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[Continued on next page]

(54) Title: METHODS AND SYSTEMS FOR DRIVER IDENTIFICATION

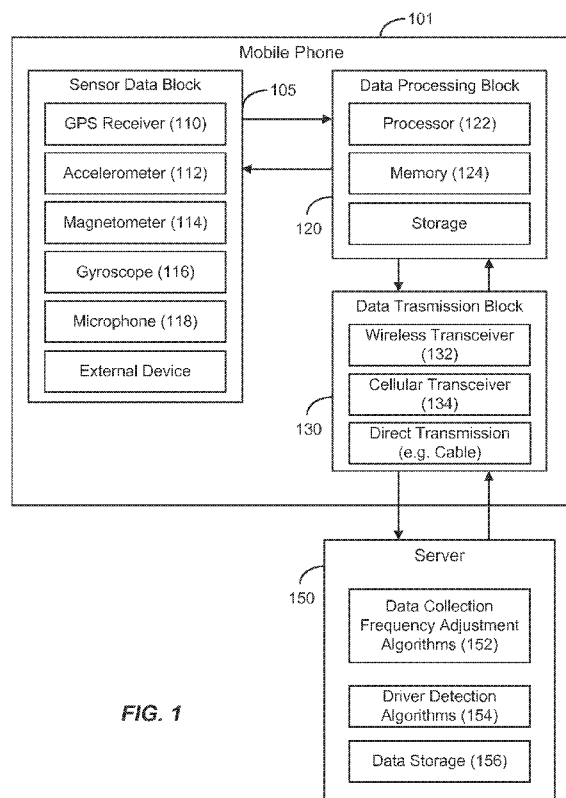


FIG. 1

(57) Abstract: A method of determining vehicle entry information for a user includes obtaining a yaw measurement using a mobile device, determining, using a processor, a first time span associated with a user entering a vehicle, and determining, using the processor, a second time span associated with a user exiting the vehicle. The method also includes determining that a change in magnitude over a portion of the yaw measurement is greater than a predetermined threshold over at least one of the first time span or the second time span and determining an angular change of the yaw measurement over the predetermined threshold. The method further includes associating right hand entry with the vehicle entry information if the angular orientation of the yaw measurement is clockwise and associating left hand entry with the vehicle entry information if the angular orientation of the yaw measurement is counter-clockwise.



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/77544

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01P 15/00 (2014.01); H05K 11/02 (2014.01)

USPC - 702/141; 455/345

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)

USPC: 702/141; 455/345

IPC(8): G01P 15/00 (2014.01); H05K 11/02 (2014.01)

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

USPC: 340/669; 455/418, 455/456.4, 455/456.1, 455/556.1, 455/574, 455/344, 455/345, 455/550.1; 701/51, 701/1, 701/2; 702/141; 704/270 (Keyword limited; terms below)

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

PatBase; Google (Scholar, Patents, Web)

Terms used: detect vehicle entry exit mobile yaw time (period OR span) (change OR delta) magnitude angle right left clockwise counterclockwise z-axis acceleration gravity "40 degrees"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/0071151 A1 (ABRAMSON et al.), 22 March 2012 (22.03.2012), entire document, especially Abstract; para [0020], [0097], [0188], [0194], [0200], [0206], [0218]	1-5
A	US 2012/0214463 A1 (SMITH et al.), 23 August 2012 (23.08.2012), entire document	1-5

☐ Further documents are listed in the continuation of Box C.



* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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)

"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

Date of the actual completion of the international search

23 June 2014 (23.06.2014)

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/77544

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

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

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

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

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

--- See Extra 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 additional fees, this Authority did not invite payment of additional fees.
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.:

1-5

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/77544

Continuation of Box No. III, Observations where unity of invention is lacking:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

Group I: Claims 1-5, directed to determining vehicle entry information for a user by using a mobile device to obtain a yaw measurements, determining vehicle entry and exit time spans associated with a user, determining changes associated with the yaw measurements, and based on the yaw measurements, associating either right or left hand entry with the vehicle entry information.

Group II: Claims 6-10, directed to aligning a mobile device having an accelerometer, a gyroscope, and an alignment axis to a reference frame of a vehicle by placing the mobile device in the vehicle, obtaining data from the mobile device's accelerometer, detecting one or more braking events and forward acceleration events, determining, using the accelerometer, a direction of travel of the vehicle, obtaining angular measurement data from the mobile device's gyroscope, and aligning, using the angular measurement data, the alignment axis of the mobile device to the reference frame of the vehicle.

Group III: Claims 11-20, directed to determining a position of a mobile device in a vehicle by obtaining data from the mobile device's accelerometer, obtaining angular orientation data from the mobile device's gyroscope, determining a start time of a driving event, determining an entry side for the mobile device prior to the driving event, detecting an acceleration event, aligning the mobile device to a reference frame of the vehicle, determining a front/back location of the mobile device, detecting a braking event, determining an end time of the driving event, determining an exit side for the mobile device after the driving event, and determining the position of the mobile device during at least a portion of the driving event.

The groups of inventions listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature of the Group I invention is wherein vehicle entry information for a user is determined by using a mobile device to obtain a yaw measurements, determining vehicle entry and exit time spans associated with a user, determining changes associated with the yaw measurements, and based on the yaw measurements, associating either right or left hand entry with the vehicle entry information, not required by Groups II or III (See Figs. 5, 7B and 7C for example).

The special technical feature of the Group II invention is wherein aligning a mobile device having an accelerometer, a gyroscope, and an alignment axis to a reference frame of a vehicle by placing the mobile device in the vehicle, determining, using the accelerometer, a direction of travel of the vehicle, not required by Groups I or III (See Fig. 9A for example).

The special technical feature of the Group III invention is wherein a position of a mobile device in a vehicle is determined by determining a start time of a driving event, determining an entry side for the mobile device prior to the driving event, determining a front/back location of the mobile device, determining an end time of the driving event, determining an exit side for the mobile device after the driving event, and determining the position of the mobile device during at least a portion of the driving event, not required by Groups I or II (See Fig. 12A, 16 and 18A for example).

Groups I-III share the technical features of, in various combination, obtaining position and/or orientation data corresponding to a user and/or mobile device and a vehicle by utilizing a mobile device. However, these shared technical features fail to represent a contribution over the prior art of US 2012/0071151 A1 to Abramson et al. (hereinafter 'Abramson'), which discloses obtaining position and/or orientation data corresponding to a user and/or mobile device (para [0014]-[0016], [0028] - "determining at least one of (a) an in-vehicle role of a user; and (b) an in-vehicle location of a first mobile device"; "orientation of the mobile device relative to a coordinate system of a vehicle") and a vehicle by utilizing a mobile device (para [0014]-[0016], [0028] - "based on the orientation, at least one of: (i) interpreting one or more subsequent inputs of the mobile device in relation to the coordinate system of the vehicle; and (ii) transforming the one or more subsequent inputs originating at the first device into values that are comparable with the coordinate system of the vehicle").

Groups I and III additionally share the technical feature of determining an [vehicle] entry side for the mobile device. However, these shared technical features fail to represent a contribution over the prior art of Abramson, which discloses determining an [vehicle] entry side for the mobile device (para [0206] - "Entry & In-Vehicle Movements--The signature of a user entering a vehicle, as perceived by one or more of sensors 145 of the user's mobile device 105, is also identifiable. The signatures for entering a vehicle on the right side are different than those for entering on the left side (mobile device 105 experiences lateral acceleration to the left in the former case and to the right in the latter case--which can be determine using an integration of the axis-aligned acceleration figures at the relevant timespan before the car began to move)").

Groups II and III additionally share the technical features of detecting at least one acceleration event; and detecting at least one braking event. However, these shared technical features fail to represent a contribution over the prior art of Abramson, which discloses detecting at least one acceleration event (para [0097], [0107], [0189] - "inputs from mobile device 105 can be processed against inputs from vehicle data system 164 (which, in turn, originate at the car itself), thereby enabling the association of various inputs from mobile device 105 with events such as the accelerating, braking, and/or swerving of the car"; "accelerometers 145A and/or gyroscope 145B of mobile device 105 can detect certain accelerations"); and detecting at least one braking event (para [0097], [0107], [0256] - "acceleration and deceleration movements detected by accelerometer").

Thus, the inventions listed as Groups I-III lack unity of invention because they do not share a same or corresponding special technical feature providing a contribution over the prior art.