.) 11 January 2007 (11.01.2007)	1-15
A	EP 1304898 A1 (NIPPON ELECTRIC CO) 23 April 2003 (23.04.2003)	1-15
A	US 5794146 A (SEVCIK PETER JOHN et al.) 11 August 1998 (11.08.1998)	1-15

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2008/050794

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
US 2004110530 A1	10/06/2004	CN 1485751 A JP 2004140778 A	31/03/2004 13/05/2004
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INTERNATIONAL SEARCH REPORT

International application No.
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

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