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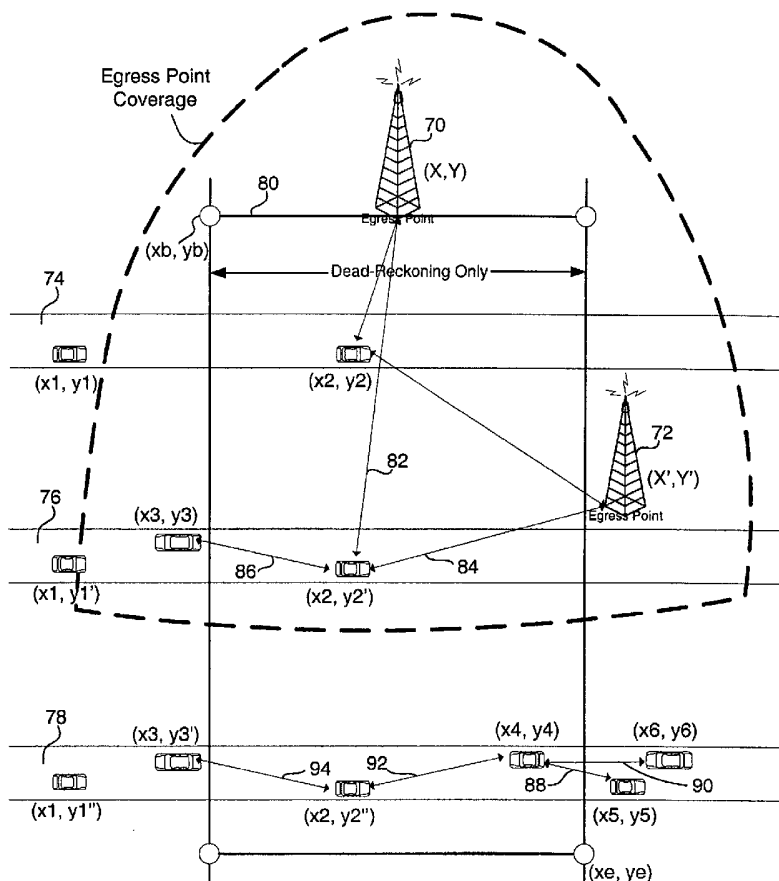
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G01C 21/36
- (21) International Application Number: PCT/US2004/014725 (74) Agent: **VAN LOY, Michael D.**; 3045 Park Boulevard, Palo Alto, CA 94555 (US).
- (22) International Filing Date: 11 May 2004 (11.05.2004) (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
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- (71) Applicant (for all designated States except US): **CIRCUMNAV NETWORKS, INC.** [US/US]; 3045 Park Boulevard, Palo Alto, CA 94306 (US). (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
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[Continued on next page]

(54) Title: ENHANCED DEAD RECKONING METHOD



(57) Abstract: An enhanced dead reckoning method determines the position of a participating vehicle (x2, y2'). The participating vehicle is unable to receive signals from global positioning satellites. The position is calculated by way of observed time difference calculations and received signal strength indications. The position is also calculated by communicating with other participating vehicles (x3, y3) or egress points (70).

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European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Published:

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/14725

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01S 5/14; G01C 21/36

US CL : 701/213, 216, 217

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)

U.S. : 701/213, 216, 217; 342/357.01-357.06; 357.14

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|---|-----------------------|
| X | US 2002/0011949 A1 (Rudow et al.) 21 January 2002, paragraphs 0064-0070, 0104 | 6-7 |
| X | US 2002/0115436 A1 (Howell et al) 22 August 2002, paragraphs 0027, 0030, 0051-0055, 0060-0062, 0065-0066. | 6-7 |

Further documents are listed in the continuation of Box C.

See patent family annex.

| * Special categories of cited documents: | "T" |
|---|--|
| "A" document defining the general state of the art which is not considered to be of particular relevance | 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 |
| "E" earlier application or patent published on or after the international filing date | "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 |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "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 |
| "O" document referring to an oral disclosure, use, exhibition or other means | "&" document member of the same patent family |
| "P" document published prior to the international filing date but later than the priority date claimed | |

Date of the actual completion of the international search

20 September 2004 (20.09.2004)

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US04/14725

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

- 3. Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
 - 2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 - 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

 - 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 6 and 7
- Remark on Protest The additional search fees were accompanied by the applicant's protest.
 No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

PCT/US04/14725

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

Group I, claim(s) 6-7, drawn to determining position of a vehicle based on dead reckoning.

Group II, claim(s) 1-3, drawn to determining position of a vehicle based on signal to/from the vehicle and an egress.

Group III, claim(s) 4-5, drawn to determining position of a vehicle based on signal to/from an egress and other vehicles.