UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

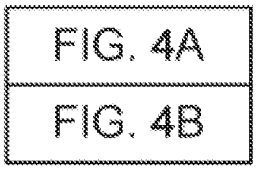
PATENT NO. : 10,882,399 B2
APPLICATION NO. : 16/433703
DATED : January 5, 2021
INVENTOR(S) : Koebler et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Drawings

Page 5 of the drawings, FIG. 4A, at the top left corner, above element 401, the following should be present to indicate that FIGS. 4A and 4B form a single FIG. 4 spread out over 2 pages:

FIG. 4



Signed and Sealed this
Tenth Day of August, 2021

Drew Hirshfeld
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	06/06/2019	Martin Koebler	INVN-00142	8048

141471 7590 07/20/2021

Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

EXAMINER	
TISSOT, ADAM D	

ART UNIT	PAPER NUMBER
3663	

NOTIFICATION DATE	DELIVERY MODE
07/20/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

gmathis@inventlyauto.com
uspto@stevenslawgroup.com

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Patent No.: 10882399
Issue Date: 01/05/2021
Appl. No.: 16/433,703
Filed: 06/06/2019

PART (A) RESPONSE FOR CERTIFICATES OF CORRECTION

This is a decision on the Certificate of Correction request filed 10 May 2021.

The request for issuance of Certificate of Correction for the above-identified correction(s) under the provisions of 37 CFR 1.322 and/or 1.323 is hereby:

(Check one)
☑ Approved ☐ Approved in Part ☐ Denied

Comments: ____

PART (B) PETITION UNDER 37 CFR 1.324 OR 37 CFR 1.48

☐ This is a decision on the petition filed ____ to correct inventorship under 37 CFR 1.324.

☐ This is a decision on the request under 37 CFR 1.48, petition filed ____. In view of the fact that the patent has already issued, the request under 37 CFR 1.48 has been treated as a petition to correct inventorship under 37 CFR 1.324.

The petition is hereby: ☐ Granted ☐ Dismissed

Comment: ____

The patented filed is being forwarded to Certificate of Corrections Branch for issuance of a certificate naming only the actual inventor or inventors.

/ANGELA Y ORTIZ/
Supervisory Patent Examiner, Art Unit 3663
Technology Center 3600
Phone: (571)272-1206

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov CoC Central Phone Number: (703) 756-1814

PTO/SB/44 (09-07)
Approved for use through 03/31/2023. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10882399

APPLICATION NO.: 16433703

ISSUE DATE : Jan. 5, 2021

INVENTOR(S) : Koebler et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings:

On page 5 of the drawings, FIG. 4A, at the top left corner, above element 401, the following should be present to indicate that FIGS. 4A and 4B form a single FIG. 4 spread out over 2 pages:

FIG. 4

FIG. 4A

FIG. 4B

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Stevens Law Group
1754 Technology Drive, Suite 226
San Jose, CA 95110

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt	
EFS ID:	42685856
Application Number:	16433703
International Application Number:	
Confirmation Number:	8048
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Customer Number:	141471
Filer:	David R. Stevens/Annette Tri
Filer Authorized By:	David R. Stevens
Attorney Docket Number:	INVN-00142
Receipt Date:	10-MAY-2021
Filing Date:	06-JUN-2019
Time Stamp:	19:41:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	Communication.pdf	89747 eed14b6062ff81f883bdc25e604b670b9956a610	no	3

Warnings:

Information:					
2	Request for Certificate of Correction	Certificate_of_Correction.pdf	146468 03f83f0d89ec22a2650ee4df9b5c569b457681c8	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	236215	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin Koebler	Art Unit:	3663
Serial No:	16/433,703	Examiner:	Adam D. Tissot
Filed:	June 6, 2019		
Title:	Electric Vehicle Power Management System		

* * *

COMMUNICATION

Commissioner for Patents
Office of Data Management Attention: Certificates of Correction Branch
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

A certificate of correction is requested for the above patent, as indicated below.

Certificate of Correction Request

Patent Number: 10882399

Application Number: 16433703

Inventor(s): Koebler et al.

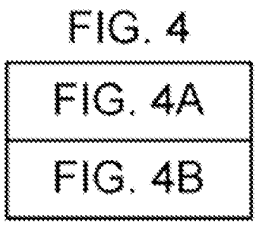
Issue Date: Jan. 5, 2021

Title of Invention: Electric Vehicle Power Management System

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings:

On page 5 of the drawings, FIG. 4A, at the top left corner, above element 401, the following should be present to indicate that FIGS. 4A and 4B form a single FIG. 4 spread out over 2 pages:



Statement of Facts Supporting the Requested Corrections

The drawings as originally filed, of record in the file wrapper, included the above item, and the applicant filed no drawing edits during prosecution. Accordingly, the removal of this item was an Office error, and therefore no fee is submitted herewith. Form PTO/SB/44 is included with this correspondence.

Conclusion

The undersigned can be reached at the telephone number set out below. The Commissioner is authorized to charge any additional fees to process this Certificate, or credit any over-payments that may apply, to our Deposit Account No. 50-2421.

Respectfully submitted,

Dated: May 10, 2021

____/David R. Stevens/____
David R. Stevens
Reg. No. 38,626

Stevens Law Group
1754 Technology Dr., Ste. 226
San Jose, CA 95110
Tel (408) 288-7588
Fax (408) 288-7542

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 10,882,399 B2
APPLICATION NO. : 16/433703
DATED : January 5, 2021
INVENTOR(S) : Koebler et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

The equation at Column 16 Lines 25-28 should be moved to after the words "the equation:" at Column 16 Line 34.

The mathematical expression at Column 16 Lines 37-38 should be deleted.

The mathematical expression at Column 16 Lines 43-44 should be moved to after the words "equation include:" at Column 16 Line 36.

Signed and Sealed this
Thirtieth Day of March, 2021

Drew Hirshfeld
Performing the Functions and Duties of the
Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

PTO/SB/44 (09-07)
Approved for use through 03/31/2023. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10882399

APPLICATION NO.: 16433703

ISSUE DATE : Jan. 5, 2021

INVENTOR(S) : Koebler et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the specification:

The equation at column 16 lines 25-28 should be moved to after the words "the equation:" at column 16 line 34.

The mathematical expression at column 16 lines 37-38 should be deleted.

The mathematical expression at column 16 lines 43-44 should be moved to after the words "equation include:" at column 16 line 36.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Stevens Law Group
1754 Technology Drive, Suite 226
San Jose, CA 95110

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	Martin Koebler	Art Unit:	3663
Serial No:	16/433,703	Examiner:	Adam D. Tissot
Filed:	June 6, 2019		
Title:	Electric Vehicle Power Management System		

* * *

COMMUNICATION

Commissioner for Patents
Office of Data Management Attention: Certificates of Correction Branch
P. O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

A certificate of correction is requested for the above patent, as indicated below.

Certificate of Correction Request

Patent Number: 10882399

Application Number: 16433703

Inventor(s): Koebler et al.

Issue Date: Jan. 5, 2021

Title of Invention: Electric Vehicle Power Management System

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the specification:

The equation at column 16 lines 25-28 should be moved to after the words "the equation:" at column 16 line 34.

The mathematical expression at column 16 lines 37-38 should be deleted.

The mathematical expression at column 16 lines 43-44 should be moved to after the words "equation include:" at column 16 line 36.

Statement of Facts Supporting the Requested Corrections

In the specification as originally filed, a few mathematical equations/expressions were in the wrong locations. These were errors of the applicant. Additionally, in the patent as issued, one mathematical expression appears twice. The corrections made herein are only to move the equations/expressions to the proper locations and to delete the duplicate expression. Form PTO/SB/44 is included with this correspondence, and since at least one of the errors was not an Office error, the appropriate fee is submitted herewith.

Conclusion

The undersigned can be reached at the telephone number set out below. The Commissioner is authorized to charge any additional fees to process this Certificate, or credit any over-payments that may apply, to our Deposit Account No. 50-2421.

Respectfully submitted,

Dated: February 16, 2021

__/David R. Stevens/____
David R. Stevens
Reg. No. 38,626

Stevens Law Group
1754 Technology Dr., Ste. 226
San Jose, CA 95110
Tel (408) 288-7588
Fax (408) 288-7542

Electronic Patent Application Fee Transmittal

Application Number:	16433703
Filing Date:	06-Jun-2019
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Filer:	David R. Stevens/Annette Tri
Attorney Docket Number:	INVN-00142

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
CERTIFICATE OF CORRECTION	2811	1	160	160

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Electronic Acknowledgement Receipt	
EFS ID:	41936161
Application Number:	16433703
International Application Number:	
Confirmation Number:	8048
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Customer Number:	141471
Filer:	David R. Stevens/Annette Tri
Filer Authorized By:	David R. Stevens
Attorney Docket Number:	INVN-00142
Receipt Date:	16-FEB-2021
Filing Date:	06-JUN-2019
Time Stamp:	17:00:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	E20212FH00504818
Deposit Account	502421
Authorized User	Annette Tri
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	Certificate_of_Correction.pdf	179598 15ae822b83769c4b9db158867c9330f5c5b3841d	no	2
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	Communication.pdf	80266 540d6fed45b323f6ae3e12556762ed9a20afd193	no	3
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30445 10913722faef8c65ddf9513750001ab59b6007d7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	290309		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	01/05/2021	10882399	INVN-00142	8048

141471 7590 12/16/2020

Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 48 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Martin Koebler, Saal/Donau, GERMANY;
Invently Automotive Inc., Los Altos, CA;
Nicole G. Goldstein, Woodside, CA;
Stephen J. Brown, Malibu, CA;
Jason H. Harper, Pleasanton, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

IR103 (Rev. 10/09)

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

141471 7590 09/23/2020
Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Annette Tri	(Typed or printed name)
/Annette Tri/	(Signature)
11/25/2020	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	06/06/2019	Martin Koebler	INVN-00142	8048

TITLE OF INVENTION: Electric Vehicle Power Management System

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	12/23/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
TISSOT, ADAM D	3663	701-123000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 David R. Stevens
2 Stevens Law Group
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Invently Automotive Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Los Altos, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 50-2421

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /David R. Stevens/ Date 11/25/2020

Typed or printed name David R. Stevens Registration No. 38626

Electronic Patent Application Fee Transmittal

Application Number:	16433703
Filing Date:	06-Jun-2019
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Filer:	David R. Stevens/Annette Tri
Attorney Docket Number:	INVN-00142

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**500**

Electronic Acknowledgement Receipt	
EFS ID:	41232778
Application Number:	16433703
International Application Number:	
Confirmation Number:	8048
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Customer Number:	141471
Filer:	David R. Stevens/Annette Tri
Filer Authorized By:	David R. Stevens
Attorney Docket Number:	INVN-00142
Receipt Date:	25-NOV-2020
Filing Date:	06-JUN-2019
Time Stamp:	20:01:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$500
RAM confirmation Number	E2020AOK02119475
Deposit Account	502421
Authorized User	Annette Tri
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	Issue_Fee.pdf	94648 50e87bcdce9342cfa943d61f61218c88d905da8c	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30264 d91b69e3b072fcb4016e7201ed1697eafdaca317	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	124912		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

141471 7590 09/23/2020

Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

EXAMINER	
TISSOT, ADAM D	
ART UNIT	PAPER NUMBER
3663	

DATE MAILED: 09/23/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	06/06/2019	Martin Koebler	INVN-00142	8048

TITLE OF INVENTION: Electric Vehicle Power Management System

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	12/23/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

141471 7590 09/23/2020
Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	06/06/2019	Martin Koebler	INVN-00142	8048

TITLE OF INVENTION: Electric Vehicle Power Management System

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	12/23/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
TISSOT, ADAM D	3663	701-123000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑Issue Fee ❑Publication Fee (if required) ❑Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/433,703	06/06/2019	Martin Koebler	INVN-00142	8048

141471 7590 09/23/2020

Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

EXAMINER	
TISSOT, ADAM D	
ART UNIT	**PAPER NUMBER**
3663	

DATE MAILED: 09/23/2020

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/433,703	Applicant(s) Koebler et al.	
	Examiner ADAM D TISSOT	Art Unit 3663	AIA (FITF) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to claims of 6/6/2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 9/26/2019.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/ADAM D TISSOT/
Primary Examiner, Art Unit 3663

Notice of References Cited	Application/Control No. 16/433,703	Applicant(s)/Patent Under Reexamination Koebler et al.	
	Examiner ADAM D TISSOT	Art Unit 3663	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6370472-B1	04-2002	Fosseen; Dwayne	B60K31/0058	701/102
*	B	US-20020177929-A1	11-2002	Kumar, Ajith Kuttannair	B60L15/2045	701/19
*	C	US-6522955-B1	02-2003	Colborn; Jeffrey A.	H02J3/005	700/286
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	Art Unit
	ADAM D TISSOT	3663

CPC						
Symbol					Type	Version
B60K	/	35	/	00	F	2013-01-01
B60L	/	58	/	12	I	2019-02-01
B60L	/	15	/	2045	I	2013-01-01
B60L	/	50	/	62	I	2019-02-01
G06F	/	7	/	00	I	2013-01-01
B60L	/	8	/	003	I	2013-01-01
B60L	/	7	/	12	I	2013-01-01
B60L	/	3	/	12	I	2013-01-01
G08G	/	1	/	096844	I	2013-01-01
G08G	/	1	/	096775	I	2013-01-01
G07C	/	5	/	085	I	2013-01-01
G01C	/	21	/	3617	I	2013-01-01
G01C	/	21	/	3469	I	2013-01-01
B60W	/	50	/	0097	I	2013-01-01
B60W	/	30	/	143	I	2013-01-01
B60W	/	10	/	11	I	2013-01-01
B60W	/	10	/	06	I	2013-01-01
B60T	/	13	/	586	I	2013-01-01
B60T	/	7	/	22	I	2013-01-01
B60T	/	7	/	18	I	2013-01-01
B60T	/	1	/	10	I	2013-01-01
B60L	/	58	/	16	I	2019-02-01
G07C	/	5	/	08	I	2013-01-01
B60K	/	2370	/	174	A	2019-05-01
B60K	/	2370	/	15	A	2019-05-01
Y02T	/	10	/	72	A	2013-01-01
Y02T	/	90	/	16	A	2013-01-01
B60L	/	2240	/	645	A	2013-01-01
B60L	/	2260	/	50	A	2013-01-01
B60L	/	2260	/	28	A	2013-01-01
B60L	/	2250	/	16	A	2013-01-01

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	04 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office

Part of Paper No.: 20200904

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	Art Unit
	ADAM D TISSOT	3663

CPC						
Symbol					Type	Version
B60L	/	2250	/	10	A	2013-01-01
B60L	/	2240	/	68	A	2013-01-01
B60L	/	2240	/	667	A	2013-01-01
B60L	/	2240	/	665	A	2013-01-01
B60L	/	2240	/	662	A	2013-01-01
B60L	/	2240	/	647	A	2013-01-01
B60L	/	2240	/	642	A	2013-01-01
B60L	/	2240	/	622	A	2013-01-01
B60L	/	2240	/	549	A	2013-01-01
B60L	/	2240	/	547	A	2013-01-01
B60L	/	2240	/	545	A	2013-01-01
B60L	/	2240	/	445	A	2013-01-01
B60L	/	2240	/	443	A	2013-01-01
B60L	/	2240	/	441	A	2013-01-01
B60L	/	2240	/	423	A	2013-01-01
B60L	/	2240	/	421	A	2013-01-01
B60L	/	2240	/	12	A	2013-01-01
B60L	/	2220	/	44	A	2013-01-01
G07C	/	5	/	008	A	2013-01-01
B60W	/	2530	/	14	A	2013-01-01
B60T	/	2210	/	36	A	2013-01-01
B60T	/	2201	/	04	A	2013-01-01
B60W	/	2552	/	20	A	2020-02-01
B60W	/	2556	/	50	A	2020-02-01
Y02T	/	10	/	40	A	2013-01-01
Y02T	/	10	/	62	A	2013-01-01
Y02T	/	10	/	64	A	2013-01-01
Y02T	/	10	/	70	A	2013-01-01
Y02T	/	10	/	7072	A	2013-01-01

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	04 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	**Art Unit**
	ADAM D TISSOT	3663

CPC Combination Sets									
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	04 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20200904

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	**Art Unit**
	ADAM D TISSOT	3663

INTERNATIONAL CLASSIFICATION				
CLAIMED				
G06G	/	7	/	70

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	04 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20200904

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	**Art Unit**
	ADAM D TISSOT	3663

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	04 September 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20200904

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/433,703	Koebler et al.
	Examiner	Art Unit
	ADAM D TISSOT	3663

CPC - Searched*		
Symbol	**Date**	**Examiner**
G07C5	09/04/2020	adt
G01C21	09/04/2020	adt
B60L3,15,2250	09/04/2020	adt
Y02T10,90	09/04/2020	adt

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
See EAST search history	09/04/2020	adt
PLUS results - no hits	09/04/2020	adt

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
	See EAST text search	09/04/2020	adt

/ADAM D TISSOT/ Primary Examiner, Art Unit 3663	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	52	(US-20020072838-$ | US-20020120390-$ | US-20020134602-$ | US-20020195288-$ | US-20030006914-$ | US-20030015358-$ | US-20030015874-$ | US-20030033069-$ | US-20040074682-$ | US-20040084237-$ | US-20040133336-$ | US-20040193420-$ | US-20040230376-$ | US-20050052290-$ | US-20050228553-$ | US-20050233185-$ | US-20060005736-$ | US-20060009890-$ | US-20060029296-$ | US-20060052917-$ | US-20060095195-$ | US-20080021628-$ | US-20080027639-$ | US-20080033624-$ | US-20090132113-$ | US-20160009304-$ | US-4347496-$ | US-4408293-$ | US-4459671-$ | US-5315977-$ | US-5396426-$ | US-5487002-$ | US-5627752-$ | US-5650931-$ | US-5842142-$ | US-5913917-$ | US-5929609-$ | US-5999864-$ | US-6061625-$ | US-6064937-$ | US-6070118-$ | US-6116363-$ | US-6135918-$ | US-6163690-$ | US-6199001-$ | US-6206123-$ | US-6233515-$ | US-6266588-$ | US-6266610-$ | US-6278915-$ | US-6307277-$ | US-6314347-$).DID.	US-PGPUB; USPAT	OR	OFF	2020/05/12 09:05
S2	1	"20030033069"	US-PGPUB; USPAT	OR	OFF	2020/05/12 09:11
S3	57	"6370472"	US-PGPUB; USPAT	OR	OFF	2020/05/12 09:11
S4	8	("2003/0033069").URPN.	USPAT	OR	OFF	2020/05/12 09:17
S5	10	histor$5 near3 brak$4 and (predict$4 or anticipat$4 or foresee or estimat$4 or project$4 or expect$4 or future or probable or likely or potential or eventual) with brak$4 with environment	US-PGPUB; USPAT	OR	OFF	2020/05/12 09:23
S6	341	histor$5 near3 brak$4 and (predict$4 or anticipat$4 or foresee or estimat$4 or project$4 or expect$4 or future or probable or likely or potential or eventual) with brak$4	US-PGPUB; USPAT	OR	OFF	2020/05/12 09:32
S7	108	"7925426"	US-PGPUB; USPAT	OR	OFF	2020/09/02 10:58

S8	15	(US-4347496-$ | US-4459671-$ | US-5315977-$ | US-5929609-$ | US-5999864-$ | US-6064937-$ | US-6307277-$ | US-6370472-$ | US-6427107-$ | US-6465908-$ | US-6522955-$ | US-6662642-$ | US-6701897-$ | US-6809429-$ | US-6838858-$).DID.	US-PGPUB; USPAT	OR	OFF	2020/09/02 11:23
S9	3	S8 and voice	US-PGPUB; USPAT	OR	OFF	2020/09/02 12:02
S10	17	(electric near3 vehicle or EV) and (route near4 segment) and remote near3 server and (predict$4 or anticipat$4 or foresee$5 or estimat$4 or project$4 or expect$4 or future or probable or likely or potential or eventual) with power	USPAT	OR	OFF	2020/09/03 09:37
S11	48	(electric near3 vehicle or EV) and (route near4 segment) and remote near3 server and (predict$4 or anticipat$4 or foresee$5 or estimat$4 or project$4 or expect$4 or future or probable or likely or potential or eventual) with power	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:38
S12	337	(electric near3 vehicle or EV) and (route near4 segment) and (predict$4 or anticipat$4 or foresee$5 or estimat$4 or project$4 or expect$4 or future or probable or likely or potential or eventual) with power	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:39
S13	271	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database)	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:50
S14	36	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database) and voice near command	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:50
S15	209	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database) and voice	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:50
S16	271	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database)	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:52
S17	19,726	(electric near3 vehicle or EV) and (remote or external) near3 (server or database)	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:53
S18	12,363	(electric near3 vehicle or EV) and (remote or external) near3 (server or database) and voice	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:53
S19	1,356	(electric near3 vehicle or EV) and (remote or external) near3 (server or database) and voice near command	US-PGPUB; USPAT	OR	OFF	2020/09/03 09:53

S20	21,962	(G07C5/085 G01C21/34 G01C21/3617 B60L3/12 B60L15/2045 B60L2250/12 Y02T10/64 Y02T90/161 Y02T10/72 Y02T10/7283 G07C5/008 Y02T90/16 Y02T10/645).cpc.	USPAT	OR	OFF	2020/09/04 09:38
S21	12,363	(electric near3 vehicle or EV) and (remote or external) near3 (server or database) and voice	US-PGPUB; USPAT	OR	OFF	2020/09/04 09:38
S22	321	(G07C5/085 G01C21/34 G01C21/3617 B60L3/12 B60L15/2045 B60L2250/12 Y02T10/64 Y02T90/161 Y02T10/72 Y02T10/7283 G07C5/008 Y02T90/16 Y02T10/645).cpc. and S21	USPAT	OR	OFF	2020/09/04 09:38
S23	321	S20 and S21	US-PGPUB; USPAT	OR	OFF	2020/09/04 09:39
S24	744	(G07C5/085 G01C21/34 G01C21/3617 B60L3/12 B60L15/2045 B60L2250/12 Y02T10/64 Y02T90/161 Y02T10/72 Y02T10/7283 G07C5/008 Y02T90/16 Y02T10/645).cpc. and S21	US-PGPUB; USPAT	OR	OFF	2020/09/04 09:39
S25	1,303	(G07C5/$ G01C21/$ B60L3/$ B60L15/$ B60L2250/$ Y02T10/$ Y02T90/$).cpc. and S21	US-PGPUB; USPAT	OR	OFF	2020/09/04 09:48
S26	29	(US-7369938-$ | US-7386389-$ | US-7392194-$ | US-7433889-$ | US-7454291-$ | US-7456509-$ | US-7479897-$ | US-7497201-$ | US-7509193-$ | US-7512477-$ | US-7528572-$ | US-7532960-$ | US-7617108-$ | US-7647153-$ | US-7665559-$ | US-7715958-$ | US-7747365-$ | US-7751973-$ | US-7812555-$ | US-7822538-$ | US-7873471-$ | US-7880436-$ | US-7899584-$ | US-8069940-$ | US-8135531-$ | US-8290665-$ | US-8924049-$ | US-9193268-$ | US-9619203-$).DID.	US-PGPUB; USPAT	OR	OFF	2020/09/04 10:11
S27	186	(US-10162866-$ | US-1130415-$ | US-19749582-$ | US-2026373-$ | US-4543480-$ | US-4640882-$ | US-4677405-$ | US-4786574-$ | US-20020062183-$ | US-20020072838-$ | US-20020107618-$ | US-20020120390-$ | US-20020134602-$ | US-20020174798-$ | US-20020195288-$ | US-20030006914-$ | US-20030015358-$ | US-20030015874-$ | US-20030033069-$ | US-20030074115-$ | US-20030098187-$ | US-20040074682-$ | US-20040084237-$ | US-20040133336-$ | US-20040193420-$ | US-20040230376-$ | US-20050052290-$ | US-20050061562-$ | US-	US-PGPUB; USPAT	OR	OFF	2020/09/04 10:11

		20050228553-$ | US-20050233185-$ | US-20060005736-$ | US-20060009890-$ | US-20060029296-$ | US-20060052917-$ | US-20060095195-$ | US-20070112475-$ | US-20080021628-$ | US-20080027639-$ | US-20080033624-$ | US-20090132113-$ | US-20160009304-$ | US-4305254-$ | US-4347496-$ | US-4408293-$ | US-4459671-$ | US-4725956-$ | US-5161634-$ | US-5176213-$ | US-5177685-$ | US-5214707-$ | US-5247705-$ | US-5315977-$ | US-5343399-$ | US-5343970-$ | US-5359228-$ | US-5396426-$ | US-5397991-$ | US-5487002-$ | US-5592385-$ | US-5627752-$ | US-5650931-$ | US-5656921-$ | US-5760713-$ | US-5775449-$ | US-5778326-$ | US-5842142-$ | US-5903112-$ | US-5913917-$ | US-5929609-$ | US-5959420-$ | US-5983188-$ | US-5983189-$ | US-5999864-$ | US-6061625-$ | US-6064937-$ | US-6070118-$ | US-6073712-$ | US-6116363-$ | US-6135918-$ | US-6163690-$ | US-6181996-$ | US-6199001-$ | US-6206123-$ | US-6208034-$ | US-6208931-$ | US-6209672-$ | US-6230496-$ | US-6233508-$ | US-6233515-$ | US-6242873-$ | US-6266588-$ | US-6266610-$ | US-6269290-$ | US-6278915-$ | US-6307277-$ | US-6314347-$ | US-6321143-$ | US-6335610-$ | US-6339706-$ | US-6344732-$ | US-6362602-$ | US-6370472-$ | US-6374173-$ | US-6393573-$ | US-6397601-$ | US-6401024-$ | US-6404880-$ | US-6415217-$ | US-6427107-$ | US-6436005-$ | US-6441574-$ | US-6449537-$ | US-6465908-$ | US-6470240-$ | US-6484086-$ | US-6484830-$ | US-6487477-$ | US-6490511-$ | US-6496107-$ | US-6500089-$ | US-6512967-$ | US-6522955-$ | US-6526335-$ | US-6532447-$ | US-6591758-$ | US-6629034-$ | US-6636787-$ | US-6640186-$ | US-6662096-$ | US-6662642-$ | US-6670788-$ | US-6687581-$ | US-6687595-$ | US-6701251-$ | US-6701897-$ | US-6778895-$ | US-6794848-$ | US-6809429-$ | US-6814170-$ | US-6838858-$ | US-6843337-$ | US-6845251-$ | US-6847189-$ | US-6877488-$ | US-6895320-$ | US-6909200-$ | US-6917693-$ | US-6928344-$ | US-6931307-$ | US-6931309-$ | US-6949841-$ | US-6949897-$ | US-6982540-$ | US-6991053-$ | US-7013205-$ | US-7021409-$ | US-7026957-$ | US-7061131-$ | US-7073615-$ | US-7099770-$ | US-7102496-$ | US-7120520-$ | US-7124027-$ | US-7167787-$ | US-7177750-$ |			

		US-7188012-$ | US-7197390-$ | US-7222004-$ | US-7228925-$ | US-7233861-$ | US-7243246-$ | US-7252165-$ | US-7268442-$ | US-7272497-$ | US-7276815-$ | US-7283838-$ | US-7289039-$ | US-7295902-$ | US-7317973-$ | US-7321354-$ | US-7321825-$ | US-7337055-$ | US-7346449-$ | US-7360615-$ | US-7363122-$ | US-7367414-$).DID.				

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S28	3	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database) and voice near command	USPAT	OR	OFF	2020/09/04 09:53
S29	33	(electric near3 vehicle or EV) and (route near4 segment) and (remote or external) near3 (server or database) and voice near command	US-PGPUB	OR	OFF	2020/09/04 09:53
S30	34	"Term Removed"	US-PGPUB	OR	OFF	2020/09/04 10:11
S31	0	"Term Removed"	US-PGPUB	OR	OFF	2020/09/04 10:11

9/4/2020 10:20:29 AM
C:\Users\atissot\Documents\EAST\Workspaces\16433703.wsp

Bibliographic Data

Application No: 16/433,703

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /ADAM D TISSOT/ (Examiner's Signature) (Initials)

Title: Electric Vehicle Power Management System

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
06/06/2019	701	3663	INVN-00142
RULE			

APPLICANTS

Invently Automotive Inc., Los Altos, CA, UNITED STATES

INVENTORS

Martin Koebler, Saal/Donau, GERMANY

Nicole G. Goldstein, Woodside, CA, UNITED STATES

Stephen J. Brown, Malibu, CA, UNITED STATES

Jason H. Harper, Pleasanton, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 15720032 09/29/2017

15720032 is a CON of 15626676 06/19/2017

15626676 is a CON of 14566848 12/11/2014 PAT 9682624

14566848 is a CON of 14206138 03/12/2014 PAT 8972162

14206138 is a CON of 13066189 04/08/2011 PAT 8712650

13066189 is a CIP of 11283137 11/17/2005 PAT 7925426

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

06/13/2019

** SMALL ENTITY **

STATE OR COUNTRY

GERMANY

ADDRESS

Stevens Law Group - Invently Automotive

1754 Technology Drive

Suite 226

San Jose, CA 95110
UNITED STATES

FILING FEE RECEIVED

$785

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

U.S. PATENTS/ U.S. PATENT APPLICATION PUBLICATIONS

Examiner Initials	Document No.	Publish/Grant Date	Inventors	Pages, Columns, Lines Where Relevant
	US20040193420A1	2004-09-30	Kennewick, Robert A	
	US8924049B2	2014-12-30	Kumar, Ajith Kuttannair	
	US5929609	1999-07-27	Joy, George Cecil	
	US7454291B2	2008-11-18	Kawakami, Seiji	
	US6393573B1	2002-05-21	Gillespie, Douglas Brian	
	US7177750B2	2007-02-13	Schröder, Marko	
	US6794848B2	2004-09-21	Shinada, Akira	
	US7317973B2	2008-01-08	Dieterle, Werner	
	US7346449B2	2008-03-18	Sato, Makoto	
	US7822538B2	2010-10-26	Hovestadt, Guido	
	US20020120390A1	2002-08-29	Bullock, James Blake	
	US6484086B2	2002-11-19	Jeon, Yong-won	
	US6687595B2	2004-02-03	Seto, Yoji	
	US7497201B2	2009-03-03	Hollenbeck, Bruce Phelps	
	US5913917	1999-06-22	Murphy, Michael D.	
	US7433889B1	2008-10-07	Barton, Mark A.	
	US7321354B1	2008-01-22	Jacobsen, Jeffrey	
	US6314347	2001-11-06	Kuroda, Kouichi;	
	US8135531B2	2012-03-13	Zhao, Side	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6116363	2000-09-12	Frank, Andrew A.	
	US6061625	2000-05-09	Fastenrath, Ulrich	
	US6465908B1	2002-10-15	Karuppana, Samy V.	
	US6470240B1	2002-10-22	Haynes, Ian Frederick	
	US20060029296A1	2006-02-09	King, Martin T.	
	US6070118	2000-05-30	Ohta, Takashi;	
	US6662642B2	2003-12-16	Breed, David S.	
	US20060009890A1	2006-01-12	Meister, Dirk	
	US6928344B2	2005-08-09	Mcwalter, William F	
	US4459671	1984-07-10	Teass, Garnette S.	
	US7647153B2	2010-01-12	Sugano, Takeshi	
	US6687581B2	2004-02-03	Deguchi, Yoshitaka	
	US20050052290A1	2005-03-10	Naden, Gary	
	US7289039B2	2007-10-30	Kato, Manabu	
	US6163690	2000-12-19	Lilja, Patrik	
	US20080033624A1	2008-02-07	Gronau, Ralph	
	US7013205B1	2006-03-14	Hafner, James Lee	
	US5842142	1998-11-24	Murray, Daniel J.	
	US20090132113A1	2009-05-21	Kumar, Ajith Kuttannair	
	US7386389B2	2008-06-10	Stolle, Uwe	
	US5999864	1999-12-07	Thiel, Kent O.	
	US6064937	2000-05-16	Yang, Chaemo	
	US20030006914A1	2003-01-09	Todoriki, Tsuyoshi	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6636787B2	2003-10-21	Yamaguchi, Kozo	
	US7512477B2	2009-03-31	Quigley, Jon M.	
	US6415217B1	2002-07-02	Higashimata, Akira	
	US6701897B2	2004-03-09	Chatfield, Glen F.	
	US6809429B1	2004-10-26	Frank, Andrew A.	
	US7873471B2	2011-01-18	Gieseke, Arnold	
	US5487002	1996-01-23	Diller, Robert W.	
	US7360615B2	2008-04-22	Salman, Mutasim A.	
	US7102496B1	2006-09-05	Ernst Jr., Raymond P..	
	US20060005736A1	2006-01-12	Kumar, Ajith Kuttannair	
	US7479897B2	2009-01-20	Gertsch, Jamie	
	US6838858B2	2005-01-04	Berneis, Paul Allen	
	US6931309B2	2005-08-16	Phelan, Joseph	
	US20020072838A1	2002-06-13	Mcclellan, Scott B.	
	US6522955B1	2003-02-18	Colborn, Jeffrey A.	
	US5650931	1997-07-22	Nii, Yoshihide	
	US7509193B2	2009-03-24	Kustosch, Mario	
	US6427107B1	2002-07-30	Chiu, George T. G.	
	US20080021628A1	2008-01-24	Tryon, Bruce W.	
	US20040230376A1	2004-11-18	Ichikawa, Shinji	
	US7099770B2	2006-08-29	Naden, Gary	
	US20040074682A1	2004-04-22	Fussey, Peter Michael	
	US6949897B2	2005-09-27	Wakashiro, Teruo;	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US20040084237A1	2004-05-06	Alfred Jr., Petrie E.	
	US7233861B2	2007-06-19	Van Buer, Darrel J.e	
	US6135918	2000-10-24	Bellinger, Steven M.	
	US20020195288A1	2002-12-26	Komiyama, Susumu	
	US6374173B1	2002-04-16	Ehlbeck, James M.	
	US6487477B1	2002-11-26	Woestman, Joanne T	
	US5315977	1994-05-31	Fosseen, Dwayne	
	US6199001	2001-03-06	Ohta, Takashi	
	US6266588	2001-07-24	Mcclellan, Scott B.	
	US8069940B2	2011-12-06	Nenno, Rudolf	
	US6814170B2	2004-11-09	Abe, Tatsuo	
	US5396426	1995-03-07	Hibino, Katsuhiko	
	US20060052917A1	2006-03-09	Schwarzhaupt, Andreas	
	US6436005B1	2002-08-20	Bellinger, Steven M.	
	US20040133336A1	2004-07-08	Fosseen, Dwayne	
	US6877488B2	2005-04-12	Washeleski, John	
	US6895320B2	2005-05-17	Bauer, Wolf-dietrich	
	US7367414B2	2008-05-06	Iida, Hiroaki	
	US20030015358A1	2003-01-23	Abe, Tatsuo	
	US6629034B1	2003-09-30	Kozak, Frank	
	US20060095195A1	2006-05-04	Nishimura, Takao	
	US6278915	2001-08-21	Deguchi, Yoshitaka	
	US6307277	2001-10-23	Tamai, Goro	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6401024B1	2002-06-04	Tange, Satoshi	
	US6233515	2001-05-15	Engelman, Gerald H.	
	US7899584B2	2011-03-01	Schricker, David R.	
	US6370472B1	2002-04-09	Fosseen, Dwayne	
	US8290665B2	2012-10-16	Placke, Lars	
	US20050228553A1	2005-10-13	Tryon, Bruce W.	
	US7337055B2	2008-02-26	Matsumoto, Shinji	
	US7369938B2	2008-05-06	Scholl, Gregor	
	US4347496	1982-08-31	Kubalak, Thomas P.	
	US7747365B1	2010-06-29	Lowrey, Larkin Hill	
	US7751973B2	2010-07-06	Ibrahim, Faroog Abdel-kareem	
	US20050233185A1	2005-10-20	Dunn, Glenn M.	
	US20030033069A1	2003-02-13	Bauer, Wolf-dietrich	
	US20030015874A1	2003-01-23	Abe, Tatsuo	
	US6206123	2001-03-27	Kim, Young-gab	
	US4408293	1983-10-04	Avins, Jack	
	US20160009304A1	2016-01-14	Kumar, Ajith Kuttannair	
	US6847189B2	2005-01-25	Frank, Andrew A.	
	US7124027B1	2006-10-17	Ernst Jr., Raymond P.	
	US5627752	1997-05-06	Buck, Michae	
	US9619203B2	2017-04-11	Tamir, Asaf	
	US20080027639A1	2008-01-31	Tryon, Bruce W.	
	US6843337B2	2005-01-18	Matsubara, Atsushi	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7243246B2	2007-07-10	Allen, Robert	
	US7167787B2	2007-01-23	Bastian, Dieter	
	US20020134602A1	2002-09-26	Kobayashi, Yosuke	
	US6266610	2001-07-24	Schultz, Robert L	
	US6991053B2	2006-01-31	Kuang, Ming Lang	
	US6662096B2	2003-12-09	Komiyama, Susumu	
	US7456509B2	2008-11-25	Gray Jr., Charles L.	
	US6269290	2001-07-31	Egami, Tsuneyuki	
	US6209672	2001-04-03	Severinsky, Alex J.	
	US6242873	2001-06-05	Drozdz, Piotr	
	US7532960B2	2009-05-12	Kumar, Ajith	
	US6512967B2	2003-01-28	Östberg,Claes	
	US7276815B2	2007-10-02	Algrain, Marcelo C.	
	US7061131B2	2006-06-13	King, Robert Dean	
	US5176213	1993-01-05	Kawai, Masao	
	US6314347	2001-11-06	Kuroda, Kouichi	
	US7268442B2	2007-09-11	Syed, Fazal	
	US6116363	2000-09-12	Frank, Andrew A.	
	US6073712	2000-06-13	Buglione, Arthur J.	
	US6449537B1	2002-09-10	Phillips, Anthony Mark	
	US5161634	1992-11-10	Ichihara, Masahiro	
	US6591758B2	2003-07-15	Kumar, Ajith Kuttannair	
	US7013205B1	2006-03-14	Hafner, James Lee	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US5775449	1998-07-07	Moroto, Shuzo	
	US5343970	1994-09-06	Severinsky, Alex J.	
	US20050182526A1	2005-08-18	Hubbard, Gregory A.	
	US6208034	2001-03-27	Yamaguchi, Katsuhiko	
	US20020107618A1	2002-08-08	Deguchi, Yoshitaka	
	US6484830B1	2002-11-26	Gruenwald, Robert	
	US7228925B2	2007-06-12	Hightower, Paul	
	US7021409B2	2006-04-04	Tamor, Michael Alan	
	US5397991	1995-03-14	Rogers, Wesley A.	
	US6362602B1	2002-03-26	Kozarekar, Shailesh S.	
	US5487002	1996-01-23	Diller, Robert W.	
	US6230496	2001-05-15	Hofmann, Lee Gregor	
	US7073615B2	2006-07-11	Mack, David J.	
	US7528572B2	2009-05-05	Masias, Alvaro	
	US7295902B2	2007-11-13	Chen, Jyh-shin	
	US7197390B2	2007-03-27	Yuan, Guohui	
	US6949841B1	2005-09-27	Cailleux, Helene	
	US6909200B2	2005-06-21	Bouchon, Nicolas Louis	
	US6441574B1	2002-08-27	Phillips, Anthony Mark	
	US20020174798A1	2002-11-28	Kumar, Ajith Kuttannair	
	US6670788B2	2003-12-30	Prabhu, Sameer	
	US7363122B2	2008-04-22	Bischoff, Claus	
	US6335610B1	2002-01-01	Winstead, Vincent John	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6982540B2	2006-01-03	Richter, Gerolf	
	US6208931	2001-03-27	Schoettle, Richard	
	US20030074115A1	2003-04-17	Yamaguchi, Musashi	
	US20030098187A1	2003-05-29	Phillips, Anthony Mark	
	US5959420	1999-09-28	Boberg, Evan S.	
	US6487477B1	2002-11-26	Woestman, Joanne T.	
	US6500089B2	2002-12-31	Lasson, Anders	
	US5359228	1994-10-25	Yoshida, Masato	
	US9193268B2	2015-11-24	Kumar, Ajith Kuttanair	
	US20050061562A1	2005-03-24	Mack, David J.	
	US6278915	2001-08-21	Deguchi, Yoshitaka	
	US6397601B2	2002-06-04	Morimoto, Kazuhiko	
	US4305254	1981-12-15	Kawakatsu, Shiro	
	US6344732B2	2002-02-05	Suzuki, Naoto	
	US7120520B2	2006-10-10	Seto, Keisuke	
	US5903112	1999-05-11	Yamada, Eiji	
	US6847189B2	2005-01-25	Frank, Andrew A.	
	US20020062183A1	2002-05-23	Yamaguchi, Musashi	
	US6490511B1	2002-12-03	Raftari, Abbas	
	US5627752	1997-05-06	Buck, Michael	
	US5656921	1997-08-12	Farrall, Simon David	
	US6321143	2001-11-20	Phillips, Anthony Mark	
	US5760713	1998-06-02	Yokoyama, Shoji	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7880436B2	2011-02-01	Fischer, Gerhard	
	US7252165B1	2007-08-07	Gruenwald, Robert	
	US5778326	1998-07-07	Moroto, Shuzo	
	US6233508	2001-05-15	Deguchi, Yoshitaka	
	US20040193420A1	2004-09-30	Kennewick, Robert A.	
	US5983188	1999-11-09	Roessle, Manfred	
	US6339706B1	2002-01-15	Tillgren, Magnus	
	US6778895B1	2004-08-17	Schwab, Manfred	
	US6640186B2	2003-10-28	Stefan, Jeffrey M.	
	US5983189	1999-11-09	Lee, See-woo	
	US6404880B1	2002-06-11	Stevens, Gilman R.	
	US5214707	1993-05-25	Fujimoto, Shoji	
	US4725956	1988-02-16	Jenkins, Michael W. M.	
	US7272497B2	2007-09-18	Koshiji, Yoshikazu	
	US6526335B1	2003-02-25	Treyz, Victor G.	
	US7617108B2	2009-11-10	Matsubara, Tsutomu	
	US6496107B1	2002-12-17	Himmelstein, Richard B.	
	US7321825B2	2008-01-22	Ranalli, Ronald J.	
	US6845251B2	2005-01-18	Everhart, Charles A.	
	US6917693B1	2005-07-12	Kiridena, Vijitha Senaka	
	US6532447B1	2003-03-11	Christensson, Nils	
	US6701251B2	2004-03-02	Stefan, Jeffrey M.	
	US5343399	1994-08-30	Yokoyama, Shoji	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7188012B2	2007-03-06	Salmeen, Irv T.	
	US7026957B2	2006-04-11	Rubenstein, Jeffrey D.	
	US5177685	1993-01-05	Davis, James R.	
	US5247705	1993-09-21	Attig, Joachim	
	US6181996	2001-01-30	Chou, Paul Bao-luo	
	US8290665B2	2012-10-16	Placke, Lars	
	US7392194B2	2008-06-24	Tanaka, Makoto	
	US5592385	1997-01-07	Katayama, Kazuyori	
	US6931307B2	2005-08-16	Everhart, Charles Allen	
	US20070112475A1	5/17/2007	Martin Koebler	
	US7222004B2	5/22/2007	Anderson	
	US7283838B2	10/16/2007	Lu, Wei	
	US7665559B2	2/23/2010	Jose De La Torre-Bueno	
	US7715958B2	5/11/2010	Kumar, Ajith Kuttannair	
	US7812555B2	10/12/2010	Rodwan Tarek Adra	

FOREIGN PATENT DOCUMENTS

Examiner Initials	Foreign Document Number	Country Code	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant
	2000075682	WO	12/14/2000	Kovacs	
	2004012250	JP	2004-01-15	Yamada	
	1130415	EP	2/9/2005	Hasegawa	
	2005115787	WO	12/8/2005	Harada	
	200722778	TW	6/1/2007	Chuang	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	102006009710	DE	6/14/2007	Chuang	
	2007155695	JP	6/14/2007	Kung	
	2008053789	WO	5/8/2008	Kurokawa	
	4543480	JP	9/15/2010	Hasegawa	
	10162866A1	DE	2003-07-10	GIERLING ARMIN	
	19749582A1	DE	1999-05-12	BASTIAN ANDREAS DR	

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

NON-PATENT LITERATURE DOCUMENTS	
Examiner Initials	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.
	"Answers.com", pp. 1-7, Answers.com, http://www.answers.com/topic/drag-coefficient-1.
	"Cell Specification Data", pp. 1-2, Kokam Co., Ltd., http://www.kokam.com/product/product-pdf/high-power/PL-301-SLPB60460330H-70ah-Grade.pdf
	Cassidy et al., "GM Sunraycer Case History/M101 lecture 4-1", Dec. 1, 1990, pp. 1-61, Society for Automotive Engineers, Inc., Warrendale, USA.
	Gong et al., Computationally efficient optimal power management for plug-in hybrid electric vehicles based on spatial-domain two-scale dynamic programming; Vehicular Electronics and Safety, 2008, ICVES 2008, IEEE International Conference on; Digital Object Identifier: 10.1109/ICVES.2008.4640882; Publication Year: 2008.
	Gong et al., Trip Based Power Management of Plug-in Hybrid Electric Vehicle with Two-Scale Dynamic Programming; Vehicle Power and Propulsion Conference, 2007. VPPC 2007. IEEE; Digital Object Identifier: 10.1109/VPPC.2007.4544089; Publication Year: 2007, pp. 12-19.
	Hibbs, "GM Sunraycer History/M101 lecture 2-2", Dec. 1, 1990, pp. 1-37, Society for Automotive Engineers, Inc., Warrendale, USA.
	Janach, Ultralight electric vehicle for mass transportation; Vehicle Power and Propulsion Conference, 2008. VPPC '08. IEEE; Digital Object Identifier: 10.1109/VPPC.2008.4677405; Publication Year: 2008, pp. 1-4.
	Johannesson et al., Assessing the Potential of Predictive Control for Hybrid Vehicle Powertrains Using Stochastic Dynamic Programming, Intelligent Transportation Systems, IEEE Transactions on vol. 8, Issue: 1; Digital Object Identifier: 10.1109/TITS.2006.884887; Publication Year: 2007, pp. 71-83.
	Kim et al., An adaptive address power saving method based on the prediction of power consumption in and AC PDP., Industrial Electronics, IEEE Transaction on, vol. 56, issue 12, Dec. 2009 pp. 4949-4948; Digital Object Identifier 10.1109/TIE.2009.2026373.
	Lovins, et al., "Winning the Oil Endgame", Mar. 1, 2005, p. 50, Rocky Mountain Institute, Snowmass, USA.

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	Ngo et al., An optimal control-based algorithm for Hybrid Electric Vehicle using preview route information; A.F.A.; American Control Conference (ACC), 2010; Publication Year: 2010, pp. 5818-5823.
	Roche et al., "The Speed of Light, The 1996 World Solar Challenge", 1997, pp. 43-46 & 189-194, UNSW.
	Shafiullah et al., Reduction of power consumption in sensor network applications using machine learning techniques; TENCON 2008—2008 IEEE Region 10 Conference; Digital Object Identifier: 10.1109/TENCON.2008.4766574; Publication Year: 2008, pp. 1-6.
	Xue et al., Traffic-Known Urban Vehicular Route Prediction Based on Partial Mobility Patterns; Parallel and Distributed Systems (ICPADS), 2009 15th International Conference on; Digital Object Identifier: 10.1109/ICPADS.2009.129; Publication Year: 2009, pp. 369-375.

EXAMINER SIGNATURE			
Examiner Signature	/ADAM D TISSOT/	Date Considered	09/16/2020

All References Considered Except Where Lined Through. /A.D.T/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

CERTIFICATION STATEMENT	
OR	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).
	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).
	See attached certification statement.
	The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
X	A certification statement is not submitted herewith.

SIGNATURE			
Signature	/David R. Stevens/	Date (YYYY-MM-DD)	2019-09-26
Name/Print	David R. Stevens	Registration Number	38626

All References Considered Except Where Lined Through. /A.D.T/

PLUS Search Results for S/N 16433703, Searched Thu Sep 03 11:58:59 EDT 2020

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

4770410 99
5637144 99
6145625 99
4246184 87
4269744 87
4286481 87
4301570 87
4302939 87
4436326 87
4448396 87
4551623 87
4555258 87
4796926 87
4806203 87
4836893 87
4921707 87
5188692 87
5202667 87
5250146 87
5406914 87
5494546 87
6036446 87
4243070 75
4257482 75
4269611 75
4272640 75
4273374 75
4281805 75
4288558 75
4299530 75
4310334 75
4320333 75
4324078 75
4324921 75
4330553 75
4334908 75
4336606 75
4338499 75
4338737 75
4347679 75
4352957 75
4355357 75
4359761 75
4360187 75
4362072 75
4365112 75
4366353 75
4367229 75
4375510 75
4381127 75

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

U.S. PATENTS/ U.S. PATENT APPLICATION PUBLICATIONS				
Examiner Initials	**Document No.**	**Publish/Grant Date**	**Inventors**	**Pages, Columns, Lines Where Relevant**
	US20040193420A1	2004-09-30	Kennewick, Robert A	
	US8924049B2	2014-12-30	Kumar, Ajith Kuttannair	
	US5929609	1999-07-27	Joy, George Cecil	
	US7454291B2	2008-11-18	Kawakami, Seiji	
	US6393573B1	2002-05-21	Gillespie, Douglas Brian	
	US7177750B2	2007-02-13	Schröder, Marko	
	US6794848B2	2004-09-21	Shinada, Akira	
	US7317973B2	2008-01-08	Dieterle, Werner	
	US7346449B2	2008-03-18	Sato, Makoto	
	US7822538B2	2010-10-26	Hovestadt, Guido	
	US20020120390A1	2002-08-29	Bullock, James Blake	
	US6484086B2	2002-11-19	Jeon, Yong-won	
	US6687595B2	2004-02-03	Seto, Yoji	
	US7497201B2	2009-03-03	Hollenbeck, Bruce Phelps	
	US5913917	1999-06-22	Murphy, Michael D.	
	US7433889B1	2008-10-07	Barton, Mark A.	
	US7321354B1	2008-01-22	Jacobsen, Jeffrey	
	US6314347	2001-11-06	Kuroda, Kouichi;	
	US8135531B2	2012-03-13	Zhao, Side	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6116363	2000-09-12	Frank, Andrew A.	
	US6061625	2000-05-09	Fastenrath, Ulrich	
	US6465908B1	2002-10-15	Karuppana, Samy V.	
	US6470240B1	2002-10-22	Haynes, Ian Frederick	
	US20060029296A1	2006-02-09	King, Martin T.	
	US6070118	2000-05-30	Ohta, Takashi;	
	US6662642B2	2003-12-16	Breed, David S.	
	US20060009890A1	2006-01-12	Meister, Dirk	
	US6928344B2	2005-08-09	Mcwalter, William F	
	US4459671	1984-07-10	Teass, Garnette S.	
	US7647153B2	2010-01-12	Sugano, Takeshi	
	US6687581B2	2004-02-03	Deguchi, Yoshitaka	
	US20050052290A1	2005-03-10	Naden, Gary	
	US7289039B2	2007-10-30	Kato, Manabu	
	US6163690	2000-12-19	Lilja, Patrik	
	US20080033624A1	2008-02-07	Gronau, Ralph	
	US7013205B1	2006-03-14	Hafner, James Lee	
	US5842142	1998-11-24	Murray, Daniel J.	
	US20090132113A1	2009-05-21	Kumar, Ajith Kuttannair	
	US7386389B2	2008-06-10	Stolle, Uwe	
	US5999864	1999-12-07	Thiel, Kent O.	
	US6064937	2000-05-16	Yang, Chaemo	
	US20030006914A1	2003-01-09	Todoriki, Tsuyoshi	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6636787B2	2003-10-21	Yamaguchi, Kozo	
	US7512477B2	2009-03-31	Quigley, Jon M.	
	US6415217B1	2002-07-02	Higashimata, Akira	
	US6701897B2	2004-03-09	Chatfield, Glen F.	
	US6809429B1	2004-10-26	Frank, Andrew A.	
	US7873471B2	2011-01-18	Gieseke, Arnold	
	US5487002	1996-01-23	Diller, Robert W.	
	US7360615B2	2008-04-22	Salman, Mutasim A.	
	US7102496B1	2006-09-05	Ernst Jr., Raymond P..	
	US20060005736A1	2006-01-12	Kumar, Ajith Kuttannair	
	US7479897B2	2009-01-20	Gertsch, Jamie	
	US6838858B2	2005-01-04	Berneis, Paul Allen	
	US6931309B2	2005-08-16	Phelan, Joseph	
	US20020072838A1	2002-06-13	Mcclellan, Scott B.	
	US6522955B1	2003-02-18	Colborn, Jeffrey A.	
	US5650931	1997-07-22	Nii, Yoshihide	
	US7509193B2	2009-03-24	Kustosch, Mario	
	US6427107B1	2002-07-30	Chiu, George T. G.	
	US20080021628A1	2008-01-24	Tryon, Bruce W.	
	US20040230376A1	2004-11-18	Ichikawa, Shinji	
	US7099770B2	2006-08-29	Naden, Gary	
	US20040074682A1	2004-04-22	Fussey, Peter Michael	
	US6949897B2	2005-09-27	Wakashiro, Teruo;	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US20040084237A1	2004-05-06	Alfred Jr., Petrie E.	
	US7233861B2	2007-06-19	Van Buer, Darrel J.e	
	US6135918	2000-10-24	Bellinger, Steven M.	
	US20020195288A1	2002-12-26	Komiyama, Susumu	
	US6374173B1	2002-04-16	Ehlbeck, James M.	
	US6487477B1	2002-11-26	Woestman, Joanne T	
	US5315977	1994-05-31	Fosseen, Dwayne	
	US6199001	2001-03-06	Ohta, Takashi	
	US6266588	2001-07-24	Mcclellan, Scott B.	
	US8069940B2	2011-12-06	Nenno, Rudolf	
	US6814170B2	2004-11-09	Abe, Tatsuo	
	US5396426	1995-03-07	Hibino, Katsuhiko	
	US20060052917A1	2006-03-09	Schwarzhaupt, Andreas	
	US6436005B1	2002-08-20	Bellinger, Steven M.	
	US20040133336A1	2004-07-08	Fosseen, Dwayne	
	US6877488B2	2005-04-12	Washeleski, John	
	US6895320B2	2005-05-17	Bauer, Wolf-dietrich	
	US7367414B2	2008-05-06	Iida, Hiroaki	
	US20030015358A1	2003-01-23	Abe, Tatsuo	
	US6629034B1	2003-09-30	Kozak, Frank	
	US20060095195A1	2006-05-04	Nishimura, Takao	
	US6278915	2001-08-21	Deguchi, Yoshitaka	
	US6307277	2001-10-23	Tamai, Goro	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6401024B1	2002-06-04	Tange, Satoshi	
	US6233515	2001-05-15	Engelman, Gerald H.	
	US7899584B2	2011-03-01	Schricker, David R.	
	US6370472B1	2002-04-09	Fosseen, Dwayne	
	US8290665B2	2012-10-16	Placke, Lars	
	US20050228553A1	2005-10-13	Tryon, Bruce W.	
	US7337055B2	2008-02-26	Matsumoto, Shinji	
	US7369938B2	2008-05-06	Scholl, Gregor	
	US4347496	1982-08-31	Kubalak, Thomas P.	
	US7747365B1	2010-06-29	Lowrey, Larkin Hill	
	US7751973B2	2010-07-06	Ibrahim, Faroog Abdel-kareem	
	US20050233185A1	2005-10-20	Dunn, Glenn M.	
	US20030033069A1	2003-02-13	Bauer, Wolf-dietrich	
	US20030015874A1	2003-01-23	Abe, Tatsuo	
	US6206123	2001-03-27	Kim, Young-gab	
	US4408293	1983-10-04	Avins, Jack	
	US20160009304A1	2016-01-14	Kumar, Ajith Kuttannair	
	US6847189B2	2005-01-25	Frank, Andrew A.	
	US7124027B1	2006-10-17	Ernst Jr., Raymond P.	
	US5627752	1997-05-06	Buck, Michae	
	US9619203B2	2017-04-11	Tamir, Asaf	
	US20080027639A1	2008-01-31	Tryon, Bruce W.	
	US6843337B2	2005-01-18	Matsubara, Atsushi	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7243246B2	2007-07-10	Allen, Robert	
	US7167787B2	2007-01-23	Bastian, Dieter	
	US20020134602A1	2002-09-26	Kobayashi, Yosuke	
	US6266610	2001-07-24	Schultz, Robert L	
	US6991053B2	2006-01-31	Kuang, Ming Lang	
	US6662096B2	2003-12-09	Komiyama, Susumu	
	US7456509B2	2008-11-25	Gray Jr., Charles L.	
	US6269290	2001-07-31	Egami, Tsuneyuki	
	US6209672	2001-04-03	Severinsky, Alex J.	
	US6242873	2001-06-05	Drozdz, Piotr	
	US7532960B2	2009-05-12	Kumar, Ajith	
	US6512967B2	2003-01-28	Östberg,Claes	
	US7276815B2	2007-10-02	Algrain, Marcelo C.	
	US7061131B2	2006-06-13	King, Robert Dean	
	US5176213	1993-01-05	Kawai, Masao	
	US6314347	2001-11-06	Kuroda, Kouichi	
	US7268442B2	2007-09-11	Syed, Fazal	
	US6116363	2000-09-12	Frank, Andrew A.	
	US6073712	2000-06-13	Buglione, Arthur J.	
	US6449537B1	2002-09-10	Phillips, Anthony Mark	
	US5161634	1992-11-10	Ichihara, Masahiro	
	US6591758B2	2003-07-15	Kumar, Ajith Kuttannair	
	US7013205B1	2006-03-14	Hafner, James Lee	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US5775449	1998-07-07	Moroto, Shuzo	
	US5343970	1994-09-06	Severinsky, Alex J.	
	US20050182526A1	2005-08-18	Hubbard, Gregory A.	
	US6208034	2001-03-27	Yamaguchi, Katsuhiko	
	US20020107618A1	2002-08-08	Deguchi, Yoshitaka	
	US6484830B1	2002-11-26	Gruenwald, Robert	
	US7228925B2	2007-06-12	Hightower, Paul	
	US7021409B2	2006-04-04	Tamor, Michael Alan	
	US5397991	1995-03-14	Rogers, Wesley A.	
	US6362602B1	2002-03-26	Kozarekar, Shailesh S.	
	US5487002	1996-01-23	Diller, Robert W.	
	US6230496	2001-05-15	Hofmann, Lee Gregor	
	US7073615B2	2006-07-11	Mack, David J.	
	US7528572B2	2009-05-05	Masias, Alvaro	
	US7295902B2	2007-11-13	Chen, Jyh-shin	
	US7197390B2	2007-03-27	Yuan, Guohui	
	US6949841B1	2005-09-27	Cailleux, Helene	
	US6909200B2	2005-06-21	Bouchon, Nicolas Louis	
	US6441574B1	2002-08-27	Phillips, Anthony Mark	
	US20020174798A1	2002-11-28	Kumar, Ajith Kuttannair	
	US6670788B2	2003-12-30	Prabhu, Sameer	
	US7363122B2	2008-04-22	Bischoff, Claus	
	US6335610B1	2002-01-01	Winstead, Vincent John	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US6982540B2	2006-01-03	Richter, Gerolf	
	US6208931	2001-03-27	Schoettle, Richard	
	US20030074115A1	2003-04-17	Yamaguchi, Musashi	
	US20030098187A1	2003-05-29	Phillips, Anthony Mark	
	US5959420	1999-09-28	Boberg, Evan S.	
	US6487477B1	2002-11-26	Woestman, Joanne T.	
	US6500089B2	2002-12-31	Lasson, Anders	
	US5359228	1994-10-25	Yoshida, Masato	
	US9193268B2	2015-11-24	Kumar, Ajith Kuttanair	
	US20050061562A1	2005-03-24	Mack, David J.	
	US6278915	2001-08-21	Deguchi, Yoshitaka	
	US6397601B2	2002-06-04	Morimoto, Kazuhiko	
	US4305254	1981-12-15	Kawakatsu, Shiro	
	US6344732B2	2002-02-05	Suzuki, Naoto	
	US7120520B2	2006-10-10	Seto, Keisuke	
	US5903112	1999-05-11	Yamada, Eiji	
	US6847189B2	2005-01-25	Frank, Andrew A.	
	US20020062183A1	2002-05-23	Yamaguchi, Musashi	
	US6490511B1	2002-12-03	Raftari, Abbas	
	US5627752	1997-05-06	Buck, Michael	
	US5656921	1997-08-12	Farrall, Simon David	
	US6321143	2001-11-20	Phillips, Anthony Mark	
	US5760713	1998-06-02	Yokoyama, Shoji	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7880436B2	2011-02-01	Fischer, Gerhard	
	US7252165B1	2007-08-07	Gruenwald, Robert	
	US5778326	1998-07-07	Moroto, Shuzo	
	US6233508	2001-05-15	Deguchi, Yoshitaka	
	US20040193420A1	2004-09-30	Kennewick, Robert A.	
	US5983188	1999-11-09	Roessle, Manfred	
	US6339706B1	2002-01-15	Tillgren, Magnus	
	US6778895B1	2004-08-17	Schwab, Manfred	
	US6640186B2	2003-10-28	Stefan, Jeffrey M.	
	US5983189	1999-11-09	Lee, See-woo	
	US6404880B1	2002-06-11	Stevens, Gilman R.	
	US5214707	1993-05-25	Fujimoto, Shoji	
	US4725956	1988-02-16	Jenkins, Michael W. M.	
	US7272497B2	2007-09-18	Koshiji, Yoshikazu	
	US6526335B1	2003-02-25	Treyz, Victor G.	
	US7617108B2	2009-11-10	Matsubara, Tsutomu	
	US6496107B1	2002-12-17	Himmelstein, Richard B.	
	US7321825B2	2008-01-22	Ranalli, Ronald J.	
	US6845251B2	2005-01-18	Everhart, Charles A.	
	US6917693B1	2005-07-12	Kiridena, Vijitha Senaka	
	US6532447B1	2003-03-11	Christensson, Nils	
	US6701251B2	2004-03-02	Stefan, Jeffrey M.	
	US5343399	1994-08-30	Yokoyama, Shoji	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	US7188012B2	2007-03-06	Salmeen, Irv T.	
	US7026957B2	2006-04-11	Rubenstein, Jeffrey D.	
	US5177685	1993-01-05	Davis, James R.	
	US5247705	1993-09-21	Attig, Joachim	
	US6181996	2001-01-30	Chou, Paul Bao-luo	
	US8290665B2	2012-10-16	Placke, Lars	
	US7392194B2	2008-06-24	Tanaka, Makoto	
	US5592385	1997-01-07	Katayama, Kazuyori	
	US6931307B2	2005-08-16	Everhart, Charles Allen	
	US20070112475A1	5/17/2007	Martin Koebler	
	US7222004B2	5/22/2007	Anderson	
	US7283838B2	10/16/2007	Lu, Wei	
	US7665559B2	2/23/2010	Jose De La Torre-Bueno	
	US7715958B2	5/11/2010	Kumar, Ajith Kuttannair	
	US7812555B2	10/12/2010	Rodwan Tarek Adra	

FOREIGN PATENT DOCUMENTS

Examiner Initials	Foreign Document Number	Country Code	Publication Date	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines Where Relevant
	2000075682	WO	12/14/2000	Kovacs	
	2004012250	JP	2004-01-15	Yamada	
	1130415	EP	2/9/2005	Hasegawa	
	2005115787	WO	12/8/2005	Harada	
	200722778	TW	6/1/2007	Chuang	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	102006009710	DE	6/14/2007	Chuang	
	2007155695	JP	6/14/2007	Kung	
	2008053789	WO	5/8/2008	Kurokawa	
	4543480	JP	9/15/2010	Hasegawa	
	10162866A1	DE	2003-07-10	GIERLING ARMIN	
	19749582A1	DE	1999-05-12	BASTIAN ANDREAS DR	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

NON-PATENT LITERATURE DOCUMENTS	
Examiner Initials	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.
	"Answers.com", pp. 1-7, Answers.com, http://www.answers.com/topic/drag-coefficient-1.
	"Cell Specification Data", pp. 1-2, Kokam Co., Ltd., http://www.kokam.com/product/product-pdf/high-power/PL-301-SLPB60460330H-70ah-Grade.pdf
	Cassidy et al., "GM Sunraycer Case History/M101 lecture 4-1", Dec. 1, 1990, pp. 1-61, Society for Automotive Engineers, Inc., Warrendale, USA.
	Gong et al., Computationally efficient optimal power management for plug-in hybrid electric vehicles based on spatial-domain two-scale dynamic programming; Vehicular Electronics and Safety, 2008, ICVES 2008, IEEE International Conference on; Digital Object Identifier: 10.1109/ICVES.2008.4640882; Publication Year: 2008.
	Gong et al., Trip Based Power Management of Plug-in Hybrid Electric Vehicle with Two-Scale Dynamic Programming; Vehicle Power and Propulsion Conference, 2007. VPPC 2007. IEEE; Digital Object Identifier: 10.1109/VPPC.2007.4544089; Publication Year: 2007, pp. 12-19.
	Hibbs, "GM Sunraycer History/M101 lecture 2-2", Dec. 1, 1990, pp. 1-37, Society for Automotive Engineers, Inc., Warrendale, USA.
	Janach, Ultralight electric vehicle for mass transportation; Vehicle Power and Propulsion Conference, 2008. VPPC '08. IEEE; Digital Object Identifier: 10.1109/VPPC.2008.4677405; Publication Year: 2008, pp. 1-4.
	Johannesson et al., Assessing the Potential of Predictive Control for Hybrid Vehicle Powertrains Using Stochastic Dynamic Programming, Intelligent Transportation Systems, IEEE Transactions on vol. 8, Issue: 1; Digital Object Identifier: 10.1109/TITS.2006.884887; Publication Year: 2007, pp. 71-83.
	Kim et al., An adaptive address power saving method based on the prediction of power consumption in and AC PDP., Industrial Electronics, IEEE Transaction on, vol. 56, issue 12, Dec. 2009 pp. 4949-4948; Digital Object Identifier 10.1109/TIE.2009.2026373.
	Lovins, et al., "Winning the Oil Endgame", Mar. 1, 2005, p. 50, Rocky Mountain Institute, Snowmass, USA.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

	Ngo et al., An optimal control-based algorithm for Hybrid Electric Vehicle using preview route information; A.F.A.; American Control Conference (ACC), 2010; Publication Year: 2010, pp. 5818-5823.
	Roche et al., "The Speed of Light, The 1996 World Solar Challenge", 1997, pp. 43-46 & 189-194, UNSW.
	Shafiullah et al., Reduction of power consumption in sensor network applications using machine learning techniques; TENCON 2008—2008 IEEE Region 10 Conference; Digital Object Identifier: 10.1109/TENCON.2008.4766574; Publication Year: 2008, pp. 1-6.
	Xue et al., Traffic-Known Urban Vehicular Route Prediction Based on Partial Mobility Patterns; Parallel and Distributed Systems (ICPADS), 2009 15th International Conference on; Digital Object Identifier: 10.1109/ICPADS.2009.129; Publication Year: 2009, pp. 369-375.

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application Number	16/433,703
	Filing Date	06-06-2019
	First Named Inventor	Martin Koebler
	Art Unit	
	Examiner Name	
	Attorney Docket Number	INVN-00142

CERTIFICATION STATEMENT	
OR	That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).
	That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).
	See attached certification statement.
	The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
X	A certification statement is not submitted herewith.

SIGNATURE			
Signature	/David R. Stevens/	Date (YYYY-MM-DD)	2019-09-26
Name/Print	David R. Stevens	Registration Number	38626

Electronic Acknowledgement Receipt	
EFS ID:	37271222
Application Number:	16433703
International Application Number:	
Confirmation Number:	8048
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Customer Number:	141471
Filer:	David R. Stevens/TRAM RICHARDS
Filer Authorized By:	David R. Stevens
Attorney Docket Number:	INVN-00142
Receipt Date:	26-SEP-2019
Filing Date:	06-JUN-2019
Time Stamp:	18:57:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	Answers.pdf	811795 57d2fc000044b1a5300bf70c9bce5b932499bdac	no	12
Warnings:					

Information:					
2	Non Patent Literature	Kokam.pdf	489181 0ae7d95b272f0ad3fe31fc5923f75cf9f21c1466	no	6
Warnings:					
Information:					
3	Non Patent Literature	Cassidy.pdf	1592966 bdc906d3496e47db9b00b9c2d8a5a7c6413ce380	no	61
Warnings:					
Information:					
4	Non Patent Literature	Gong.pdf	597174 dbce4039fd6719623f5bd15f46e55104cee4bda8	no	6
Warnings:					
Information:					
5	Non Patent Literature	Gong_.pdf	670839 d95d9d538fb6a10911f46bfc27b9857e7901576c	no	8
Warnings:					
Information:					
6	Non Patent Literature	Hibbs.pdf	1148932 30eec6d82b59af35d536a9c8605b046d812102d6	no	37
Warnings:					
Information:					
7	Non Patent Literature	Janach.pdf	691607 65175fdd6a1ab74c12ced1ca960888929259488d	no	4
Warnings:					
Information:					
8	Non Patent Literature	Johannesson.pdf	1183425 0838c78a36e6ad6269ea33a3095654576572b0	no	13
Warnings:					
Information:					

9	Non Patent Literature	Kim.pdf	906446 358e679f872ec4e11226292d7bdfceec112f a3b4	no	10
Warnings:					
Information:					
10	Non Patent Literature	Lovins.pdf	88507 48fb36eb181fe81ca07004de18b8461453f0 6e2d	no	1
Warnings:					
Information:					
11	Non Patent Literature	Ngo.pdf	612251 8d9b007883221517518 4d7e5b78581f1a92 0fa01	no	6
Warnings:					
Information:					
12	Non Patent Literature	Roche.pdf	526714 58c3b17a74aaca996e92da9a7edb6267216 e654d	no	10
Warnings:					
Information:					
13	Non Patent Literature	Shafiullah.pdf	425742 c07b484dff9945eb27794b37ce9dd75fe0f7 c260	no	6
Warnings:					
Information:					
14	Non Patent Literature	Xue.pdf	684916 83b61362109d1860b27d9eb9f374494a9d 372f46	no	8
Warnings:					
Information:					
15	Foreign Reference	DE10162866A1.pdf	243649 4765909e9187c3f157e0b6fa1c2b8f73c6a2 1992	no	4
Warnings:					
Information:					

16	Foreign Reference	DE19749582A1.pdf	260956 426085c734b4082bcbac0bb78b2f23e5d25943f	no	4
Warnings:					
Information:					
17	Foreign Reference	DE102006009710A1.pdf	2408996 cc2bedbb2aacd6d70c4507f1900a69a305450d14	no	14
Warnings:					
Information:					
18	Foreign Reference	EP1130415A2.pdf	1101477 624a11329011915ae63b38868ad71bae208ca721	no	17
Warnings:					
Information:					
19	Foreign Reference	JP4543480B2.pdf	3006399 8a8a9264cf2ecd90868c16338180194e485487d1	no	23
Warnings:					
Information:					
20	Foreign Reference	JP2004012250A.pdf	2848112 acd27ea696f7fe45b99d5df61754a7b15aa3fc6b	no	19
Warnings:					
Information:					
21	Foreign Reference	JP2007155695A.pdf	1710004 a51a5e73919ab9980e21f92cc429ff72b8d1dc65	no	14
Warnings:					
Information:					
22	Foreign Reference	TW20072278.pdf	596574 9a924cfcb39e18753b278fa3356b1f68a78e0ee6	no	17
Warnings:					
Information:					

23	Foreign Reference	WO2000075682.pdf	778917 0f61b087216eaff4fe1afe7f8f1b86238db1d33e	no	22
Warnings:					
Information:					
24	Foreign Reference	WO2005115787.pdf	2858638 b4f6b2fda756f17cfbfff8c1dd39ed136f794f81	no	59
Warnings:					
Information:					
25	Foreign Reference	WO2008053789.pdf	5292105 3d7d38b54efc77c4fb8e5bbce3ca24a1e29b9901	no	85
Warnings:					
Information:					
26	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	156317 80b3c2dff46d4b5f1afade22193d67a023e333dd	no	14
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
		Total Files Size (in bytes):	31692639		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Patents DE10162866A1

Control and navigation system for a motor vehicle, is able to be used to automate or semi-automate control of the vehicle according to input driver preferences, e.g. for optimizing fuel use or so that a journey takes a set time

Abstract

Control and navigation system for a motor vehicle that can be connected to a traffic guidance system and has means for control and regulation of the vehicle-driving behavior, whereby control and regulation is automatic or semi-automatic. In contrast to existing systems, where a navigation system generates instructions or advice for a driver to follow, the inventive system operates automatically or semi- automatically, so that after a driver has input chosen parameters the system acts accordingly. E.g. a driver may want to optimize fuel use in which case the route chosen will be the shortest, while vehicle behavior will be controlled to maximize fuel usage.

Classifications

G08G1/096838 Systems involving transmission of navigation instructions to the vehicle where different aspects are considered when computing the route where the user preferences are taken into account or the user selects one route out of a plurality

View 19 more classifications

DE10162866A1
Germany

Find Prior Art Similar

Other languages: German

Inventor: Armin Sterling

Current Assignee : ZF Friedrichshafen AG

Worldwide applications

2001 DE

Application DE10162866A events

2001-12-20 Application filed by ZF Friedrichshafen AG

2001-12-20 Priority to DE10162866A

2003-07-10 Publication of DE10162866A1

2019-07-01 Application status is Withdrawn

Info: Patent citations (6), Cited by (8), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, DPMA, Discuss

Claims (16)

Hide Dependent
translated from German

1. guidance system for a motor vehicle, which is connected to a traffic control system and comprises means for controlling and / or regulating the vehicle control response, wherein the control and / or regulation of the vehicle control response from the starting location to the destination is carried out wholly or partially automatically.

2. The guide system according to claim 1, characterized in that the vehicle speed and / or the steering behavior and / or the acceleration behavior and / or the braking behavior of the vehicle can be controlled and / or regulated.

3. The guide system according to claim 1 or 2, characterized in that predefined travel strategies are manually selectable.

4. The guide system according to any one of claims 1 to 3, characterized in that the vehicle speed in dependence on the selected travel strategy and / or a predetermined maximum vehicle speed and / or predetermined by the traffic guidance system speed limit and / or current climate conditions controlled and / or is controlled, the climatic conditions are determined from the environment data from a vehicle-mounted detecting device and / or provided by the traffic management system.

5. The guide system according to one of the preceding claims, characterized in that safety-related vehicle parameters are taken into account in the control and / or regulating the vehicle control response.

6. The guide system according to claim 5, characterized in that driving dynamics limit values and / or parameters of engine protection functions and / or gearbox protection functions are taken into account.

7. The guide system according to one of the preceding claims, characterized in that for controlling and / or regulating the current vehicle speed, an engine control unit and / or a transmission control unit and / or a brake controller are provided, so that the engine power and / or the gear ratio and / or the braking power are controlled and / or regulated.

8. A guide system according to one of claims 3 to 7, characterized in that the predefined strategy travel a destination and a desired travel time to reach the driving target or a target arrival time at the destination can be predetermined.

9. Automatic guidance system according to one of claims 3 to 8, characterized in that within the preset travel strategy optimum route is determined for the optimization of the control behavior of the vehicle, the current traffic density and / or the current speed limits along the route are taken into account.

10. A guide system according to one of the preceding claims, characterized in that the guide behavior of the vehicle can be optimized to the lowest possible fuel consumption.

11. A guide system according to claim 10, characterized in that the shortest possible route is determined.

12. A guide system according to claim 10 or 11, characterized in that the topology of the route is taken into account in the selection of the travel route, the required drive power of the vehicle is determined on the basis of an economically oriented combination of engine operating point and transmission ratio.

13. A guide system according to any one of claims 3 to 8, characterized in that the guide behavior of the vehicle can be optimized as short as possible travel time, the route is determined taking into account the length of the route, the current traffic density and the speed limits and the topology.

14. A guide system according to claim 13, characterized in that the currently required drive power of the vehicle is determined based on an optimal mileage-oriented combination of engine operating point and transmission ratio.

15. Automatic guidance system according to one of the preceding claims, characterized in that the vehicle can be guided automatically by means of influence of the drive system and / or the brake system and / or of the steering system of the vehicle.

16. A guide system according to one of the preceding claims, characterized in that the travel strategy can be changed during the journey.

Description

translated from German

[0001] The present invention relates to a guidance system for a motor vehicle according to the patent claim. 1

[0002] Nowadays some guidance or vehicle control systems are known which guide a vehicle on the way from Startzum destination. In most cases, such systems are supported by a bearing provided in the vehicle navigation computer which evaluates the data of the current position and data of traffic management systems and traffic data collection systems.

[0003] However, such systems only provide information to the driver without being able to directly influence the vehicle systems.

[0004] The object of the present invention is of providing a guidance system for a motor vehicle, which influences without the involvement of the driver crucial parameter of the vehicle motion.

[0005] in particular, the guide system of the invention is to enable an influencing of the vehicle speed and / or the vehicle steering performance.

[0006] This is intended to enable the driver by selecting suitable parameters to adjust the guidance system to their needs.

[0007] This object is solved by the features of claim 1. Other variants will be apparent from the dependent claims.

[0008] Accordingly, a guide system for a vehicle is proposed, which automatically influences the vehicle control behavior or controls and / or regulates. To this end, the guide system on a device for automatic influencing or controlling and / or regulating relevant vehicle guidance parameters, in particular the vehicle speed, the vehicle steering behavior of the vehicle braking behavior and / or the vehicle acceleration behavior.

[0009] According to the invention, it is possible for the driver to select discrete, predefined travel strategies manually.

[0010] Such predefined travel strategies may contain as a minimum a destination parameter and a target travel time to reach of a destination or a desired arrival time at the destination.

[0011] Furthermore, the invention provides that the control behavior of the vehicle can be optimized at a predefined travel strategy at the lowest possible fuel. For this purpose, the shortest possible route recommended by the vehicle system.

[0012] in a further variant of the invention, the vehicle is automatically guided by the guide system by influencing the vehicle steering system along the shortest route, wherein the route topology is considered in the selection of the route and, optionally, the currently required drive power of the vehicle by the optimal combination of engine operating point and transmission ratio is provided.

[0013] Further, according to the invention is raised under the optimized for low fuel consumption travel as possible strategy, the performance of the vehicle to comply with the predefined by the driver driving strategy data when necessary.

[0014] When entering the travel policy data by the driver is also contemplated that these data are evaluated for plausibility so that not maintainable values - are displayed - for example, for an intended by the driver duration.

[0015] it is also possible within the guidance system of the invention that the pre-defined travel policies are optimized for the shortest possible journey time out. Here, too, an optimum route is determined, in particular taking into account the path length of the current traffic density and of the current speed limits along the route; Moreover, the topology of the route is considered when determining the optimal route with. Here, the travel distance determined to be optimal can be recommended to the driver or the vehicle can automatically influencing or controlling and / or regulation of the vehicle steering system are led along this path, the driving power of the vehicle is optimized to a mileage-oriented combination of engine operating point and transmission ratio back and thus the vehicle acceleration behavior and / or the vehicle braking performance is affected.

[0016] To facilitate the handling of the system and to increase the comfort of the driver, it is provided that the selected travel strategy can be changed during the journey.

[0017] While driving is also provided that the current vehicle speed is automatically set, in particular depending on the chosen travel strategy and / or a manually set by the driver maximum vehicle speed and / or in dependence on a predetermined by a traffic control system rate limiting. Furthermore, the current climate conditions can be taken into account, where the climatic conditions are determined by means of a detection device arranged in the vehicle and / or can be provided as information from a traffic control system.

[0018] An advantageous development of the invention provides that safety vehicle parameters such. incorporated as driving dynamic limits, engine protection functions and transmission protection functions in the Fahrparameter- and speed interference with.

[0019] The current vehicle speed is influenced by the novel guide system by means of an engine control unit for influencing the motor power and / or a transmission control device for influencing the transmission ratio and / or by means of a control device for controlling the braking devices of the vehicle or controlled and / or regulated.

Patent Citations (6)

Publication number	Priority date	Publication date	Assignee	Title
DE19501950A1 *	1995-01-24	1995-08-10	Gerd Dr ing Kraemer	Automatically guiding road vehicles using central guidance system
DE19600734A1 *	1996-01-11	1997-07-17	Zahnradfabrik Friedrichshafen	Motor vehicle system control method w.r.t. external conditions, location etc.
DE19743024A1 *	1997-09-29	1999-04-08	Daimler Chrysler Ag	Road vehicle with automatic guidance and communication system
DE19749582A1 *	1997-11-10	1999-05-12	Volkswagen Ag	Fuel economy controlled operation of a road vehicle
DE19821163A1 *	1998-05-12	1999-11-18	Volkswagen Ag	Driver assist method for vehicle used as autonomous intelligent cruise control
DE19916967C1 *	1999-04-15	2000-11-30	Daimler Chrysler Ag	A method for updating a traffic route network map and map-based method for vehicle guidance information generating

Family To Family Citations

* Cited by examiner, † Cited by third party

Cited By (8)

Publication number	Priority date	Publication date	Assignee	Title
EP1505555A1 *	2003-08-06	2005-02-09	Siemens Aktiengesellschaft	Navigation system with determination of a route where consumption is optimized
EP1675077A1 *	2004-12-17	2006-06-28	EADS Deutschland GmbH	A method forseen to be implemented in a computer system for obtaining the optimised path of a vehicle
DE102008034606A1 *	2008-07-25	2010-01-28	Bayerische Motoren Werke Aktiengesellschaft	Method for displaying environment of vehicle on mobile unit, involves wirelessly receiving image signal from vehicle, and generating display image signal on mobile unit through vehicle image signal, where mobile unit has virtual plane
WO2011025443A1 *	2009-08-24	2011-03-03	Scania Cv Ab	System and method for maintaining driving times
WO2015051968A1 *	2013-10-11	2015-04-16	Zf Friedrichshafen Ag	Method and device for anticipatory or predictive economical running of a motor vehicle including a determination of a route and a probable driving time and time of arrival
DE102014217528A1	2014-09-02	2016-03-03	Patrick Pascheka	A process for selection or pre-selection of driving profiles for a system for automatic vehicle guidance
WO2018049443A1 *	2016-09-13	2018-03-22	Rosenbauer International Ag	Operating method for an emergency vehicle
DE112015000924B4 *	2014-03-25	2019-01-24	Scania Cv Ab	Target-dependent speed control

Family To Family Citations

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
DE60304628T2	2007-04-05	Accelerator pedal arrangement and method for adjusting the reaction force
EP1272814B1	2004-06-16	Route planning method for use in a navigation system
EP1807267B1	2008-08-06	Driver assistance method
EP1441927B1	2009-06-24	Information system in a motor vehicle with driving-style-dependent production of information to be outputted
DE102005045891B3	2007-02-15	Fuel consumption reduction method e.g. for internal combustion engine, involves specifying operating window of motor vehicle with wind direction and wind velocity recorded to determine wind conditions on vehicle
EP0739465B1	2001-06-06	Control system for an automatic transmission in a motor vehicle
DE4437678B4	2007-07-05	Process for the distance control of motor vehicles
DE602004012963T2	2007-01-18	Method and apparatus for control of a vehicle
DE10117410B4	2004-11-18	Method and apparatus for outputting data on an information of a motor vehicle
EP1214216B1	2004-03-10	Method and device for actively assisting a vehicle driver in a motor vehicle
EP2293255B1	2016-06-29	Method for controlling a motor vehicle and motor vehicle
DE102009052853B4	2017-07-20	A method for range estimation of a motor vehicle
EP2010423B1	2011-02-23	Speed control apparatus and motor vehicle with a speed control apparatus of this type
DE102009046010B4	2016-03-10	Hierarchical information display system for a vehicle
DE102009017153B4	2018-04-26	Driver assistance system and its operating concept
EP1610971B1	2006-09-06	Method for adjusting the speed of a motor vehicle according to risk and device for carrying out said method
EP0057820A1	1982-08-18	Service interval indicator for vehicle
DE60019493T2	2006-02-23	Cruise control system for optimized distance control
DE102013210941A1	2014-12-18	Method and device for operating a vehicle
EP0956993B1	2003-03-05	Process and system for cruise control

EP0513424A1	1992-11-19	Vehicle transmission including a control device
DE19752035A1	1998-08-06	System and method for controlling the operating behavior of an internal combustion engine
EP1398681B1	2010-02-10	System for guiding vehicles
EP1034388B1	2002-02-20	Control for an automatic transmission in a motor vehicle
DE10356309A1	2005-06-23	Method and apparatus for warning the driver of a motor vehicle

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
DE10162866A	2001-12-20	2001-12-20	Control and navigation system for a motor vehicle, is able to be used to automate or semi-automate control of the vehicle according to input driver preferences, e.g. for optimizing fuel use or so that a journey takes a set time

Applications Claiming Priority (1)

Application	Filing date	Title
DE10162866A	2001-12-20	Control and navigation system for a motor vehicle, is able to be used to automate or semi-automate control of the vehicle according to input driver preferences, e.g. for optimizing fuel use or so that a journey takes a set time

Legal Events

Date	Code	Title	Description
2003-07-10	OM8	Search report available as to paragraph 43 lit. 1 sentence 1 patent law	
2004-10-21	8139	Disposal/non-payment of the annual fee	

Data provided by IFI CLAIMS Patent Services

About Send Feedback Public Datasets Terms Privacy Policy

Patents DE19749582A1

Fuel economy controlled operation of a road vehicle

Abstract

The vehicle system has a central controller (5) that accepts inputs from a distance sensor (2), a camera (3) and other sensors (4) that indicate vehicle status and also its status in the environment. Outputs are generated to actuators (7-9) on the vehicle. The vehicle is controlled to provide a fuel economy optimized driving profile.

Classifications

B60R16/0236 Circuits relating to the driving or the functioning of the vehicle for economical driving

View 2 more classifications

DE19749582A1
Germany

Find Prior Art Similar

Other languages: German

Inventor: Andreas Dr Bastian

Current Assignee : Volkswagen AG

Worldwide applications

1997 DE

Application DE19749582A events

1997-11-10 Application filed by Volkswagen AG

1997-11-10 Priority to DE19749582A

1999-05-12 Publication of DE19749582A1

2019-07-01 Application status is Withdrawn

Info: Cited by (18), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, DPMA, Discuss

Claims (10)

Hide Dependent
translated from German

1. A device for saving fuel in motor vehicles, comprising sensors for sensing vehicle-state data, and means for recording the vehicle environment, **characterized in** that the device (1) comprises a central processing unit (5) by means of a function of the detected vehicle location and the vehicle state data detected a consumption-optimized driving profile and buildable in the form of a set of control signals for actuators (7-9) is implemented.

2. Device according to claim 1, characterized in that the means for detecting the vehicle surroundings as distance sensors (2) are formed.

3. Device according to claim 2, characterized in that the distance sensors (2) as the lidar and / or radar and / or ultrasound sensors are formed.

4. Device according to one of the preceding claims, characterized in that the means for detecting the vehicle surroundings include at least one camera (3).

5. Device according to one of the preceding claims, characterized in that the means for detecting the vehicle surroundings comprise a digital road map with associated GPS receiver.

6. Device according to one of the preceding claims, characterized in that the actuators (7-9) are formed as a braking device, a gas supply and a gear selector mechanism.

7. The device according to claim 6, characterized in that the actuators (7-9) are formed in a steering device and / or an ignition device.

8. Device according to one of the preceding claims, characterized in that the actuators (7-9) are designed as x-by-wire systems.

9. A method for reducing fuel consumption in motor vehicles, by means of sensors (4) for detecting vehicle condition data, means for recording the vehicle environment and a central unit (5), comprising the following steps:

a) transfer of the vehicle state detected data and the data of the means for detecting the vehicle surroundings to the central unit (5),
b) evaluation of the data of the means for detecting the vehicle surroundings for determining the number of the surrounding objects whose relative speed and position,
c) calculation of a consumption-optimized driving profile based on the determined according to method step b) free circulation surface taking into account the vehicle condition data,
d) calculating a set of control signals for actuators (7-9) of the motor vehicle to implement the motion profile according to process step c).

10. The method according to claim 9, characterized in that are detected as the vehicle state data at least the speed, engine speed and gear ratio.

Description

translated from German

The invention relates to a method and an apparatus for saving fuel in motor vehicles.

Due to rising fuel prices and an increased environmental consciousness of the vehicle owner is a desire for a fuel-efficient as possible motor vehicle. In addition to vehicle-specific parameters, the driving style has a significant influence on fuel consumption. To provide modern motor vehicles the motor vehicle driver a savings program at, with these particular for the same procedure, as described, for example, highway driving at a constant speed, achieve lower fuel consumption. A disadvantage is that the one of the motor vehicle driver himself must choose the most appropriate courses depending on the situation and on the other has to adapt his driving style accordingly.

The problem of appropriate gear selection is achieved by automatic, can be chosen in which between a sporting and an economical driving style. In the economic speed level, a higher speed is selected as early as possible so that the engine operates with lower speeds. However, the problem with the procedure is not considered.

From DE 43 34 886 route guidance device for a motor vehicle having an on-board computer for obtaining signals for a Fahrzeit- and / or consumption-optimal route is known to include in the traffic situation-dependent variations of the optimum route. An optimum gear selection and / or adaptation of driving style does not take place.

The invention is therefore based on the technical problem of providing a method and an apparatus for saving fuel in motor vehicles, wherein the driving of the motor vehicle driver is influenced consumption optimized.

The solution of the technical problem is solved by the features of claims 1 and 9. From the data of sensors for detecting vehicle condition data and the means for recording the vehicle environment is created in a central unit a consumption-optimized driving profile and produces a set of control signals for actuators of the motor vehicle to implement the motion profile. With activated device, therefore, the motor vehicle behaves like a quasi-autonomous motor vehicle, as for example in a cruise control or automatic distance regulation (ADR) systems is the case. Quasi because the motor vehicle driver active at all times can leave the calculated driving profile again to initiate for example, a passing maneuver. The principle is based the fact that is detectable by the means for detecting the vehicle surroundings, how many vehicles the speed at which are located where. This can be derived with which constant speed, for example, the vehicle can travel as long as possible without violating safety distances. a consumption-optimized gear / speed pair may then be, for example, at that speed from a map determined. Further advantageous embodiments of the invention emerge from the subclaims.

in a preferred embodiment, the means for detecting the vehicle surroundings are designed as distance sensors. Since these are usually present in any case in modern motor vehicles, they can be used dual, and even the evaluation of the distance sensor is used, namely the number of detected objects whose relative speed and position. Also, the vehicle condition data can be transferred from existing sensors so that additional hardware is necessary only for the central unit and possibly for the wiring from the central unit to the actuators. By combining different types of sensors for the distance sensor an improved reliability is achieved with changing external conditions. For instance fog affects the results of a lidar sensor, but not by radar or ultrasonic sensors. In addition, can be applied by means of which one behind the other moving vehicles are detected, a camera. By assigning a digital road map with associated GPS receiver, additional information about road guidance, traffic signs and the like are available, so that the driving profile can be predictive determined. By forming the actuators as the x-by-wire systems, the control signals generated by the central unit can be supplied simply as electronic signals directly to the respective control devices of the x-by-wire systems.

The invention is explained in more detail below with reference to a preferred embodiment. The single figure shows a block diagram of the device for saving fuel in motor vehicles. The device 1 comprises a distance sensor 2, a camera 3, sensors 4, a central processing unit 5, a multiplexer 6 and actuators 7-9. The distance sensor 2 is preferably a combination of lidar, radar, and formed ultrasonic sensors. This on the one hand emit their respective radiation and receive the other hand, the reflected portions of objects. can be deduced from duration and angle of incidence then the distance and the position of the object. The camera 3 also monitors the traffic space. By means of the camera 3 is also concealed objects such close succession moving vehicles are, for example, be resolved that are not detected by the distance sensor. 2 The data of the distance sensor 2 and the camera 3 are transferred via data lines 10 and 11 to the central unit. 5 Based on this data, the central unit 5 can calculate an image of the vehicle environment. The sensors 4 detect for the consumption of the motor vehicle-related parameters such. As speed, engine speed, engine torque and engaged gear ratio. The detected data are also transferred via a data line 12 to the central unit. 5 Alternatively, at least some of the data can also be taken over by an engine control unit. The central unit 5 calculated from the data supplied to a consumption-optimized driving profile. This calculation is illustrated with reference to some considerations. For the fuel consumption, a smooth driving, for example, cheaper than a variety of braking and acceleration. Using the determined free movement area, a speed range can be determined where the vehicle could drive evenly over time. For this range a speed can be selected by empirically determined characteristics fields in turn specific vehicle, which has the least fuel consumption based on the distance traveled. an optimal parameter pair of speed / gear ratio, which is also removed to a map exists at this speed. In order to implement the driving profile determined in this way, a set generates control signals for the actuators 7-9. The actuator 7 can, for example, a gas supply device and the actuator 9 may be a gear selector, a brake means of the actuator. 8 Then, the set of control signals could include, for example, first a deceleration to a desired velocity, a subsequent gear change at a constant gas supply for maintaining the desired speed. The set of control signals is transferred via a data bus 13 to a data input of the multiplexer. 6 At the other data input 14 of the multiplexer 6, the control signals of the associated actuators 7-9 to the pedals and switches are. Via the control line 15 selects whether the device 1 is active or not, that is, control signals for the actuators 7-9 are switched through to the output of the multiplexer. 6 The actuators are designed as x-by-wire systems, that is mechanically decoupled. For this purpose, a mechanical manipulated variable is converted into an electric control value and transmitted to an associated control device, which then performs the purely electrical control of the component. The control signals generated by the central unit 5 can then be transferred directly to the control units of the actuators 7-9. The switching of the multiplexer 6 can be effected for example by a separate switch or a strong change of the brake or accelerator pedal operations, for example to perform an overtaking maneuver.

Another way to save fuel is to temporarily switch off the ignition at traffic lights. This can be made to the data of a digital map of a navigation system, for example, in which the length of the traffic signals are stored. By the camera 3 can be registered to the traffic lights at the approach then already, when the switching is done and how long it will last a standstill, so that ignition can be turned off for Kraftstoffeinsprung long standstill.

Cited By (18)

Publication number	Priority date	Publication date	Assignee	Title
US6533654B2	2000-05-26	2003-03-25	Trw Automotive Safety Systems Gmbh & Co. Kg	Method for controlling the steering angle of a steered wheel of a vehicle and a system to carry out the method
DE10162866A1 *	2001-12-20	2003-07-10	Zahnradfabrik Friedrichshafen	Control and navigation system for a motor vehicle, is able to be used to automate or semi-automate control of the vehicle according to input driver preferences, e.g. for optimizing fuel use or so that a journey takes a set time
DE102005035624A1 *	2005-07-29	2007-02-08	Daimlerchrysler Ag	Method and apparatus for providing route dependent driving instructions
DE102007020773A1	2007-03-19	2008-09-25	Wilfried Fittkau	Device for optimizing the efficiency of a vehicle combustion engine comprises a feed section and a removal section for feeding and removing fluid from a reactor chamber

DE102007038059A1	2007-08-10	2009-02-12	Daimler Ag	A method of operating a headway control system for vehicles and a vehicle distance control system for carrying out the method
DE102007050504A1	2007-10-19	2009-04-23	Daimler Ag	Driver assistance device for use during operation of vehicle in emission-reduced operation mode, has control unit for implementation of operational functions, and input unit for combined activation of functions by single driver input
WO2009063036A1 *	2007-11-16	2009-05-22	Continental Teves Ag & Co. Ohg	Motor vehicle energy saving assistance system
DE102008053103A1	2008-10-24	2009-06-10	Daimler Ag	Optimal operating condition determining method for hybrid vehicle, involves detecting temperature of electric motor as parameter, and determining optimal operating condition by consideration of parameters and torque demand at drive chain
WO2009156221A1 *	2008-06-26	2009-12-30	Robert Bosch Gmbh	Assistance system for a motor vehicle, method and data carrier therefor
EP2258588A1 *	2008-04-01	2010-12-08	Crambo, S.a.	Device for monitoring vehicle driving
DE102009048783A1 *	2009-10-08	2011-04-14	Dr. Ing. H.C. F. Porsche Aktiengesellschaft	Method for finding reason of high fuel consumption in hybrid vehicle, involves reading fuel relevant driving-and operating data of motor vehicle, and testing functionality of motor vehicle based on testing procedures
DE102010012739A1	2010-03-25	2011-09-29	Iav Gmbh Ingenieurgesellschaft Auto Und Verkehr	Method for determining fuel saving potential of internal combustion engines
DE202011105191U1	2011-08-31	2011-12-01	Jutta Fittkau	The multi-stage unit for reducing the products of incomplete combustion with simultaneous reducing fuel consumption in internal combustion engines
DE102010052361A1 *	2010-07-15	2012-02-09	Jean-Yves Goosse	Method for reducing loss of kinetic energy while driving vehicle, involves determining current parameter and future parameter and current parameter is compared with future parameter
DE102010061850A1 *	2010-11-24	2012-05-24	Robert Bosch Gmbh	Driving information device for outputting driving information for commercial vehicle, has detection units for outputting information about route situations to control device that converts situations into operating information for vehicle
US8706389B2	2010-11-18	2014-04-22	Audi Ag	Range- and/or consumption calculation with energy costs associated with area segments
DE102015119730A1	2015-11-16	2017-05-18	Dr. Ing. H.C. F. Porsche Aktiengesellschaft	Method and apparatus for assisting a vehicle driver
DE102006000074B4	2005-02-17	2019-01-10	Denso Corporation	Driving assistance system
Family To Family Citations				

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
DE19621085B4	2007-02-08	Method and apparatus for transmitting power control of a motor vehicle
EP1554604B2	2009-09-30	Method and device for preventing a collision of vehicles
DE69826078T2	2005-01-27	Adaptive cruise control system with Mode
EP1485283B1	2005-09-07	Lane-change assistant for motor vehicles
EP1737695B1	2011-03-23	Assistance system for motor vehicles
DE69731585T2	2005-12-01	Vehicle driving condition prediction device and warning apparatus using the device
DE10326358B9	2013-05-29	Driver warning device and the stopping distance
US5521579A	1996-05-28	Method for providing guiding assistance for a vehicle in changing lane
EP0858662B1	1998-01-28	Navigation device for road vehicles
EP1448402B1	2005-06-08	Speed control with stop function
EP1028886B1	2002-02-20	Drive regulating system for vehicles especially for motor vehicles
Winner et al.	1996	Adaptive cruise control system aspects and development trends
DE102007010325B4	2017-03-02	Transmission-neutral condition management for vehicle safety and driving comfort systems
DE4437678B4	2007-07-05	Process for the distance control of motor vehicles

EP1758755B1	2009-08-26	Driver assistance method and device
DE10028130C2	2003-08-21	System for vehicle guidance before traffic controlled intersections
EP1805530B1	2010-12-29	Process for enhancing the safety and/or comfort of a motor vehicle
EP1940665B1	2009-06-17	Adaptive cruise control featuring recognition of a traffic jam
EP1920268B1	2009-12-30	Method for the detection of a traffic zone
EP1841615B1	2008-11-05	Driver assistance system with driving path prediction
DE102015117620A1	2016-04-28	A method and system for reducing the effects of an impaired driver
DE102013214328B4	2017-12-28	Vehicle behavior prediction device and vehicle behavior prediction method
DE112010005666T5	2013-05-23	Driving support device
DE602174307T2	2007-10-25	Speed control with status display for a vehicle
DE102009010006A1	2009-10-01	Method and apparatus for semi-autonomous or autonomous driving of a motor vehicle

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
DE19749582A	1997-11-10	1997-11-10	Fuel economy controlled operation of a road vehicle

Applications Claiming Priority (1)

Application	Filing date	Title
DE19749582A	1997-11-10	Fuel economy controlled operation of a road vehicle

Legal Events

Date	Code	Title	Description
1999-05-12	OR8	Request for search as to paragraph 43 lit. 1 sentence 1 patent law	
1999-10-14	8105	Search report available	
2003-12-04	8110	Request for examination paragraph 44	
2012-11-07	R016	Response to examination communication	
2014-09-04	R084	Declaration of willingness to licence	**Effective date**: 20140722
2017-06-01	R119	Application deemed withdrawn, or ip right lapsed, due to non-payment of renewal fee	

Data provided by IFI CLAIMS Patent Services

About Send Feedback Public Datasets Terms Privacy Policy

Patents de102006009710

System for determining the position of a mobile communications device and method thereof

Abstract

translated from German

A system for a mobile communication device for determining the position of the mobile communication device is provided. The mobile communications device comprises a controller, a signal transmitter / receiver, a position receiver and a display. Here, the position of a receiver receives a global positioning system (GPS) transmitted position signal. The coupled to the positioning receiver signal transmitter / receiver is configured such that it transmits the position signal to an external device. The signal transmitter / receiver receives the determined according to the position signal position related information from the external device. The controller is / receiver in each case with the signal transducer, coupled to the positioning receiver and the display. In addition, the display is capable of displaying the position related information.

Classifications

- G01S5/0036 Transmission from mobile station to base station of measured values, i.e. measurement on mobile and position calculation on base station

DE102006009710A1
Germany

Find Prior Art Similar

Other languages: German

Inventor: Ko-Chien Chuang, Shao-Tsu Kung

Current Assignee : Compal Electronics Inc

Worldwide applications

2005 TW 2006 US DE JP

Application DE200610009710 events

2005-12-05 Priority to TW094142748

2005-12-05 Priority to TW094142748A

2006-03-02 Application filed by Compal Electronics Inc

2007-06-14 Publication of DE102006009710A1

2019-08-27 Application status is Withdrawn

Info: Patent citations (19), Cited by (6), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, DPMA, Discuss

Claims (11)

Hide Dependent
translated from German

1. A system for a mobile communication device for determining the position of the mobile communication device, comprising: a position receiver for receiving a corresponding one of a global positioning system (GPS) position signal transmitted; and a signal transmitter / receiver which is coupled to the positioning receiver, for transmitting the corresponding position signal is outside of the mobile communication device and for receiving a position-related information that is determined according to the respective position signal outside the mobile communication device.

    2. The system for a mobile communication device for determining the position of the mobile communication device of claim 1, further comprising a controller for controlling transmission / reception operations of the signal transfer agent / receiver.

    3. The system for a mobile communication device for determining the position of the mobile communication device of claim 1, further comprising a display for displaying the corresponding position-related information.

    4. The system for a mobile communication device for determining the position of the mobile communication device of claim 1, wherein the signal transmitter / receiver further includes a function for sending a "request for a position signal of a second person" and receiving a position-related information is determined according to one of the "request of the position signal of a second person" corresponding position signal of the mobile communication device outside of the mobile communication device.

    5. The system for a mobile communication device for determining the position of the mobile communication device of claim 4, wherein the position related information includes addresses.

6. A method for determining the position of a mobile communication device, comprising: using a mobile communication device to receive a position signal; Transmitting the position signal to an external device for generating a position-related information; and receiving the position-related information from the external device.

    7. The method for determining the position of the mobile communication device of claim 6, wherein the position related information includes addresses.

    8. The method for determining the position of the mobile communication device of claim 6, wherein the message received from the mobile communication device position-related information is transmitted by one of the following method is employed: A method for transmitting short messages, processes for the transmission of voice and method for transmission of graphic images.

    9. The method for determining the position of the mobile communication device of claim 6, further comprising: using the mobile communication device to send out a "request a position signal of a second person" in order to request the position-related information of a second person on their mobile communications device ; and using the mobile communication device to receive the position-related information of the second person, which is determined according to the position signal of the second person on their mobile communications device.

10. The method for determining the position of the mobile communication device of claim 9, wherein the position-related information of the second person comprises addresses.

11. The method for determining the position of the mobile communication device of claim 9, wherein the message received from the mobile communication device position-related information of the second person is transmitted by using one of the following methods: Method for transmitting short messages, processes for the transmission of voice and methods for transferring graphic images.

Description

translated from German

Background of the Invention

Field of the Invention

[0001] The present invention relates to a global positioning system (GPS, Global Positioning System), and more particularly to a system for determining the position of a mobile communication device.

Description of Related Art

[0002] The Global Positioning System (GPS) is a widely used device that is used in the satellite navigation system in the vehicle or in the personal digital assistant (PDA, Personal Digital Assistant) is installed. Since it is necessary in the GPS, the position signals are received from the positioning satellite, to compare it with the corresponding datum systems, requires the electronic device into which the GPS is installed, usually a high-resolution satellite positioning and a high-density memory to the loading map reference systems previously and to provide the high-speed multimedia computing power. in the conventional method for determining the position of the mobile communication device, a large amount of cards reference systems in the mobile communication device is stored, and the position signals are compared with the map reference systems. Such Positionsbetimmungsverfahren not only binds computing capacity, but also increases the utilization and power consumption of the mobile communication device, which has a significant to the available life of the mobile communication device. In addition, the need for a high-density storage and computing system would cause the mobile communication device is technically sophisticated and complex, and this in turn would hear the total cost of the mobile communication device. Furthermore, the operation of such a system is rather difficult, as several operating steps are required to obtain the desired position data. For those users who are not familiar with the interface of the electronic device or the software user interface, such a process is very difficult. For example, such a process of searching addresses or the positioning is more difficult for children or the elderly.

Summary of the Invention

[0003] Therefore, an object of the present invention to provide a system for determining the position of a mobile communication device, wherein the position determination processing system is adapted to process the received position signal to obtain the desired position related information. Thus, it is not necessary that the mobile communication device compares the position signals and calculates or stores large amounts of map reference systems. For this reason, the mobile communication device of the present invention is not only easy to use but it is also less costly compared to the conventional mobile communication device and consumes less energy.

[0004] According to this object and other objects of the invention, a system for determining the position of a mobile communication device is provided. The system is integrated in the mobile communication device. The mobile communication device includes a position receiver, a signal transmitter / receiver, a controller and a display. In this case, the positioning system receives the position-related information of the light emitted from the satellite high-frequency, low-energy position signals. In addition, the position receiver receives the corresponding transmitted from the GPS position signal. The coupled to the positioning receiver signal transmitter / receiver is configured such that it transmits the position signal to a device outside of the mobile communications device and the position-related information is located which is determined according to the position signal of the same or another device outside the mobile communication device is transmitted.

[0005] One of the above-mentioned devices, which are located outside the mobile communication device, or in short, an external device comprises a position determination processing system. The position determination processing system compares the position signals and transmits the position related data to the mobile communication device, which are obtained by the comparison, using the method for transmitting short messages, graphic images, voice or text. The position-related information includes the addresses. Further, the controller controls in the mobile communication apparatus, the transmission and reception operations of the position receiver and the signal transfer agent / receiver. The controller is capable of transmitting and processing the received data. The controller further comprises a keyboard. In response to the actuation of a key of the signal transmitter / receiver is directly controlled so that it transmits the position signal to the external device and receives the corresponding said position signal position-related information from the external device. The display is adapted to display the received position-related information. Such an operator interface with a button reduces the complexity of the operation, so that the position determination system is user friendly.

[0006] In one embodiment of the present invention, the above-mentioned signal transmitter used / receiver of the mobile communication device the specific protocol of each mobile communication device to perform the functions of sending a "request for a position signal of a second person" and receiving the position-related information of the second person provide from the mobile communication device or the external device mentioned above. here, the position-related information from the arithmetic operation according to the signal sent from the mobile communication device of the second person position signal is obtained. This feature is very useful for the safety of children and also for the locations the current position of people, such as older people with memory disorders and intellectual disabilities.

[0007] According to a further aspect of the present invention, a method for determining the position of a mobile communication device is provided. The method for determining the position comprises the following steps. First, the mobile communication device receives a position signal. Then, the mobile communication device transmits the received position signal to an external device to generate the position-related information. Here, the position-related information including addresses a method for transmitting short messages, voice or graphic images being transmitted. Then, the mobile communication apparatus receives the position related information from the external device and the received position-related information is displayed in the display of the mobile communication device.

[0008] in one embodiment of the present invention, the mobile communication device sends a "request for a position signal of a second person" in order to request the position-related information of the mobile communication device of the second person, and then the mobile communication device receives the transmitted from the mobile communication device of the second person position signal corresponding position-related information of the mobile communication device of the second person.

[0009] Accordingly, the position determination processing system is suitable for calculating the received position signal to obtain the desired position related information in the mobile communication apparatus according to the present invention. Thus, it is not necessary that the mobile communication device compares the received position signals and calculates or stores a large amount of cards reference systems. For this reason, the mobile communication device of the present invention is not only easy to use, but also in comparison to the conventional mobile communication device cheaper and consumes less energy. In addition, the functions of searching the position-related information of another mobile communication device and the one-button operation way reduce significantly the complexity of use. Accordingly, provided by the present invention positioning system is very useful for the safety of children and also for locating the current position of people, such as older people with memory disorders and intellectual disabilities.

Brief Description of Drawings

[0010] The attached images are included to provide a further understanding of the invention and are incorporated in this specification and constitute a part of it. The drawings illustrate embodiments of the invention and together with the description, serve to explain the principles of the invention.

[0011] 1 schematically shows a block diagram of a system for determining the position of a mobile communication device according to an embodiment of the present invention.

[0012] 2 schematically shows a flow chart illustrating a method for determining the position of a mobile communication device according to an embodiment of the present invention.

[0013] 3 schematically shows a flow chart illustrating a method for determining the position of a mobile communication device of a second person in accordance with an embodiment of the present invention.

Description of preferred embodiments

[0014] It should be made in detail to the present preferred embodiments of the invention now, examples of which are illustrated in the appended drawings. Where possible, the same reference numbers will be used throughout the drawings and the description to refer to the same or like parts.

[0015] An embodiment of the present invention will be described with reference to 1 described in detail below. 1 schematically shows a block diagram of a system for determining the position of a mobile communication device according to an embodiment of the present invention. The mobile communications device 100 comprises a position receiver 110 A signal transmitter / receiver 120 , A controller 130 and a display 140 , Here, the control 130 in each case with the signal transmitter / receiver 120 , The position receiver 110 and the display 140 coupled. The signal transmitter / receiver 120 is further connected to the position receiver 110 coupled. In addition, a position determination processing system 150 installed at a specific location of a base where it / receiver with the signal transducer 120 can communicate. After the mobile communication device 100 the signal transmitted from the GPS position signal via the receiver position 110 has received, transmits the signal transmitter / receiver 120 the position signal to the position determination processing system 150 , Here is the position determination processing system 150 a system outside of the mobile communication device 100 is installed. The position determination processing system is configured such that it stores the corresponding datums and / receiver of the signal transducer 120 Position signals sent compares / calculates and generates the corresponding position signal to the position-related information. The position-related information addresses certain landmarks or buildings includes etc.. In addition, the position-related information about the use of a method for transmitting short messages, graphic images, voice or text to the signal transducer is / receiver 120 transfer. After the signal transmitter / receiver 120 receiving the position-related information, the position-related information from the display is 140 displayed. Moreover, further comprising a controller 130 in the mobile communication device 100 be installed to the receiver signal transducer / 120 to control so as to transmit the position signals and receives the position-related information. it must be noted that between the signal transmitter / receiver 120 and an external device including the position instruction processing system 150 can transmitted signals have different transmission path, which consists of different transmission components. Accordingly, it may be that an external device, the signal from the signal transmitter / receiver 120 receives not the external device, the receiver the signal to the signal transmitter / 120 transfers.

[0016] In the present embodiment of the present invention, the control 130 are controlled by a button. In particular, receives and transmits the mobile communication device 100 the position signals in response to the actuation of a key, and receives the position-related information of the mobile communication device 100 from the position determination processing system 150 and displays them. In other words, the user can position-related information of the mobile communication device 100 obtained by merely performing such one-step button operation without the additional operating steps as in the case of the conventional mobile communication device. In addition, when the user wishes to receive the position-related information of a second person, the signal transmitter / receiver 120 send a "request of the position signal of a second person" to the position-related information of the mobile communication device 100 the second person on the between different communication devices 100 to request communications protocol used. Then the position determination processing system receives 150 the position signal of the mobile communication device 100 the second person in accordance with the request signal and transmits the communication device 100 the second person corresponding position-related information to the signal transmitter / receiver 120 user. Thereafter, the signal transmitter receives / receiver 120 the position-related information of the mobile communication device 100 the second person on the display 140 is shown. The above-mentioned position-related information corresponding to the position signal sent from the mobile communication device of the second person.

[0017] For a better understanding of the expert, the following embodiments are referred to with reference 1 described in detail.

[0018] 2 schematically shows a flow chart illustrating a method for determining the position of a mobile communication device according to an embodiment of the present invention. The method for determining the position comprises the following steps. First receives in step 210 the mobile communication device 100 a position signal from the position receiver 110 , Thereafter transmits in step 220 the mobile communication device 100 the received position signal via the signal transmitter / receiver 120 to the position determination processing system 150 , in step 230 compares / calculates the position instruction processing system 150 the corresponding position-related information according to the mobile communication device from the 100 Position signal and transmitted transmits the position-related information using one of the following procedures to the mobile communication device 100 Method for transmitting short messages, voice, graphic images and text. The above-mentioned position related information includes addresses. Thereafter used in step 240 the mobile communication device 100 the signal transmitter / receiver 120 To the position of the determination processing system 150 in step 230 to receive transmitted position related information. Finally shows in step 250 the display 140 the / receiver of the signal transducer 120 received position-related information to.

[0019] 3 schematically shows a flow chart illustrating a method for determining the position of the mobile communication device of a second person in accordance with an embodiment of the present invention. The method for determining the position comprises the following steps. First used in step 310 the mobile communication device 100 the signal transmitter / receiver 120 To send out a "request a position signal of a second person" to the position-related information of the mobile communication device 100 Call the second person. Thereafter generated in step 320 the position determination processing system 150 corresponding to the position signal of the mobile communication device of the second person position-related information of the mobile communication device of the second person and transmits the position-related information using one of the following methods: Method for the transmission of short messages, voice, graphic images and text. The position-related information corresponding to the position signal sent from the mobile communication device of the second person. Finally, in step 340 the received position-related information of the mobile communication device of the second person on the display 140 displayed.

[0020] In summary, the mobile communication device of the present invention is not only easy to use but also more cost effective and consumes less energy compared to the conventional mobile communication device as a storage of large amounts of map reference system or a computing device are not required. In addition, the functions of searching the position-related information of another mobile communication device and the one-button operation way reduce significantly the complexity of use. Accordingly, provided by the present invention positioning system is very useful for the safety of children and the places of the real-time location of people, such as older people with memory disorders and intellectual disabilities.

[0021] Although the invention has been described with reference to a specific embodiment thereof, it is apparent to one skilled in the art that modifications to the described embodiment may be made without departing from the spirit of the invention. Accordingly, the scope of the invention by the appended claims and not by the above detailed description is defined.

Patent Citations (19)

Publication number	Priority date	Publication date	Assignee	Title
GB2356098A *	1997-02-06	2001-05-09	Fujitsu Ltd	Portable radio terminal for position information system
DE10156832A1 *	2001-11-20	2003-06-05	Siemens Ag	Method and apparatus for displaying information

Family To Family Citations

US5043736B1 *	1990-07-27	1994-09-06	Cae Link Corp	Cellular position location system
JP3133770B2 *	1991-01-18	2001-02-13	マツダ株式会社	Automobile travel system of
US6266614B1 *	1997-12-24	2001-07-24	Wendell Alumbaugh	Travel guide
US6222483B1 *	1998-09-29	2001-04-24	Nokia Mobile Phones Limited	GPS location for mobile phones using the internet
US20050026589A1 *	1999-07-29	2005-02-03	Bryan Holland	Remote locator system using A E911-enabled wireless system
US7260448B2 *	2000-05-18	2007-08-28	Sirf Technology, Inc.	Satellite based positioning method and system for coarse location positioning
US7474896B2 *	2000-07-14	2009-01-06	Norman Mohi	Locating system and method
US20030141973A1 *	2001-07-24	2003-07-31	Hen-Geul Yeh	Smart object locator
KR100814251B1 *	2000-09-20	2008-03-17	엔엑스피 비 브이	A method of determining the position of a mobile unit
US20050288034A1 *	2001-11-15	2005-12-29	Judson Bruce A	Method and apparatus for using position location to direct narrow beam antennas
US20020164998A1 *	2001-05-01	2002-11-07	Saed Younis	System and method for providing position-based information to a user of a wireless device
JP4278952B2 *	2001-11-08	2009-06-17	ヤマハ株式会社	Mobile terminal
US6888337B2 *	2003-09-10	2005-04-26	Sony Ericsson Mobile Communications Ab	Methods and apparatus for determining the position of a mobile terminal using localized source assistance information
US7245255B2 *	2004-03-16	2007-07-17	Global Locate, Inc	Method and apparatus for determining absolute time-of-day in a mobile-assisted satellite positioning system
JP3870952B2 *	2004-04-15	2007-01-24	セイコーエプソン株式会社	Monitoring system, a terminal device, a mobile object monitoring method, control method of a terminal device, a control program of the terminal device, and computer readable recording medium a control program of the terminal device, the management device, control method for a management device, the management device control program
US7642958B2 *	2005-06-21	2010-01-05	Motorola, Inc.	Satellite positioning system receivers and methods
US20070069946A1 *	2005-09-27	2007-03-29	Diego Kaplan	Systems and methods for position based services in a mobile device

* Cited by examiner, † Cited by third party

Cited By (6)

Publication number	Priority date	Publication date	Assignee	Title
US7925426B2 *	2005-11-17	2011-04-12	Motility Systems	Power management systems and devices
US9682624B1	2005-11-17	2017-06-20	Invent.Ly, Llc	Power management using route information for a hybrid electric vehicle
US9792736B1	2005-11-17	2017-10-17	Invently Automotive Inc.	Telemetry device for capturing vehicle environment and operational status history
Family To Family Citations				
CN102957869B	2011-08-30	2014-10-29	国际商业机器公司	Method and apparatus for determining the location of a mobile device
CN104918326A *	2015-05-11	2015-09-16	上海网罗电子科技有限公司	Indoor positioning system and method
CN105549045A	2015-12-14	2016-05-04	联想(北京)有限公司	Information processing method and electronic devices

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
DE102337908B4	2016-04-07	ID registration process for a tire pressure sensor ID registration system, tire pressure monitoring system, tire pressure sensor and smart control system
DE60313328T2	2008-01-03	System and method for providing alerts inscribed possible partial presence

DE602008165T2	2006-07-27	System and method for use restriction of cordless phones in moving vehicles
DE60018263T2	2005-08-25	Board communication terminal and information supply center for this terminal
DE60130888T2	2008-07-17	Transportation planning system
DE102005058564B4	2015-08-06	Wireless handheld communication device in a process control environment
EP1282578B1	2005-03-23	Method for controlling an elevator
DE60020178T2	2006-05-04	Method and device for the automatic data acquisition of the traffic situation by a distributed automotive computing system
DE60304799T2	2007-04-26	System, apparatus and method for Taxirufdienst
DE69829785T2	2006-11-23	signaling system
DE60130724T2	2008-07-17	Detection of changes of ground targets between a line drawing and a captured image
DE1010720784	2010-03-18	Method and apparatus for communication between applications in wireless networks
DE69729855T2	2005-08-04	A method of allocating a device identification
DE60124971T2	2007-06-21	Health Monitoring System
DE102005013281B4	2016-03-03	A method and system for vehicle software configuration management
DE60032969T2	2007-10-18	Traffic information system for vehicles
DE60029106T2	2007-05-31	Mobile communication system, the abode-related news enables
DE602212137T2	2008-04-17	System, method and program information server and terminal device for navigation with different means of transportation
DE602006035T2	2006-09-14	navigation system
DE69908972T2	2004-05-13	Remote control of electronic devices
EP1518383B1	2012-07-25	Method and device for emitting and/or receiving information relating to a vehicle
EP0805952B1	1999-05-06	Navigation device for people
DE69535649T2	2008-10-30	Methods and apparatus for automatically selecting a radio talk group
DE102006037033B4	2015-11-12	RFID valuable asset management method and system for vehicles
DE19548393C2	2001-07-19	Application device, encoder apparatus and method for setting preference data

Priority And Related Applications

Priority Applications (2)

Application	Priority date	Filing date	Title
TW094142748		2005-12-05	
TW094142748A	2005-12-05	2005-12-05	System for positioning mobile communication apparatus and method thereof

Legal Events

Date	Code	Title	Description
2007-06-14	OP8	Request for examination as to paragraph 44 patent law	
2007-08-30	8130	Withdrawal	

Data provided by IFI CLAIMS Patent Services

About Send Feedback Public Datasets Terms Privacy Policy

(19) Bundesrepublik Deutschland
Deutsches Patent- und Markenamt

(10) DE 10 2006 009 710 A1 2007.06.14

(12) # Offenlegungsschrift

(21) Aktenzeichen: 10 2006 009 710.8
(22) Anmeldetag: 02.03.2006
(43) Offenlegungstag: 14.06.2007

(51) Int Cl.[8]: *H04Q 7/32* (2006.01)

(30) Unionspriorität:
094142748 05.12.2005 TW

(71) Anmelder:
Compal Electronics, Inc., Taipei, TW

(74) Vertreter:
ABK Patentanwälte, 82152 Planegg

(72) Erfinder:
Kung, Shao-Tsu, Taipei, TW; Chuang, Ko-Chien, Taipei, TW

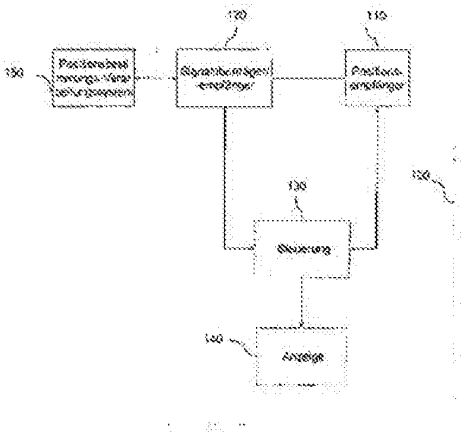
(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:
DE 101 56 832 A1
GB 23 58 098 A

Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Prüfungsantrag gemäß § 44 PatG ist gestellt.

(54) Bezeichnung: System für das Bestimmen der Position eines mobilen Kommunikationsgeräts und Verfahren dafür

(57) Zusammenfassung: Ein System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts wird bereitgestellt. Das mobile Kommunikationsgerät umfasst eine Steuerung, einen Signalüberträger/-empfänger, einen Positionsempfänger und eine Anzeige. Dabei empfängt der Positionsempfänger ein von einem globalen Positionsbestimmungssystem (GPS) übertragenes Positionssignal. Der mit dem Positionsempfänger gekoppelte Signalüberträger/-empfänger ist derart konfiguriert, dass er das Positionssignal an eine externe Vorrichtung überträgt. Der Signalüberträger/-empfänger empfängt auch die gemäß dem Positionssignal bestimmte Positions-bezogene Information von der externen Vorrichtung. Die Steuerung ist jeweils mit dem Signalüberträger/-empfänger, dem Positionsempfänger und der Anzeige gekoppelt. Außerdem ist die Anzeige geeignet, die Positions-bezogene Information anzuzeigen.



Beschreibung

Hintergrund der Erfindung

Gebiet der Erfindung

[0001] Die vorliegende Erfindung bezieht sich auf ein globales Positionsbestimmungssystem (GPS, Global Positioning System) und insbesondere auf ein System für das Bestimmen der Position eines mobilen Kommunikationsgeräts.

Beschreibung der zugehörigen Technik

[0002] Das globale Positionsbestimmungssystem (GPS) ist eine weit verbreitete Vorrichtung, die im Satellitennavigationssystem im Fahrzeug verwendet wird oder in die persönlichen digitalen Assistenten (PDA, Personal Digital Assistant) eingebaut ist. Da es beim GPS erforderlich ist, dass die Positionssignale von den Positionsbestimmungssatelliten empfangen werden, um diese mit den zugehörigen Kartenbezugssystemen zu vergleichen, benötigt das elektronische Gerät, in welches das GPS eingebaut ist, für gewöhnlich eine hoch auflösende Satellitenpositionsbestimmung und einen hochdichten Speicher, um die Kartenbezugssysteme vorher zu laden und um die Hochgeschwindigkeits-Multimedia-Rechenleistung bereitzustellen. Bei dem herkömmlichen Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts wird eine große Menge von Kartenbezugssystemen in dem mobilen Kommunikationsgerät gespeichert, und die Positionssignale werden mit den Kartenbezugssystemen verglichen. Ein derartiges Positionsbetimmungsverfahren bindet nicht nur Rechenkapazität, sondern erhöht auch die Auslastung und den Energieverbrauch des mobilen Kommunikationsgeräts, was sich bedeutsam auf die verfügbare Nutzungsdauer des mobilen Kommunikationsgeräts auswirkt. Zusätzlich würde die Notwendigkeit eines hochdichten Speicher- und Rechensystems dazu führen, dass das mobile Kommunikationsgerät technisch ausgefeilter und komplexer ist, und dies würde wiederum die Gesamtkosten des mobilen Kommunikationsgeräts erhören. Des Weiteren ist das Bedienen eines solchen Systems eher schwierig, da mehrere Bedienungsschritte erforderlich sind, um die gewünschten Positionsdaten zu erhalten. Für diejenigen Benutzer, die nicht mit der Schnittstelle des elektronischen Geräts oder mit der Software-Benutzerschnittstelle vertraut sind, ist ein solches Verfahren sehr schwierig. Beispielsweise ist ein derartiger Vorgang des Suchens von Adressen oder der Positionsbestimmung eher schwierig für Kinder oder ältere Menschen.

Zusammenfassung der Erfindung

[0003] Deshalb ist eine Aufgabe der vorliegenden Erfindung, ein System für das Bestimmen der Position eines mobilen Kommunikationsgeräts bereitzustellen, wobei das Positionsbestimmungs-Verarbeitungssystem geeignet ist, das empfangene Positionssignal zu verarbeiten, um die gewünschte Positions-bezogene Information zu erhalten. Somit ist es nicht notwendig, dass das mobile Kommunikationsgerät die Positionssignale vergleicht und berechnet oder große Mengen an Kartenbezugssystemen speichert. Aus diesem Grund ist das mobile Kommunikationsgerät der vorliegenden Erfindung nicht nur leicht zu bedienen, sondern es ist auch im Vergleich zu dem herkömmlichen mobilen Kommunikationsgerät weniger kostenaufwendig und verbraucht weniger Energie.

[0004] Gemäß dieser Aufgabe und weiteren Aufgaben der Erfindung wird ein System für das Bestimmen der Position eines mobilen Kommunikationsgeräts bereitgestellt. Das System ist in das mobile Kommunikationsgerät integriert. Das mobile Kommunikationsgerät umfasst einen Positionsempfänger, einen Signalüberträger/-empfänger, eine Steuerung und eine Anzeige. Dabei erhält das Positionsbestimmungssystem die Positions-bezogene Information von den von dem Satelliten ausgesendeten hochfrequenten, niederenergetischen Positionssignalen. Zusätzlich empfängt der Positionsempfänger das entsprechende, von dem GPS gesendete Positionssignal. Der mit dem Positionsempfänger gekoppelte Signalüberträger/-empfänger ist derart konfiguriert, dass er das Positionssignal an eine Vorrichtung außerhalb des mobilen Kommunikationsgeräts überträgt und die Positionsbezogene Information empfängt, die gemäß dem Positionssignal bestimmt wird, das von derselben oder einer anderen Vorrichtung außerhalb des mobilen Kommunikationsgeräts übertragen wird.

[0005] Eine der oben erwähnten Vorrichtungen, die sich außerhalb des mobilen Kommunikationsgeräts befinden, oder kurz gesagt, eine externe Vorrichtung, umfasst ein Positionsbestimmungs-Verarbeitungssystem. Das Positionsbestimmungs-Verarbeitungssystem vergleicht die Positionssignale und überträgt die Positionsbezogenen Daten an das mobile Kommunikationsgerät, die nach dem Vergleich erhalten werden, unter Verwendung des Verfahrens zur Übertragung von Kurznachrichten, grafischen Bildern, Stimme oder Text. Dabei schließt die Positionsbezogene Information die Adressen ein. Ferner steuert die Steuerung in dem mobilen Kommunikationsgerät die Übertragungs- und Empfangsvorgänge des Positionsempfängers und des Signalüberträgers/-empfängers. Die Steuerung ist geeignet für das Übertragen und Verarbeiten der empfangenen Daten. Die Steuerung umfasst ferner eine Tastatur. Als Antwort auf das Betätigen einer Taste wird der Signalüberträger/-empfänger unmittelbar gesteuert, so dass er das Positionssignal an die externe Vorrichtung überträgt und die dem Positionssignal entsprechende Positi-

onsbezogene Information von der externen Vorrichtung empfängt. Die Anzeige ist geeignet, die empfangene Positions-bezogene Information anzuzeigen. Eine derartige Bedienungsschnittstelle mit einer Taste verringert die Komplexität der Bedienung, so dass das Positionsbestimmungssystem benutzerfreundlicher wird.

[0006] In einer Ausführungsform der vorliegenden Erfindung verwendet der oben erwähnte Signalüberträger/-empfänger des mobilen Kommunikationsgeräts das spezifische Protokoll des jeweiligen mobilen Kommunikationsgeräts, um die Funktionen des Sendens einer „Anforderung eines Positionssignals einer zweiten Person" und des Empfangens der Positions-bezogenen Information der zweiten Person von deren mobilen Kommunikationsgerät oder der oben erwähnten externen Vorrichtung bereitzustellen. Hier wird die Positions-bezogene Information aus dem Rechenvorgang gemäß dem von dem mobilen Kommunikationsgerät der zweiten Person gesendeten Positionssignal erhalten. Diese Funktion ist sehr nützlich für die Sicherheit von Kindern und ebenso für das Orten der aktuellen Position von Menschen wie etwa älteren Menschen mit Gedächtnisstörungen und geistig behinderten Menschen.

[0007] Gemäß einem weiteren Aspekt der vorliegenden Erfindung wird ein Verfahren für das Bestimmen der Position eines mobilen Kommunikationsgeräts bereitgestellt. Das Verfahren für das Bestimmen der Position umfasst die folgenden Schritte. Zunächst empfängt das mobile Kommunikationsgerät ein Positionssignal. Dann überträgt das mobile Kommunikationsgerät das empfangene Positionssignal an eine externe Vorrichtung, um die Positions-bezogene Information zu erzeugen. Hier wird die Positions-bezogene Information einschließlich der Adressen über ein Verfahren zur Übertragung von Kurznachrichten, Stimme oder grafischen Bildern übertragen. Dann empfängt das mobile Kommunikationsgerät die Positions-bezogene Information von der externen Vorrichtung und die empfangene Positions-bezogene Information wird in der Anzeige des mobilen Kommunikationsgeräts angezeigt.

[0008] In einer Ausführungsform der vorliegenden Erfindung sendet das mobile Kommunikationsgerät eine„Anforderung eines Positionssignals einer zweiten Person", um die Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person anzufordern, und dann empfängt das mobile Kommunikationsgerät die dem von dem mobilen Kommunikationsgerät der zweiten Person gesendeten Positionssignal entsprechende Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person.

[0009] Dementsprechend ist bei dem mobilen Kommunikationsgerät gemäß der vorliegenden Erfindung das Positionsbestimmungs-Verarbeitungssystem geeignet für das Berechnen des empfangenen Positionssignals, um die gewünschte Positions-bezogene Information zu erhalten. Somit ist es nicht notwendig, dass das mobile Kommunikationsgerät die empfangenen Positionssignale vergleicht und berechnet oder eine große Menge von Kartenbezugssystemen speichert. Aus diesem Grund ist das mobile Kommunikationsgerät der vorliegenden Erfindung nicht nur einfach zu bedienen, sondern auch im Vergleich zu dem herkömmlichen mobilen Kommunikationsgerät kostengünstiger und verbraucht weniger Energie. Zusätzlich verringern die Funktionen des Suchens der Positions-bezogenen Information eines anderen mobilen Kommunikationsgeräts und die Ein-Tasten-Bedienungsweise bedeutsam die Komplexität der Benutzung. Dementsprechend ist das von der vorliegenden Erfindung bereitgestellte Positionsbestimmungssystem sehr nützlich für die Sicherheit von Kindern und auch für das Orten der aktuellen Position von Menschen, wie etwa älteren Menschen mit Gedächtnisstörungen und geistig behinderten Menschen.

Kurze Beschreibung der Zeichnungen

[0010] Die angehängten Bilder sind eingefügt, um ein genaueres Verständnis der Erfindung bereitzustellen und sind in diese Spezifikation inkorporiert und stellen einen Teil von ihr dar. Die Zeichnungen zeigen Ausführungsformen der Erfindung und dienen zusammen mit der Beschreibung dazu, die Prinzipien der Erfindung zu erklären.

[0011] Fig. 1 zeigt schematisch ein Blockdiagramm eines Systems für das Bestimmen der Position eines mobilen Kommunikationsgeräts gemäß einer Ausführungsform der vorliegenden Erfindung.

[0012] Fig. 2 zeigt schematisch ein Flussdiagramm, das ein Verfahren für das Bestimmen der Position eines mobilen Kommunikationsgeräts gemäß einer Ausführungsform der vorliegenden Erfindung veranschaulicht.

[0013] Fig. 3 zeigt schematisch ein Flussdiagramm, das ein Verfahren für das Bestimmen der Position eines mobilen Kommunikationsgeräts einer zweiten Person gemäß einer Ausführungsform der vorliegenden Erfindung veranschaulicht.

Beschreibung von bevorzugten Ausführungsformen

[0014] Es soll nun detailliert Bezug auf die vorliegenden bevorzugten Ausführungsformen der Erfindung genommen werden, deren Beispiele in den angehängten Zeichnungen veranschaulicht werden. Soweit dies möglich ist, werden dieselben Bezugszeichen in den Zeichnungen und in der Beschreibung verwendet, um sich auf gleiche oder ähnliche Teile zu

beziehen.

[0015] Eine Ausführungsform der vorliegenden Erfindung wird unter Bezugnahme auf Fig. 1 detailliert im Folgenden beschrieben. Fig. 1 zeigt schematisch ein Blockdiagramm eines Systems für das Bestimmen der Position eines mobilen Kommunikationsgeräts gemäß einer Ausführungsform der vorliegenden Erfindung. Das mobile Kommunikationsgerät **100** umfasst einen Positionsempfänger **110**, einen Signalüberträger/-empfänger **120**, eine Steuerung **130** und eine Anzeige **140**. Dabei ist die Steuerung **130** jeweils mit dem Signalüberträger/-empfänger **120**, dem Positionsempfänger **110** und der Anzeige **140** gekoppelt. Der Signalüberträger/-empfänger **120** ist ferner mit dem Positionsempfänger **110** gekoppelt. Zusätzlich ist ein Positionsbestimmungs-Verarbeitungssystem **150** an einer bestimmten Stelle einer Basis installiert, wo es mit dem Signalüberträger/-empfänger **120** kommunizieren kann. Nachdem das mobile Kommunikationsgerät **100** das von dem GPS gesendete Positionssignal über den Positionsempfänger **110** empfangen hat, überträgt der Signalüberträger/-empfänger **120** das Positionssignal an das Positionsbestimmungs-Verarbeitungssystem **150**. Hier ist das Positionsbestimmungs-Verarbeitungssystem **150** ein System, welches außerhalb des mobilen Kommunikationsgeräts **100** installiert ist. Das Positionsbestimmungs-Verarbeitungssystem ist derart konfiguriert, dass es die zugehörigen Kartenbezugssysteme speichert und die von dem Signalüberträger/-empfänger **120** gesendeten Positionssignale vergleicht/berechnet und die dem Positionssignal entsprechende Positions-bezogene Information erzeugt. Dabei schließt die Positionsbezogene Information Adressen, bestimmte Landmarken oder Gebäude etc. ein. Zusätzlich wird die Positions-bezogene Information über das Verwenden eines Verfahrens zur Übertragung von Kurznachrichten, grafischen Bildern, Stimme oder Text an den Signalüberträger/-empfänger **120** übertragen. Nachdem der Signalüberträger/-empfänger **120** die Positions-bezogene Information empfangen hat, wird die Positionsbezogene Information von der Anzeige **140** angezeigt. Außerdem kann ferner eine Steuerung **130** in dem mobilen Kommunikationsgerät **100** installiert sein, um den Signalüberträger/-empfänger **120** derart zu steuern, dass er die Positionssignale überträgt und die Positions-bezogene Information empfängt. Es muss festgestellt werden, dass die zwischen dem Signalüberträger/-empfänger **120** und einer externen Vorrichtung einschließlich des Positionsbestimmungs-Verarbeitungssystems **150** übertragenen Signale einen unterschiedlichen Übertragungsweg haben können, der aus unterschiedlichen Übertragungskomponenten besteht. Dementsprechend kann es sein, dass eine externe Vorrichtung, die das Signal von dem Signalüberträger/-empfänger **120** empfängt nicht die externe Vorrichtung ist, die das Signal an den Signalüberträger/-empfänger **120** überträgt.

[0016] In der vorliegenden Ausführungsform der vorliegenden Erfindung kann die Steuerung **130** von einer Taste gesteuert werden. Insbesondere empfängt und überträgt das mobile Kommunikationsgerät **100** die Positionssignale als Antwort auf das Betätigen einer Taste und empfängt die Positions-bezogene Information des mobilen Kommunikationsgeräts **100** von dem Positionsbestimmungs-Verarbeitungssystem **150** und zeigt diese an. Anders ausgedrückt kann der Benutzer die Positions-bezogene Information des mobilen Kommunikationsgeräts **100** erhalten, indem er lediglich einen derartigen Ein-Tasten-Bedienungsschritt ausführt ohne die zusätzlichen Bedienungsschritte wie im Falle des herkömmlichen mobilen Kommunikationsgeräte. Außerdem kann, wenn der Benutzer die Positions-bezogene Information einer zweiten Person zu erhalten wünscht, der Signalüberträger/-empfänger **120** eine "Anforderung des Positionssignals einer zweiten Person" aussenden, um die Positions-bezogene Information des mobilen Kommunikationsgeräts **100** der zweiten Person über das zwischen verschiedenen Kommunikationsgeräten **100** verwendete Kommunikationsprotokoll anzufordern. Dann erhält das Positionsbestimmungs-Verarbeitungssystem **150** das Positionssignal des mobilen Kommunikationsgeräts **100** der zweiten Person gemäß dem Anforderungssignal und überträgt die dem Kommunikationsgerät **100** der zweiten Person entsprechende Positions-bezogene Information an den Signalüberträger/-empfänger **120** des Benutzers. Danach empfängt der Signalüberträger/-empfänger **120** die Positions-bezogene Information des mobilen Kommunikationsgeräts **100** der zweiten Person, die an der Anzeige **140** angezeigt wird. Die oben erwähnte Positions-bezogene Information entspricht dem von dem mobilen Kommunikationsgerät der zweiten Person gesendeten Positionssignal.

[0017] Zum besseren Verständnis für den Fachmann werden die folgenden Ausführungsformen nachfolgend unter Bezugnahme auf Fig. 1 detailliert beschrieben.

[0018] Fig. 2 zeigt schematisch ein Flussdiagramm, das ein Verfahren für das Bestimmen der Position eines mobilen Kommunikationsgeräts gemäß einer Ausführungsform der vorliegenden Erfindung veranschaulicht. Das Verfahren für das Bestimmen der Position umfasst die folgenden Schritte. Zunächst empfängt in Schritt **210** das mobile Kommunikationsgerät **100** ein Positionssignal von dem Positionsempfänger **110**. Danach überträgt in Schritt **220** das mobile Kommunikationsgerät **100** das empfangene Positionssignal über den Signalüberträger/-empfänger **120** an das Positionsbestimmungs-Verarbeitungssystem **150**. In Schritt **230** vergleicht/berechnet das Positionsbestimmungs-Verarbeitungssystem **150** die entsprechende Positionsbezogene Information gemäß

dem von dem mobilen Kommunikationsgerät **100** gesendeten Positionssignal und überträgt die Positions-bezogene Information unter Verwendung eines der folgenden Verfahren an das mobile Kommunikationsgerät **100**: Verfahren zur Übertragung von Kurznachrichten, Stimme, grafischen Bildern und Text. Die oben erwähnte Positions-bezogene Information schließt Adressen ein. Danach verwendet in Schritt **240** das mobile Kommunikationsgerät **100** den Signalüberträger/-empfänger **120**, um die von dem Positionsbestimmungs-Verarbeitungssystem **150** in Schritt **230** gesendete Positions-bezogene Information zu empfangen. Schließlich zeigt in Schritt **250** die Anzeige **140** die von dem Signalüberträger/-empfänger **120** empfangene Positions-bezogene Information an.

[0019] Fig. 3 zeigt schematisch ein Flussdiagramm, das ein Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts einer zweiten Person gemäß einer Ausführungsform der vorliegenden Erfindung veranschaulicht. Das Verfahren zur Positionsbestimmung umfasst die folgenden Schritte. Zunächst verwendet in Schritt **310** das mobile Kommunikationsgerät **100** den Signalüberträger/-empfänger **120**, um eine "Anforderung eines Positionssignals einer zweiten Person" auszusenden, um die Positions-bezogene Information des mobilen Kommunikationsgeräts **100** der zweiten Person anzufordern. Danach erzeugt in Schritt **320** das Positionsbestimmungs-Verarbeitungssystem **150** die dem Positionssignal des mobilen Kommunikationsgeräts der zweiten Person entsprechende Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person und überträgt die Positions-bezogene Information unter Verwendung eines der folgenden Verfahren: Verfahren zur Übertragung von Kurznachrichten, Stimme, grafischen Bildern und Text. Dabei entspricht die Positions-bezogene Information dem von dem mobilen Kommunikationsgerät der zweiten Person gesendeten Positionssignal. Schließlich wird in Schritt **340** die empfangene Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person an der Anzeige **140** angezeigt.

[0020] Zusammengefasst ist das mobile Kommunikationsgerät der vorliegenden Erfindung nicht nur leicht zu bedienen, sondern auch kostengünstiger und verbraucht weniger Energie im Vergleich zu dem herkömmlichen mobilen Kommunikationsgerät, da eine Speicherung von großen Mengen von Kartenbezugssystemen oder eine Rechenvorrichtung nicht erforderlich sind. Zudem verringern die Funktionen des Suchens der Positions-bezogenen Information eines anderen mobilen Kommunikationsgeräts und die Ein-Tasten-Bedienungsweise bedeutsam die Komplexität der Benutzung. Dementsprechend ist das von der vorliegenden Erfindung bereitgestellte Positionsbestimmungssystem sehr nützlich für die Sicherheit von Kindern und für das Orten der Echtzeitposition von Menschen wie etwa älteren Menschen mit Gedächtnisstörungen und geistig behinderten Menschen.

[0021] Obwohl die Erfindung unter Bezugnahme auf eine bestimmte Ausführungsform davon beschrieben wurde, ist dem Fachmann klar ersichtlich, dass Änderungen an der beschriebenen Ausführungsform vorgenommen werden können, ohne dass vom Wesen der Erfindung abgewichen wird. Dementsprechend wird der Schutzumfang der Erfindung durch die angehängten Ansprüche und nicht durch die obige detaillierte Beschreibung definiert.

Patentansprüche

1. Ein System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts, das folgendes umfasst:
einen Positionsempfänger für das Empfangen eines entsprechenden, von einem globalen Positionsbestimmungssystem (GPS) gesendeten Positionssignals; und
einen Signalüberträger/-empfänger, der mit dem Positionsempfänger gekoppelt ist, für das Übertragen des entsprechenden Positionssignals außerhalb des mobilen Kommunikationsgerätes und für das Empfangen einer Positionsbezogenen Information, die gemäß dem entsprechenden Positionssignal außerhalb des mobilen Kommunikationsgeräts bestimmt wird.

2. Das System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 1, das ferner eine Steuerung für das Steuern von Übertragungs-/Empfangsvorgängen des Signalüberträgers/-empfängers umfasst.

3. Das System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 1, das ferner eine Anzeige für das Anzeigen der entsprechenden Positions-bezogenen Information umfasst.

4. Das System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 1, wobei der Signalüberträger/-empfänger ferner eine Funktion für das Aussenden einer „Anforderung eines Positionssignals einer zweiten Person" und das Empfangen einer Positions-bezogenen Information umfasst, die gemäß einem der „Anforderung des Positionssignals einer zweiten Person" entsprechenden Positionssignal des mobilen Kommunikationsgeräts außerhalb des mobilen Kommunikationsgeräts bestimmt wird.

5. Das System für ein mobiles Kommunikationsgerät für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 4, wobei die

Positions-bezogene Information Adressen umfasst.

6. Ein Verfahren für das Bestimmen der Position eines mobilen Kommunikationsgeräts, das folgendes umfasst:
Verwenden eines mobilen Kommunikationsgeräts, um ein Positionssignal zu empfangen;
Übertragen des Positionssignals an eine externe Vorrichtung für das Erzeugen einer Positions-bezogenen Information; und
Empfangen der Positions-bezogenen Information von der externen Vorrichtung.

7. Das Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 6, wobei die Positions-bezogene Information Adressen umfasst.

8. Das Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 6, wobei die von dem mobilen Kommunikationsgerät empfangene Positions-bezogene Information übertragen wird, indem eines der folgenden Verfahren angewendet wird: Verfahren zur Übertragung von Kurznachrichten, Verfahren zur Übertragung von Stimme und Verfahren zur Übertragung von grafischen Bildern.

9. Das Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 8, das ferner folgendes umfasst:
Verwenden des mobilen Kommunikationsgeräts, um eine „Anforderung eines Positionssignals einer zweiten Person" auszusenden, um die Positions-bezogene Information einer zweiten Person von deren mobilen Kommunikationsgerät anzufordern; und
Verwenden des mobilen Kommunikationsgeräts, um die Positions-bezogene Information der zweiten Person zu empfangen, die gemäß dem Positionssignal der zweiten Person von deren mobilen Kommunikationsgerät bestimmt wird.

10. Das Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 9, wobei die Positions-bezogene Information der zweiten Person Adressen umfasst.

11. Das Verfahren für das Bestimmen der Position des mobilen Kommunikationsgeräts von Anspruch 8, wobei die von dem mobilen Kommunikationsgerät empfangene Positions-bezogene Information der zweiten Person durch Verwenden eines der folgenden Verfahren übertragen wird:
Verfahren zur Übertragung von Kurznachrichten, Verfahren zur Übertragung von Stimme und Verfahren zur Übertragung von grafischen Bildern.

Es folgen 3 Blatt Zeichnungen

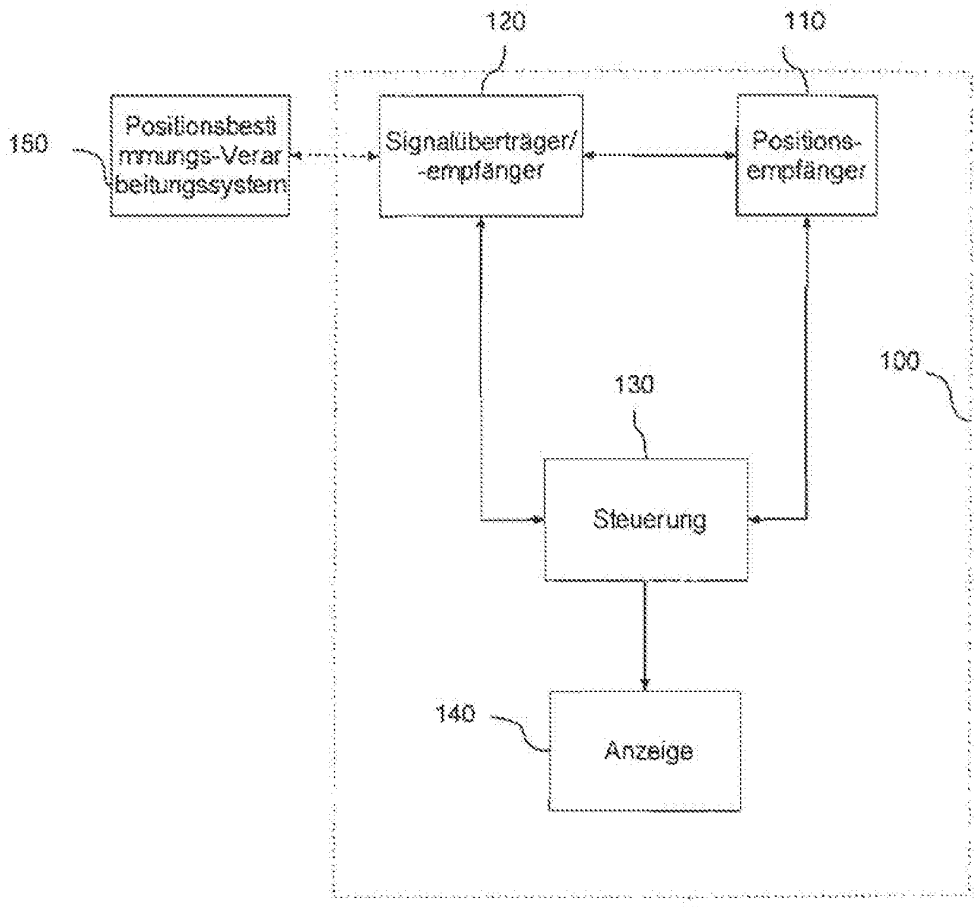

120
110
150
Positionsbestimmungs-Verarbeitungssystem
Signalüberträger/-empfänger
Positions-empfänger
100
130
Steuerung
140
Anzeige

Fig. 1

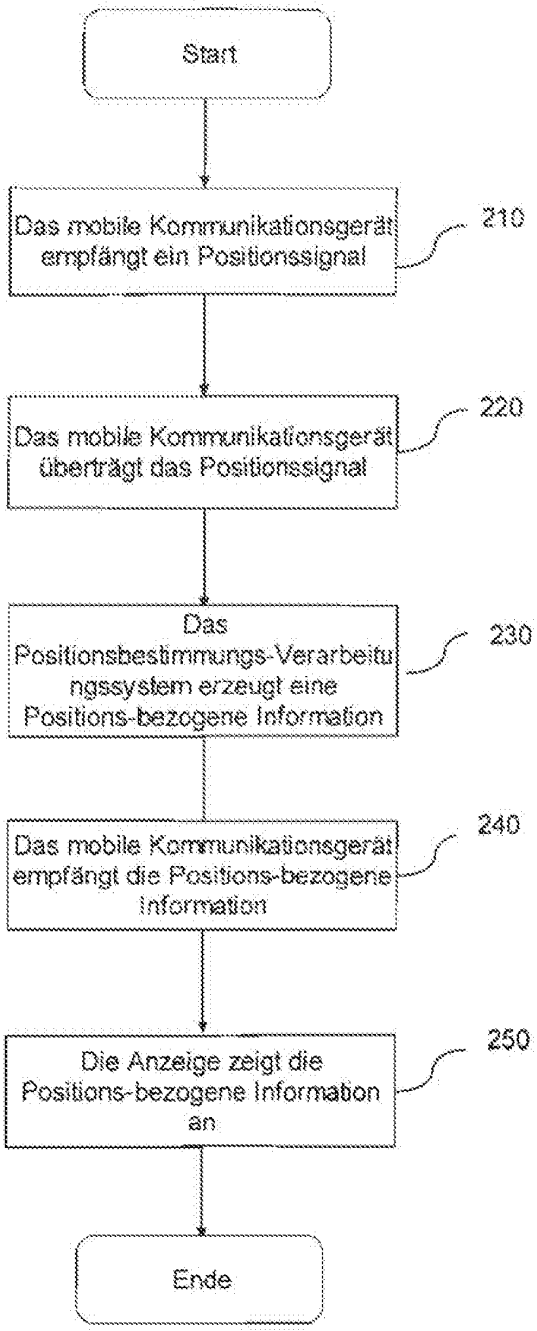

Start
Das mobile Kommunikationsgerät empfängt ein Positionssignal
210
Das mobile Kommunikationsgerät überträgt das Positionssignal
220
Das Positionsbestimmungs-Verarbeitungssystem erzeugt eine Positions-bezogene Information
230
Das mobile Kommunikationsgerät empfängt die Positions-bezogene Information
240
Die Anzeige zeigt die Positions-bezogene Information an
250
Ende

Fig. 2

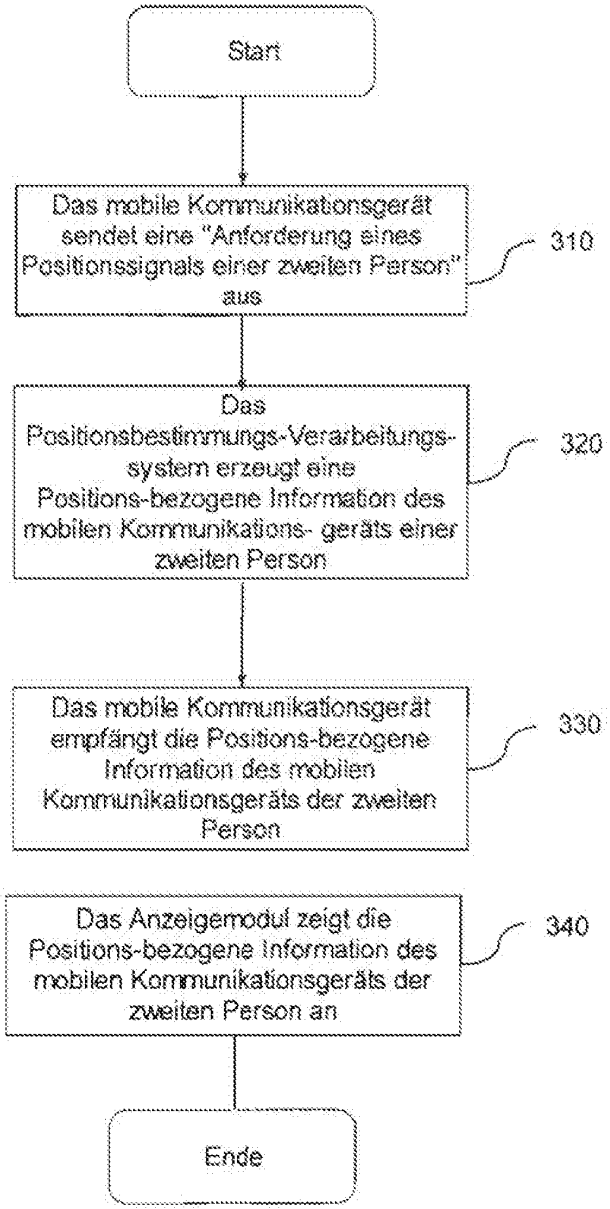

Start
Das mobile Kommunikationsgerät sendet eine "Anforderung eines Positionssignals einer zweiten Person" aus
310
Das Positionsbestimmungs-Verarbeitungs-system erzeugt eine Positions-bezogene Information des mobilen Kommunikations- geräts einer zweiten Person
320
Das mobile Kommunikationsgerät empfängt die Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person
330
Das Anzeigemodul zeigt die Positions-bezogene Information des mobilen Kommunikationsgeräts der zweiten Person an
340
Ende

Fig. 3

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 130 415 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.09.2001 Bulletin 2001/36

(51) Int Cl.[7]: G01S 5/14, G01S 1/04

(21) Application number: 01301687.4

(22) Date of filing: 01.03.2001

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 02.03.2000 JP 2000057814

(71) Applicant: SONY CORPORATION
Tokyo 141 (JP)

(72) Inventor: Hasegawa, Koji, c/o Sony Corporation
Tokyo 141 (JP)

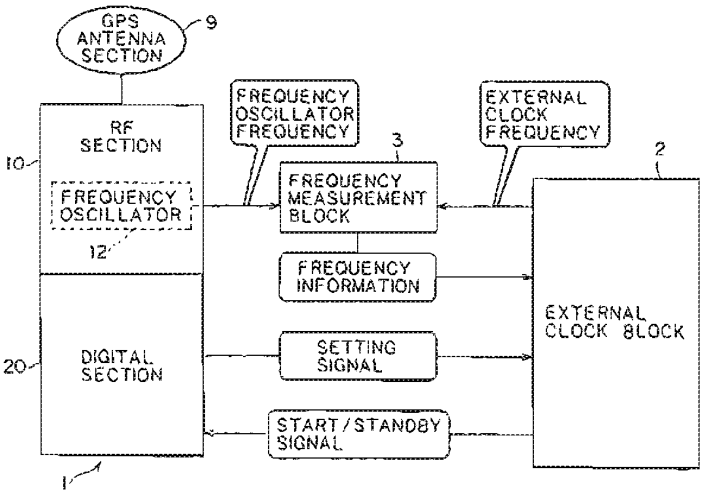
(74) Representative: Pratt, Richard Wilson et al
D. Young & Co,
21 New Fetter Lane
London EC4A 1DA (GB)

(54) GPS receiver and GPS position measurement method

(57) A GPS receiver includes a GPS block (1) for performing position measurement based on a signal transmitted from a GPS satellite to update a navigation message and repeating standby and startup thereof. An external clock block (2) holds frequency information and time information of a high accuracy and outputs a start signal to the GPS block (1), which is in a standby state, based on the frequency information and the time information held therein. A frequency measurement block (3) measures a frequency offset which is a displacement of a frequency oscillator (12) of the GPS block (1) with reference to the frequency information held in the external clock block and outputs information of the measured frequency offset to the external clock block (2).

GPS position measurement can be performed stably and rapidly without the necessity to wait for periodical time information from a GPS satellite and power consumption is minimized also with a minimized position measurement time through the selection of an optimum time interval between intermittent receptions of GPS signals.

FIG.1



EP 1 130 415 A2

Printed by Jouve, 75001 PARIS (FR)

Description

BACKGROUND OF THE INVENTION

[0001] This invention relates to a GPS receiver and a GPS position measurement method.

[0002] An illustrative embodiment of the invention relates to a navigation system for a mobile unit such as a car navigation system.

[0003] The GPS system is a position measurement system developed to allow a mobile unit such as an aircraft or a ship to determine the position on the earth or the velocity of the mobile unit on the real time basis utilizing GPS satellites which fly up in the sky. Recently, the GPS system is utilized widely in the field of the static survey for measuring the distance or the direction between different spots on the earth and the like fields in addition to the position measurement by a mobile unit. In order to utilize the GPS system, a GPS receiver for receiving radio waves radiated from GPS satellites is used.

[0004] FIG. 9A shows a general construction of a GPS system used popularly, and FIG. 9B illustrates a conventional GPS position measurement operation. Referring first to FIG. 9A, a spread spectrum signal of 1.57542 GHz is transmitted from a GPS satellite 200. An antenna section 211 of a GPS receiver 210 receives the transmitted signal after a propagation time which relies upon the distance between the GPS satellite 200 and the GPS receiver 210. The signal received by the antenna section 211 is down converted into a signal of a predetermined intermediate frequency by a radio frequency (RF) section 212 and then supplied to a signal synchronizing demodulation section 213. The intermediate frequency signal is despread into demodulated data by the signal synchronizing demodulation section 213. The demodulated data is used for position measurement calculation by a signal processing section 214. In this manner, the signal transmitted from the GPS satellite 200 is received and used for position measurement calculation by the GPS receiver 210.

[0005] FIG. 9B illustrates a conventional GPS position measurement operation performed by the GPS receiver 210. First, when power supply to the GPS receiver 210 is made available, a frequency search is performed. The frequency search is performed in order to synchronize a frequency of a low accuracy produced by a frequency oscillator 215 in the GPS receiver 210 and having an error with a signal frequency of a high accuracy transmitted from the GPS satellite 200. If some correlation between the frequencies is detected, then the GPS receiver 210 perform a PLL (Phase Locked Loop) operation for adjustment in phase to synchronize the internal frequency fully with that of the signal from the GPS satellite 200. Then, after an edge at a bit boundary is detected and therefore data can be fetched, time information is confirmed. In particular, the TOW (Time Of Week) placed in the second word of a subframe in a hierarchical navigation message and representative of a signal time within one week in the period of 6 seconds is fetched. After the TOW is fetched, position measurement calculation is started. After the position measurement calculation is completed, position measurement data is outputted, and the current position is calculated finally.

[0006] In this manner, the GPS position measurement method requires the frequency oscillator 215 for capturing a signal from the GPS satellite 200, and in order to establish synchronism with a signal frequency of a high accuracy transmitted from the GPS satellite 200, it is required that the frequency oscillator 215 is high in accuracy. However, the oscillation frequency of the frequency oscillator 215 is fluctuated generally by a temperature or a secular change. This fluctuation prevents easy capture of the signal from the GPS satellite 200 through the use of the frequency oscillator 215, and therefore, a scheme of a frequency search must be provided separately. Since usually the frequency search requires much time, a considerably long time is required until the current position is calculated finally.

[0007] Further, in the conventional GPS position measurement method, the time required after the signal from the GPS satellite 200 is captured until all of absolute time information included in the signal is acquired is approximately 6 seconds even upon hot starting, with which the time is minimized, and in the best conditions, but usually, a time of tens and several seconds is required. Further, since position measurement calculation is performed using the acquired absolute time information, a considerably long time is required until the current position is calculated.

[0008] Furthermore, in the conventional GPS position measurement method, when position measurement is performed again after a time longer than a fixed interval of time elapses, time for fetching a navigation message newly is required. Therefore, a considerably long time is required until the current position is calculated.

[0009] Where much time is required for GPS position measurement from such reasons as described above, for example, in a car navigation system, the current position cannot be discriminated immediately after power supply is made available. This raises a problem that the route to a destination cannot be discriminated rapidly or the current position is unsettled due to an error of the self-contained navigation and this increases time until the correct position is discriminated. Further, in an apparatus of the type wherein a GPS receiver is built in or connected to a recent portable information terminal, if the apparatus is used principally during walking of the user, since the current position cannot be measured rapidly, the user must wait at a place with the apparatus held in hand until the position measurement is completed, which is very inconvenient.

[0010] On the other hand, also it is a possible idea to perform position measurement with power supply normally kept on. However, this causes the apparatus to

consume very much power. Where the apparatus is particularly limited in power consumption like, for example, a car navigation system or a portable navigation system, it is not preferable to normally keep the power supply on.

[0011] Also where predetermined standby/startup of a GPS receiver is repeated to intermittently receive GPS signals, in order to maintain the accuracy in frequency and time, it is necessary to reduce the interval of intermittent receptions to perform position measurement frequently, resulting in increase of the power consumption.

SUMMARY OF THE INVENTION

[0012] An embodiment of the present invention seeks to provide a GPS receiver and a GPS position measurement method wherein GPS position measurement can be performed stably and rapidly without the necessity to wait for periodical time information from a GPS satellite.

[0013] Another embodiment of the present invention seeks to provide a GPS receiver and a GPS position measurement method wherein power consumption is minimized also with a minimized position measurement time through the selection of an optimum time interval between intermittent receptions of GPS signals.

[0014] According to an aspect of the present invention, there is provided a GPS receiver, including a GPS block for performing position measurement based on a signal transmitted from a GPS satellite to update a navigation message and repeating standby and startup thereof, and an external clock block for holding frequency information and time information of a high accuracy and outputting a start signal to the GPS block, which is in a standby state, based on the frequency information and the time information held therein.

[0015] With the GPS receiver, the GPS measurement time can be reduced significantly, and the necessity to wait for periodical time information from a GPS satellite is eliminated. Consequently, the time required before position measurement is stabilized and reduced. Further, since an optimum GPS reception interval can be selected in accordance with a situation of the external clock, reduction of power consumption can be anticipated.

[0016] The GPS receiver may further includes a frequency measurement block for measuring a frequency offset which is a displacement of a frequency oscillator of the GPS block with reference to the frequency information held in the external clock block and outputting the measured frequency offset to the external clock block. The external clock block may control standby and startup of the GPS block based on the frequency offset outputted from the frequency measurement block. With the GPS receiver, an optimum interval of intermittent GPS receptions can be obtained based on the frequency offset of the frequency oscillator, which allows augmentation in performance and further reduction in power consumption.

[0017] According to another aspect of the present invention, there is provided a GPS receiver, including position measurement execution means having a frequency oscillator for performing position measurement based on a signal transmitted from a GPS satellite, radio wave clock reception means for receiving a carrier from a radio wave clock broadcasting station, and frequency measurement means for measuring an error of the frequency oscillator of the position measurement execution means based on a frequency of the carrier received by the radio wave clock reception means.

[0018] Also with the GPS receiver, the GPS measurement time can be reduced significantly, and the necessity to wait for periodical time information from a GPS satellite is eliminated. Consequently, the time required before position measurement is stabilized and reduced. Further, since an optimum GPS reception interval can be selected in accordance with a situation of the external clock, reduction of power consumption can be anticipated.

[0019] Preferably, the frequency measurement means outputs the measured error of the frequency oscillator to the radio wave clock reception means, and the radio wave clock reception means controls startup/standby of the position measurement execution means based on the error of the frequency oscillator outputted from the frequency measurement means. The GPS receiver is advantageous in that the interval of time between intermittent receptions of the GPS receiver can be extended to a valid time of a navigation message and the intermittent reception time interval can be further extended to further reduce the power consumption.

[0020] According to a further aspect of the present invention, there is provided a GPS position measurement method for a GPS receiver, including the steps of receiving a hierarchical navigation message from each of a plurality of GPS satellites, storing the received navigation messages into a memory, storing frequency information and time information of a high accuracy into an external clock which normally is in an operating state, and repeating startup and standby of the GPS receiver within a predetermined time determined using the frequency information and the time information held in the external clock to perform position measurement of the GPS receiver from the GPS satellites to update the navigation messages stored in the memory.

[0021] Also with the GPS position measurement method for a GPS receiver, the GPS measurement time can be reduced significantly, and the necessity to wait for periodical time information from a GPS satellite is eliminated. Consequently, the time required before position measurement is stabilized and reduced. Further, since an optimum GPS reception interval can be selected in accordance with a situation of the external clock, reduction of power consumption can be anticipated.

[0022] Preferably, an interval of time between startup and standby of the GPS receiver is varied based on a degree of accuracy of the frequency information or the time information held by the external clock. With the

GPS position measurement method, frequency information and time information of a high accuracy and a navigation message can be held with certainty without depending upon a situation of the external clock.

[0023] It is to be noted that, for example, if the external clock is constructed for reception of a carrier from a radio wave clock broadcasting station, the accuracy of the frequency information or the time information held by the external block allows elongation of the intermittent reception interval to the maximum even if the GPS receiver does not include a real time clock (RTC) of a high accuracy.

[0024] A better understanding of the present invention will become apparent from the following illustrative description taken in conjunction with the accompanying drawings in which like parts or elements denoted by like reference symbols.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a diagrammatic view showing a general construction of a GPS receiver to which an embodiment of the present invention is applied;

FIG. 2 is a block diagram showing a detailed construction of a GPS block, an external clock block and a frequency measurement block of the GPS receiver;

FIG. 3 is a diagrammatic view illustrating operation of and communication contents between the GPS block and the GPS control block;

FIG. 4 is a flow chart illustrating a flow of processing in the GPS block;

FIG. 5 is a flow chart illustrating a flow of a first process in the external clock block;

FIG. 6 is a flow chart illustrating a flow of a second process in the external clock block;

FIG. 7 is a diagrammatic view illustrating position measurement operation in the GPS receiver;

FIG. 8 is a diagrammatic view showing a general construction of another GPS receiver to which an embodiment of the present invention is applied; and

FIGS. 9A and 9B are diagrammatic views showing a general construction of a conventional GPS system and illustrating conventional GPS position measurement operation, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A. Embodiment 1

[0026] Referring to FIG. 1, there is shown a general construction of a GPS receiver to which an embodiment of the present invention is applied. The GPS receiver shown includes a GPS block 1, an external clock block 2 and a frequency measurement block 3. The GPS block 1 includes a GPS antenna section 9 for receiving a radio wave of 1,575.42 MHz transmitted from a GPS satellite at the height of approximate 20,000 km, a radio frequency (RF) section 10 for converting the radio wave received by the GPS antenna section 9 into a signal of an intermediate frequency making use of a frequency of a frequency oscillator 12, and a digital section 20 for demodulating the radio wave signal of the intermediate frequency from the RF section 10, extracting necessary data from the radio wave signal of the intermediate frequency and calculating the current position of the GPS receiver based on the extracted data.

[0027] Meanwhile, the external clock block 2 is formed from a clock or a microcomputer having a built-in clock function which can transmit a predetermined signal in a predetermined period. The GPS block 1 sends to the external clock block 2 a setting signal indicative of a time interval after which the GPS block 1 should be started up. Upon reception of the setting signal, the external clock block 2 sets a period in which a start signal is to be sent. The external clock block 2 sends a start/standby signal to the GPS block 1. Upon reception of the start/standby signal, the GPS block 1 can start itself or stand by.

[0028] The frequency measurement block 3 measures a frequency offset which is an amount of displacement of the frequency of the frequency oscillator 12 of the GPS block 1 with reference to or from a frequency of a high accuracy held by the external clock block 2, and sends a value obtained by the measurement to the external clock block 2.

[0029] FIG. 2 shows a detailed construction of the GPS block 1, the external clock block 2 and the frequency measurement block 3. Referring to FIG. 2, a signal received by the GPS antenna section 9 is amplified by an amplifier (AMP) 11 of the RF section 10 of the GPS block 1. The RF section 10 has the frequency oscillator (TCXO) 12 provided therein. A frequency signal from the frequency oscillator 12 is multiplied to N times and then mixed with the signal amplified by the amplifier 11 by a mixer 14 so that the signal from the amplifier 11 is converted into an intermediate frequency signal. The intermediate frequency signal is amplified by an amplifier 15 and then converted into a digital signal by an AD converter (ADC) 16. The digital signal is inputted to the digital section 20.

[0030] The digital section 20 includes a CPU (Central Processing Unit) 21 for controlling the GPS block 1, a demodulator 22 for demodulating the intermediate frequency signal, and a real time clock (RTC) 23 for producing a clock. The digital section 20 further includes a RAM 24 so that a difference between the frequency of a high accuracy of a GPS satellite and the frequency of the built-in frequency oscillator may be stored as an offset or an acquired navigation message may be stored. The digital section 20 further includes a ROM 25 which has various kinds of control information and other necessary information stored therein.

[0031] The external clock block 2 includes a CPU 31

for controlling the external clock block 2, and a real time clock (RTC) 32 connected to a quartz oscillator (XTAL) 33 and having a clock function. The external clock block 2 further includes a ROM 34 in which control information is stored, and a RAM 35 for storing time information and so forth.

[0032] The GPS receiver further includes a power supply 30 for supplying power to the GPS block 1, the external clock block 2 and other components. The power supply 30 is controlled on/off by the CPU 21 so that it should or should not supply power to the GPS block 1 thereby to allow intermittent reception (sleep reception) wherein standby/startup of the GPS block are repeated.

[0033] The frequency measurement block 3 includes an internal counter 41. The counter 41 operates with an accurate clock obtained from a reference frequency signal from the external clock block 2 to count a measurement object frequency signal from the RF section 10 of the GPS block 1 within a predetermined time produced from the clock. The frequency measurement block 3 outputs the count value of the counter 41 as frequency measurement data (frequency information) to the external clock block 2.

[0034] FIG. 3 illustrates operation and contents of communication between the blocks 1 and 2. Referring to FIG. 3, a setting signal indicative of a time interval after which the GPS block 1 should be started up next is transmitted from the GPS block 1 to the external clock block 2. The external clock block 2 receives the setting signal transmitted thereto and signals a standby signal to the GPS block 1. Thereafter, the external clock block 2 starts up and checks the timer of the RTC 32. After the external clock block 2 discriminates elapse of a predetermined time based on the check, it transmits a start signal to the GPS block 1. At this time, where the external clock block 2 has frequency and time information of a high accuracy, also the frequency and time information is transmitted to the GPS block 1.

[0035] FIG. 4 illustrates a flow of processing of the GPS block 1.

[0036] The GPS block 1 to which power is supplied first executes a first time position measurement (step S101). As a result of the position measurement, the navigation message stored in the RAM 24 is updated (step S102). Then, the GPS block 1 transmits a setting signal to the external clock block 2 (step S103). The setting signal includes a valid time (usually within approximately 2 hours) of a navigation message, and a time in which the error of the clock held by the GPS receiver remains within a fixed value or a time in which the error of the frequency oscillator 12 held by the GPS receiver remains within a fixed value. Thereafter, the GPS block 1 waits a standby signal from the external clock block 2 (step S104). Then, if a standby signal is not received, then the position measurement is repeated, that is, the GPS block 1 repeats the processing in steps 101 to 103. If a standby signal is received, then the GPS block 1 disconnects the power supply and enters a standby mode (step S105).

[0037] Then, when that one of the times set with the setting signal which has been selected in response to the state of the external clock block 2 elapses, the GPS block 1 receives a start signal from the external clock block 2 (step S106). Thus, the GPS block 1 starts up itself (step S107). However, before a start signal is received, the GPS block 1 keeps its standby mode. At this time, if the external clock block 2 holds frequency and time information of a high accuracy, the GPS block 1 receives the frequency and time information as well. Then, the GPS block 1 performs position measurement again (step S101) and updates the navigation message (step S102), and then enters a standby mode similarly (steps S103 to S105) If the external clock block 2 does not hold frequency and time information of a high accuracy, such information is not transmitted to the GPS block 1, and consequently, the GPS 1 performs position measurement using frequency and time information held therein. In this manner, the GPS block 1 of the GPS receiver of the present embodiment executes intermittent position measurement in two different ways in response to a situation of the external clock block 2, that is, either executes position measurement using frequency and time information from the external clock block 2 or executes position measurement using frequency and time information held in the inside of the GPS block 1.

[0038] FIG. 5 illustrates a flow of a first process of the external clock block 2. The external clock block 2 of the GPS receiver of the present embodiment continues to normally operate and holds frequency and time information of a high accuracy. The external clock block 2 first waits for a setting signal transmitted from the GPS block 1 (step S111). When a setting signal is received, the external clock block 2 updates the setting time of the RTC 32 based on accurate time sent thereto from the GPS block 1 (step S112) and starts up the timer (step S113). Then, the external clock block 2 transmits a standby signal to the GPS block 1 (step S114). Thereafter, the external clock block 2 continues to operate and discriminates whether or not counting of time of the timer comes to an end (step S115). The discrimination is repeated until counting of time of the timer comes to an end. After the counting of time of the timer comes to an end, that is, after the time interval set from the GPS block 1 elapses, the external clock block 2 transmits a start signal to the GPS block 1 (step S116). The GPS block 1 receives the start signal and cancels the standby mode described above to thus start up itself. At this time, the external clock block 2 transmits the frequency measured by the frequency measurement block 3 or the frequency offset and the time information held therein as well to the GPS block 1 (step S117). Consequently, the GPS block 1 can repeat start/standby of itself after the predetermined time interval to repetitively update the frequency offset, the time and the navigation message and can thereby

hold a frequency reference and time information of a high accuracy and the latest navigation message.

[0039] FIG. 6 illustrates a flow of a second process of the external clock block 2. Here, different processes are performed depending upon whether or not the frequency and time information is accurate to some degree. The external clock block 2 waits for a setting signal transmitted from the GPS block 1 (step S121). When a setting signal is received, the external clock block 2 checks the accuracy of the frequency and time information which is held or can be acquired by the external clock block 2 (step S122). If the frequency and time information is accurate to some degree, then the external clock block 2 updates the setting time of the timer 1 (step S123). Then, the external clock block 2 starts up a timer 1 (step S124) and transmits a standby signal to the GPS block 1 (step S125). When the time of the timer 1 updated with the setting signal elapses after the standby signal is transmitted (step S126), the external clock block 2 transmits a start signal to the GPS block 1 (step S127). Further, the external clock block 2 transmits the frequency and time information held therein as well to the GPS block 1 (step S128).

[0040] On the other hand, if it is discriminated in step S122 that the frequency and time information which is held or can be acquired by the external clock block 2 is inaccurate, then the external clock block 2 updates the setting time of a timer 2 (step S129). Then, the external clock block 2 starts up the timer 2 (step S130) and transmits a standby signal to the GPS block 1 (step S131) When the time of the timer 2 updated with the setting signal elapses after the standby signal is transmitted (step S132), the external clock block 2 transmits a start signal to the GPS block 1 (step S133). In this manner, the interval of time between a standby signal and a start signal to be transmitted to the GPS block 1 is varied depending upon the accuracy of the frequency and time information which is held or can be acquired by the external clock block 2, and also contents to be transmitted to the GPS block 1 upon transmission of a start signal can be varied.

[0041] It is to be noted that the frequency measurement block 3 uses the frequency of a high accuracy held by the external clock block 2 as a reference to measure the frequency of the frequency oscillator 12 of the GPS block 1 or the frequency offset which is a displacement of the frequency of the frequency oscillator 12 from the frequency of the external clock block 2 and sends the measured value to the external clock block 2.

[0042] As described above, in the GPS receiver of the present embodiment, the external clock block 2 always operates, and the GPS block 1 can always hold frequency and time information of a high accuracy and a navigation message. Where the GPS information holds such information, the time required for GPS position measurement can be reduced significantly.

[0043] Further, where the external clock block 2 always operates and the interval of time of intermittent receptions of the GPS block 1 is varied based on the accuracy of the frequency and time information which is held or can be acquired by the external clock block 2, frequency and time information of a high accuracy and a navigation message can be held with certainty without depending upon the situation of the external clock block 2. Further, where the external clock block 2 can hold or acquire frequency and time information of a high accuracy, the valid time of the navigation message can be elongated. Therefore, the interval of time of intermittent receptions of the GPS block 1 can be increased, and consequently, reduction of the power consumption can be achieved.

[0044] FIG. 7 illustrates a position measurement operation of the GPS receiver of the present embodiment. An ordinary GPS receiver first performs a frequency search after power supply is made available as seen in FIG. 9B. The frequency search is to establish synchronism in frequency with a signal from the GPS satellite 200 using a frequency oscillated by the frequency oscillator 215 in the GPS receiver 210 as described above. Usually, the accuracy of the frequency oscillator 215 in the GPS receiver 210 is deteriorated by the temperature or the secular change, and this displaces the frequency thereof from its accuracy frequency. In such an instance, synchronism with the signal from the GPS satellite 200 cannot be established. Therefore, the frequency of the frequency oscillator 215 in the GPS receiver 210 is successively displaced stepwise until synchronism with the accurate signal from the GPS satellite 200 is established. Then, at a point of time when a correlation of a certain level is detected by the frequency search, phase adjustment is performed using the PLL. Then, after the phase adjustment is completed, range data which represents a distance from each GPS 200 is acquired, which enables demodulation of data. While the state in which demodulation data can be acquired continues, it is waited that time information in data is acquired. Then, when data is acquired, position measurement calculation is performed, and resulting position data is outputted. Accordingly, if a frequency of a high accuracy which is free from frequency displacement by the temperature or a secular change can be obtained, then such a frequency search as described above with reference to FIG. 6 need not be performed. Further, if time information of a high accuracy can be obtained simultaneously, then the necessity to perform confirmation of time information is eliminated.

[0045] In particular, as seen from FIG. 7, with the GPS receiver of the present embodiment, part of operation necessary for the GPS position measurement is not required any more, and phase adjustment in which a PLL is used can be started immediately and then a position measurement operation can be started immediately. As a result, the time which has been required for the operation is not required any more, and the position measurement time can be reduced significantly.

[0046] On the other hand, when no navigation mes-

sage is held at a point of time when position measurement is started or when lapse of time invalidates a navigation message, further time for acquiring a navigation message is required in a GPS position measurement operation. In the GPS receiver of the present embodiment, however, since the navigation message is always updated to the latest one, acquisition of a navigation message can be omitted from position measurement. Consequently, the position measurement time can be reduced significantly.

8. Embodiment 2

[0047] The GPS receiver of the Embodiment 1 described above includes the frequency measurement block 3 so that the interval of time between intermittent receptions of GPS signals is varied in accordance with the accuracy of frequency and time information which is held in or can be acquired by the external clock block 2. The GPS receiver of the present Embodiment 2 is a modification to but is different from the GPS receiver of the Embodiment 1 in that it uses a radio wave clock block, which makes use of a radio wave clock as an external clock, in place of the external clock block 2 to vary the interval of time of intermittent receptions of GPS signals. Thus, overlapping description of the other common components is omitted here to avoid redundancy.

[0048] Referring to FIG. 8, there is shown a general construction of the GPS receiver of the Embodiment 2. The GPS receiver of the Embodiment 2 includes a radio wave clock block 4 in addition to the GPS block 1 and the frequency measurement block 3 described hereinabove with reference to FIG. 1. The radio wave clock block 4 includes a GPS antenna section 5 for receiving a carrier of 40 KHz which is a standard radio wave controlled by the Communications Research Laboratory of the Ministry of Post and Telecommunications of Japan, a signal demodulation section 6 for amplifying and detecting the carrier received by the GPS antenna section 5, and a digital section 7 for reading time information from the waveform detected by the signal demodulation section 6.

[0049] In the GPS receiver of the present embodiment, power is normally supplied to the radio wave clock block 4 so that the radio wave clock block 4 receives a signal from a radio wave clock broadcasting station to normally hold time information of a high accuracy and a frequency reference of a high accuracy. The radio wave clock block 4 outputs a frequency of the carrier of 40 KHz amplified but before detected by the signal demodulation section 6 to the frequency measurement block 3. The frequency measurement block 3 thus uses the counter 41 described hereinabove to detect an error of the frequency oscillator 12 of the GPS block 1. The radio wave clock block 4 receives the error of the frequency oscillator 12 as frequency information and suitably sets a standby time based on the frequency information. Then, the radio wave clock block 4 controls standby/startup of the GPS block 1 based on the standby time so as to perform intermittent reception. The GPS block 1 starts up itself periodically under the control of the radio wave clock block 4 and updates ephemeris data necessary for position measurement calculation which are position information of GPS satellites. When the acquisition of ephemeris data is completed, the GPS block 1 enters a sleep (standby) mode. Repetitions of such startup/standby allow the GPS block 1 to normally hold the latest ephemeris data.

[0050] In order to perform position measurement, the GPS block 1 receives time information and frequency information (errors) from the radio wave clock block 4 at a moment when power supply to the GPS block 1 is made available. The GPS receiver can use the information to perform such high speed position measurement as described hereinabove with reference to FIG. 7.

[0051] An interval of time between sleep receptions (intermittent reception) and average power consumption necessary to normally realize high speed position measurement where the GPS receiver of the present embodiment is used are examined here.

[0052] Where the power consumption of the GPS block 1 is represented by Wgps, the standby time by TK, and the startup time by Ton, the average power consumption Wavg can be calculated in accordance with

$$Wavg = (Wgps \times Ton)/Tk$$

[0053] In the GPS receiver of the present embodiment, the sleep reception is used only for acquisition of ephemeris data, and therefore, it can be considered that the period necessary for updating the ephemeris data is equal to the interval of time between sleep receptions. Usually, it is regarded that the life of ephemeris data is approximately 2 hours. Therefore, also the updating time is considered to be 2 hours (7,200 seconds) at the maximum. Further, if it is assumed that the startup time (time for acquisition of ephemeris data) Ton is 60 seconds and the power consumption Wgps of the GPS block 1 is 580 mW, then

$$Wavg = (580\ mW \times 60\ s)/7{,}200\ s = 4.8\ (mW)$$

Thus, if it is assumed that the power consumption of the radio wave clock block 4 is 15 mW, then the total power consumption is 4.8 + 15 = 19.8 (mW). Consequently, the power consumption can be reduced significantly.

[0054] Further, with the GPS receiver of the present embodiment, even if it does not include a real time clock (RTC) of a high accuracy inside thereof, the sleep reception interval of the GPS receiver can be increased to the maximum. Also from this, the average power consumption can be suppressed low. Furthermore, since a frequency reference of a high accuracy from the radio wave clock block 4 can be utilized, even if the frequency

oscillator in the GPS receiver has a great error, reliable high speed position measurement can be achieved.

[0055] While illustrative embodiments of the present invention have been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the invention.

Claims

1. A GPS receiver, comprising:

   a GPS block for performing position measurement based on a signal transmitted from a GPS satellite to update a navigation message and repeating standby and startup thereof; and
   an external clock block for holding frequency information and time information of a high accuracy and outputting a start signal to said GPS block, which is in a standby state, based on the frequency information and the time information held therein.

2. A GPS receiver according to claim 1, further comprising a frequency measurement block for measuring a frequency offset which is a displacement of a frequency oscillator of said GPS block with reference to the frequency information held in said external clock block and outputting the measured frequency offset to said external clock block.

3. A GPS receiver according to claim 2, wherein said external clock block controls standby and startup of said GPS block based on the frequency offset outputted from said frequency measurement block.

4. A GPS receiver, comprising:

   position measurement execution means including a frequency oscillator for performing position measurement based on a signal transmitted from a GPS satellite;
   radio wave clock reception means for receiving a carrier from a radio wave clock broadcasting station; and
   frequency measurement means for measuring an error of said frequency oscillator of said position measurement execution means based on a frequency of the carrier received by said radio wave clock reception means.

5. A GPS receiver according to claim 4, wherein said frequency measurement means outputs the measured error of said frequency oscillator to said radio wave clock reception means, and said radio wave clock reception means controls startup/standby of said position measurement execution means based on the error of said frequency oscillator outputted from said frequency measurement means.

6. A GPS position measurement method for a GPS receiver, comprising the steps of:

   receiving a hierarchical navigation message from each of a plurality of GPS satellites;
   storing the received navigation messages into a memory;
   storing frequency information and time information of a high accuracy into an external clock which normally is in an operating state; and
   repeating startup and standby of said GPS receiver within a predetermined time determined using the frequency information and the time information held in said external clock to perform position measurement of said GPS receiver from said GPS satellites to update the navigation messages stored in said memory.

7. A GPS position measurement method according to claim 6, wherein an interval of time between startup and standby of said GPS receiver is varied based on a degree of accuracy of the frequency information or the time information held by said external clock.

FIG. 1

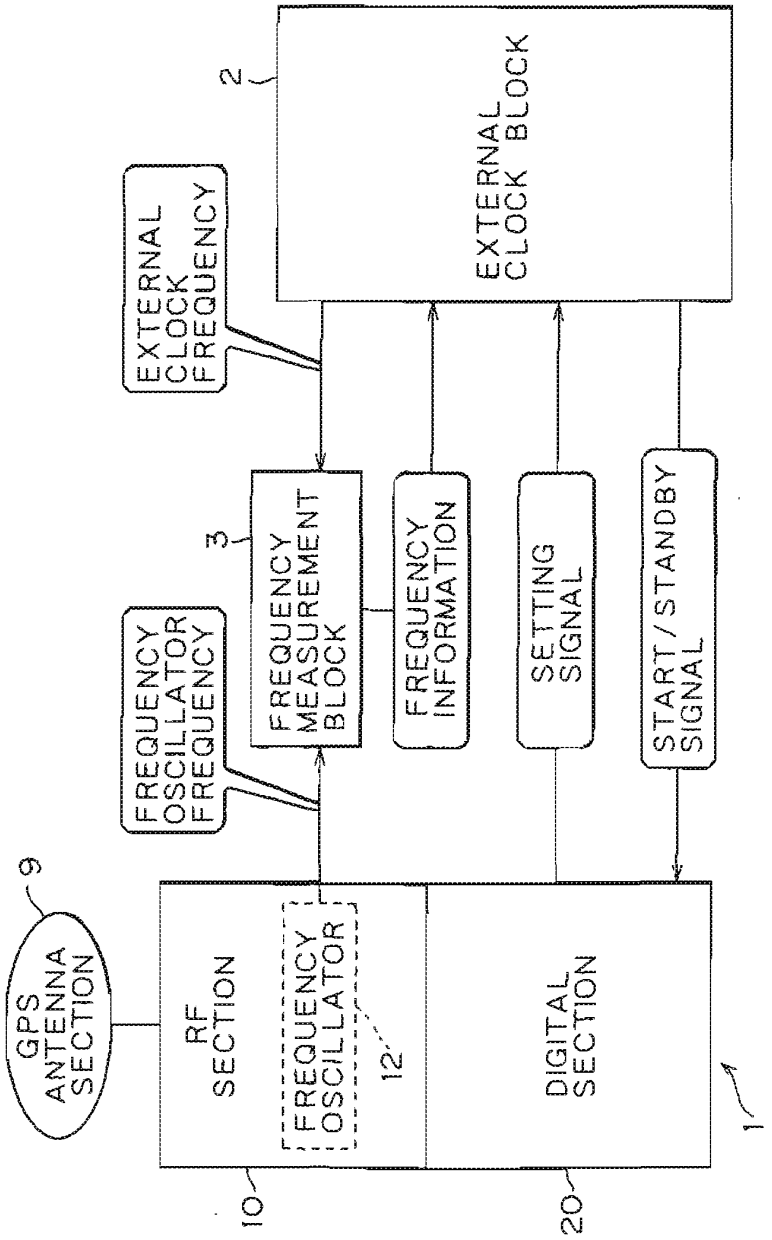

2
EXTERNAL CLOCK BLOCK
EXTERNAL CLOCK FREQUENCY
3
FREQUENCY MEASUREMENT BLOCK
FREQUENCY INFORMATION
SETTING SIGNAL
START/STANDBY SIGNAL
FREQUENCY OSCILLATOR FREQUENCY
9
GPS ANTENNA SECTION
RF SECTION
FREQUENCY OSCILLATOR
12
DIGITAL SECTION
10
20
1

FIG. 2

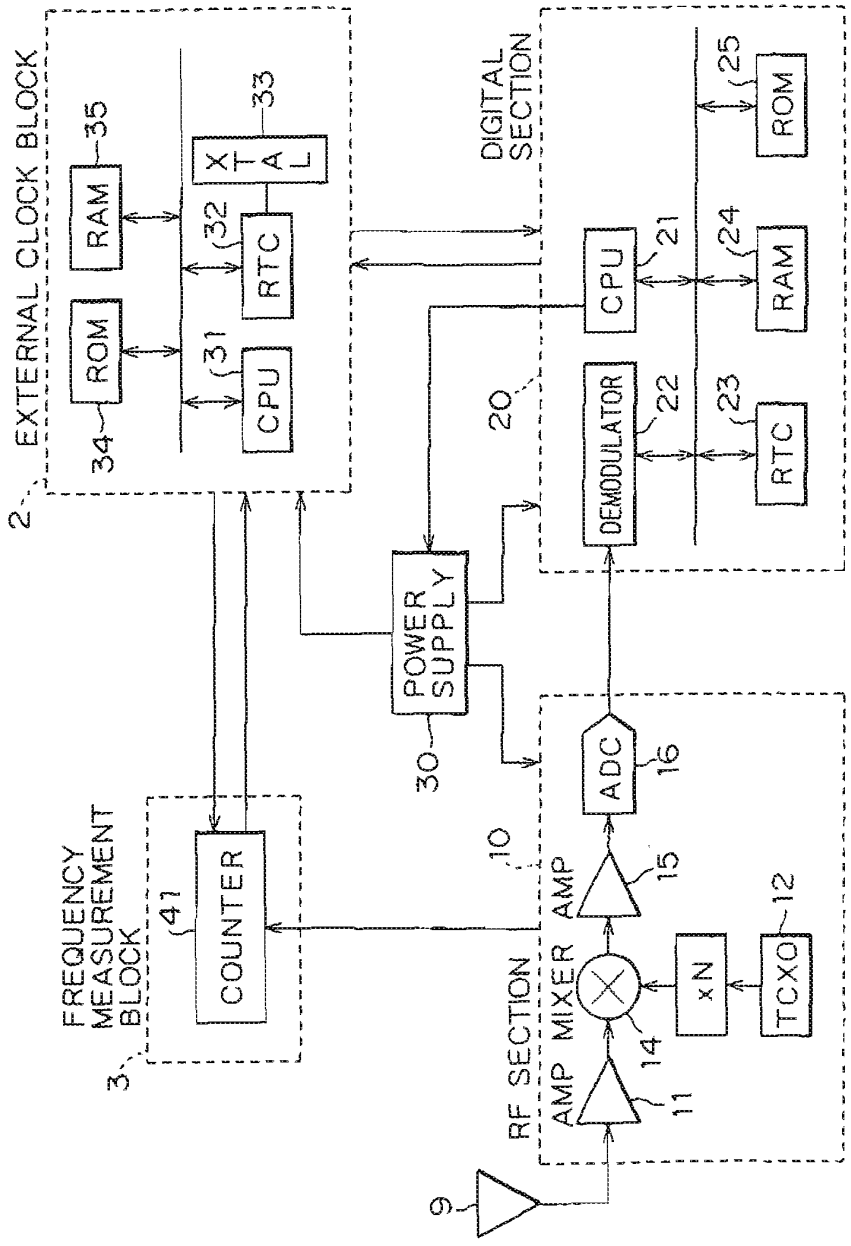

EXTERNAL CLOCK BLOCK
2
ROM
34
RAM
35
CPU
31
RTC
32
XTAL
33
DIGITAL SECTION
20
CPU
21
RAM
24
ROM
25
DEMODULATOR
22
RTC
23
POWER SUPPLY
30
FREQUENCY MEASUREMENT BLOCK
3
COUNTER
41
RF SECTION
10
AMP
MIXER
AMP
ADC
16
15
14
11
xN
TCXO
12
9

FIG. 3

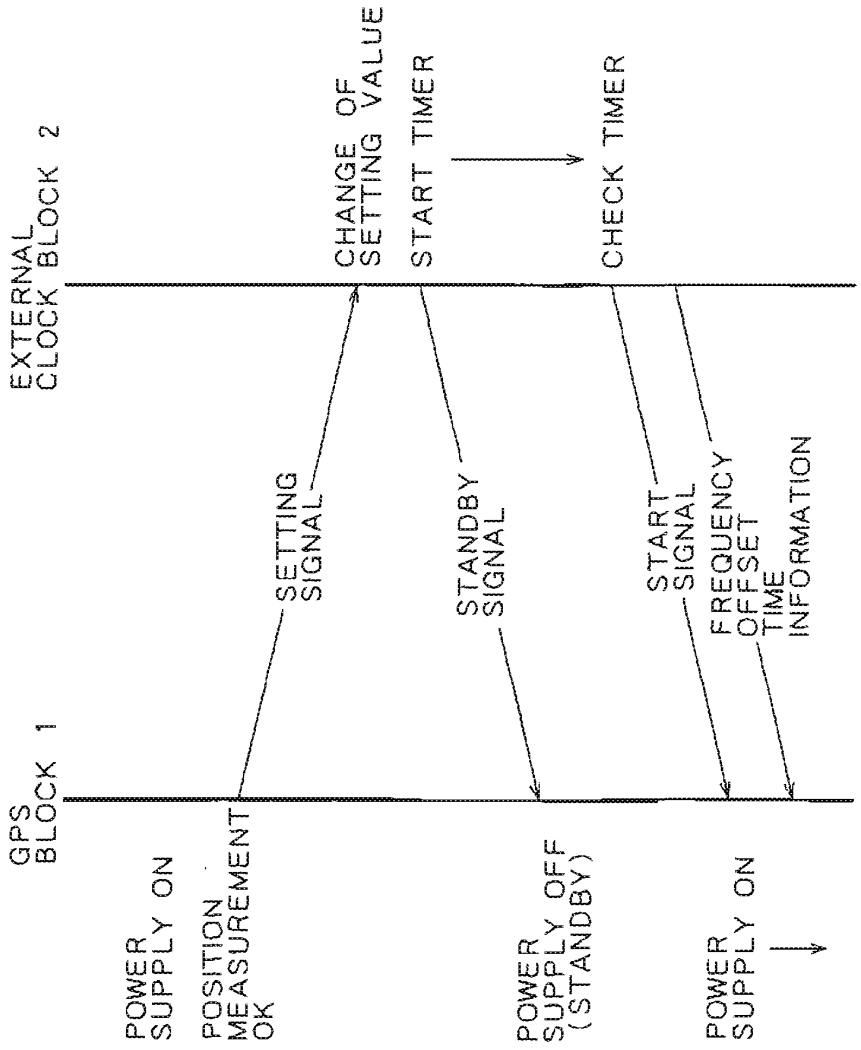

GPS BLOCK 1
EXTERNAL CLOCK BLOCK 2
POWER SUPPLY ON
POSITION MEASUREMENT OK
SETTING SIGNAL
CHANGE OF SETTING VALUE
START TIMER
CHECK TIMER
STANDBY SIGNAL
POWER SUPPLY OFF (STANDBY)
START SIGNAL
FREQUENCY OFFSET TIME INFORMATION
POWER SUPPLY ON

FIG. 4

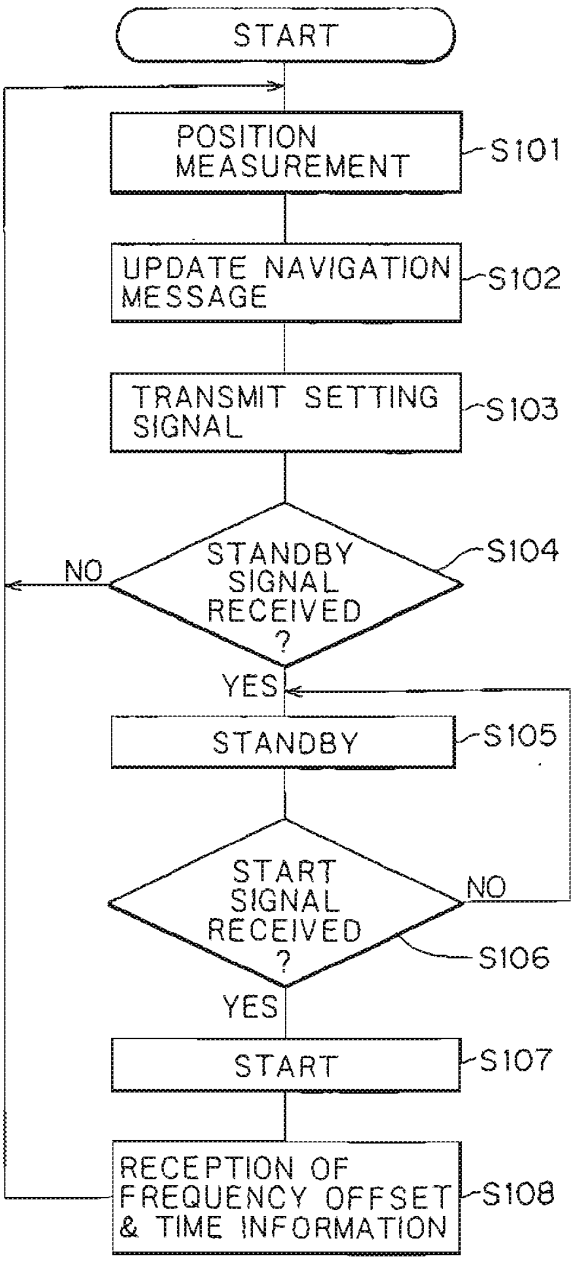

START
POSITION MEASUREMENT
S101
UPDATE NAVIGATION MESSAGE
S102
TRANSMIT SETTING SIGNAL
S103
STANDBY SIGNAL RECEIVED ?
S104
NO
YES
STANDBY
S105
START SIGNAL RECEIVED ?
NO
S106
YES
START
S107
RECEPTION OF FREQUENCY OFFSET & TIME INFORMATION
S108

FIG. 5

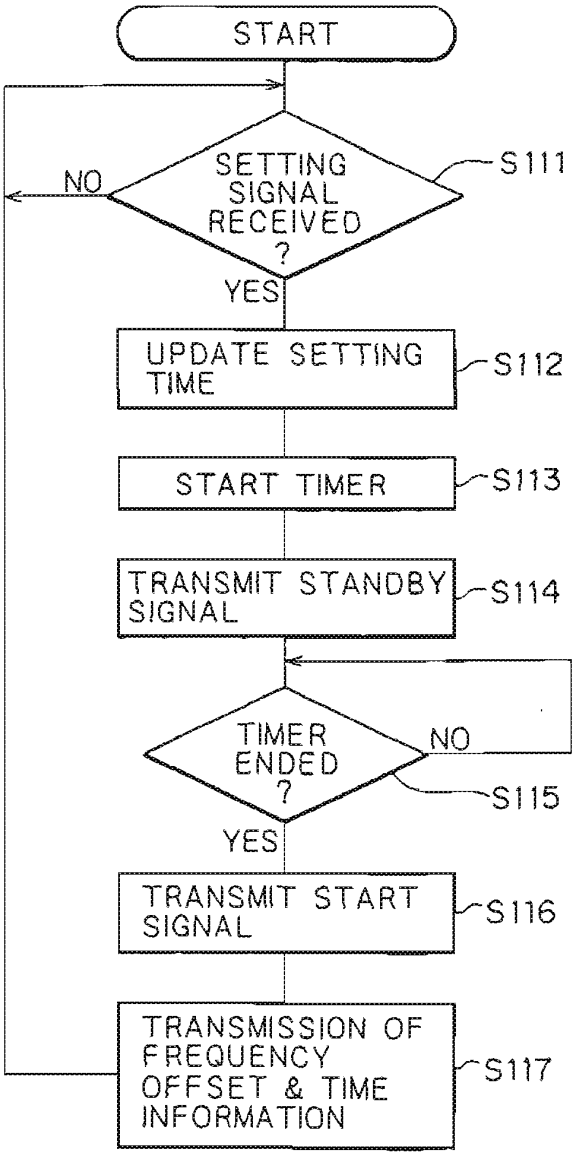

START
SETTING SIGNAL RECEIVED ?
S111
NO
YES
UPDATE SETTING TIME
S112
START TIMER
S113
TRANSMIT STANDBY SIGNAL
S114
TIMER ENDED ?
NO
S115
YES
TRANSMIT START SIGNAL
S116
TRANSMISSION OF FREQUENCY OFFSET & TIME INFORMATION
S117

FIG.6

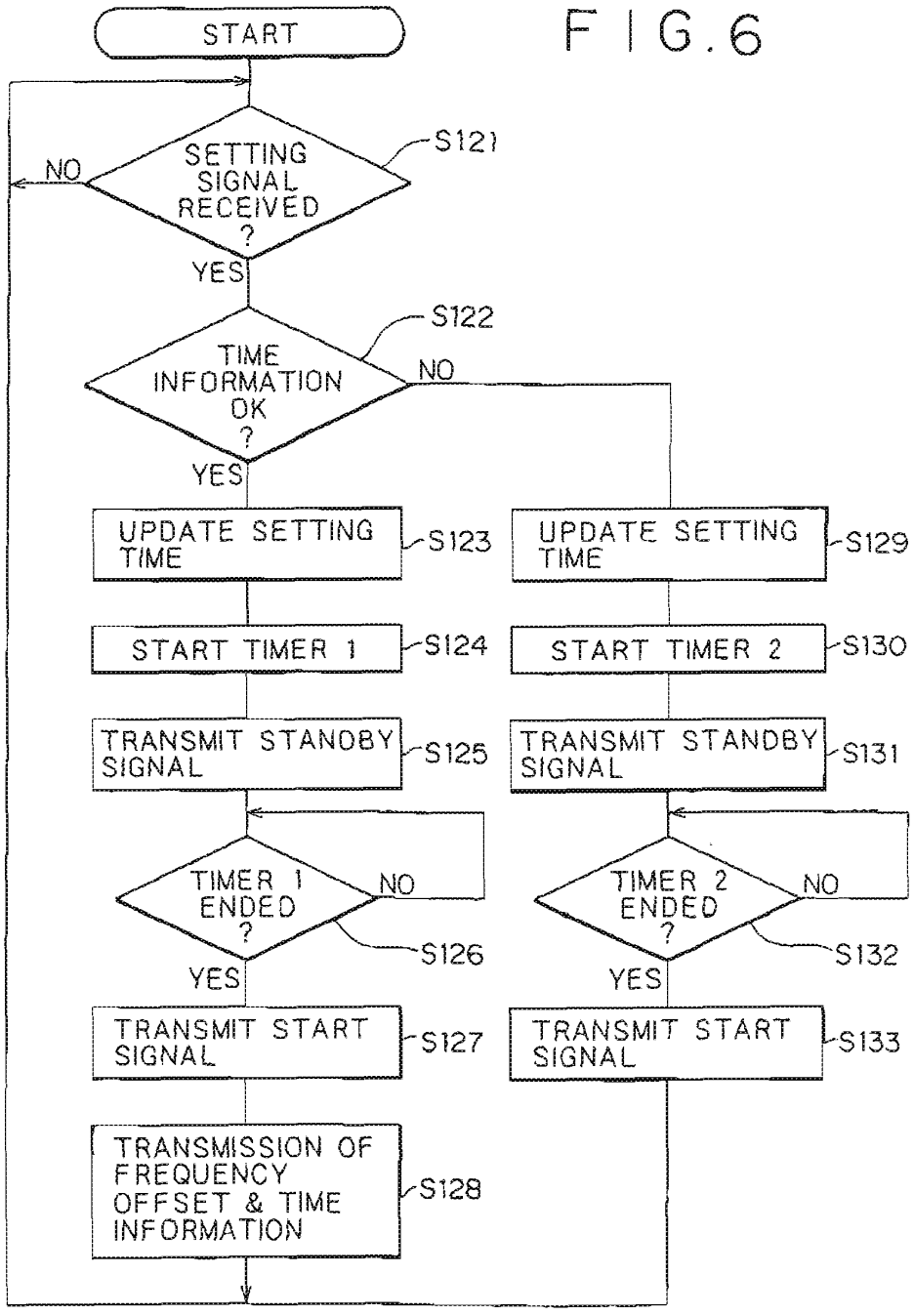

START
SETTING SIGNAL RECEIVED ?
S121
NO
YES
TIME INFORMATION OK ?
S122
NO
YES
UPDATE SETTING TIME
S123
START TIMER 1
S124
TRANSMIT STANOBY SIGNAL
S125
TIMER 1 ENDED ?
NO
S126
YES
TRANSMIT START SIGNAL
S127
TRANSMISSION OF FREQUENCY OFFSET & TIME INFORMATION
S128
UPDATE SETTING TIME
S129
START TIMER 2
S130
TRANSMIT STANDBY SIGNAL
S131
TIMER 2 ENDED ?
NO
S132
YES
TRANSMIT START SIGNAL
S133

FIG. 7

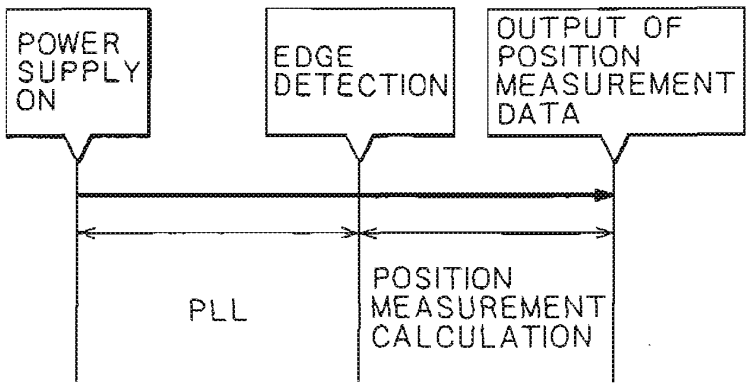

POWER SUPPLY ON
EDGE DETECTION
OUTPUT OF POSITION MEASUREMENT DATA
PLL
POSITION MEASUREMENT CALCULATION

FIG. 8

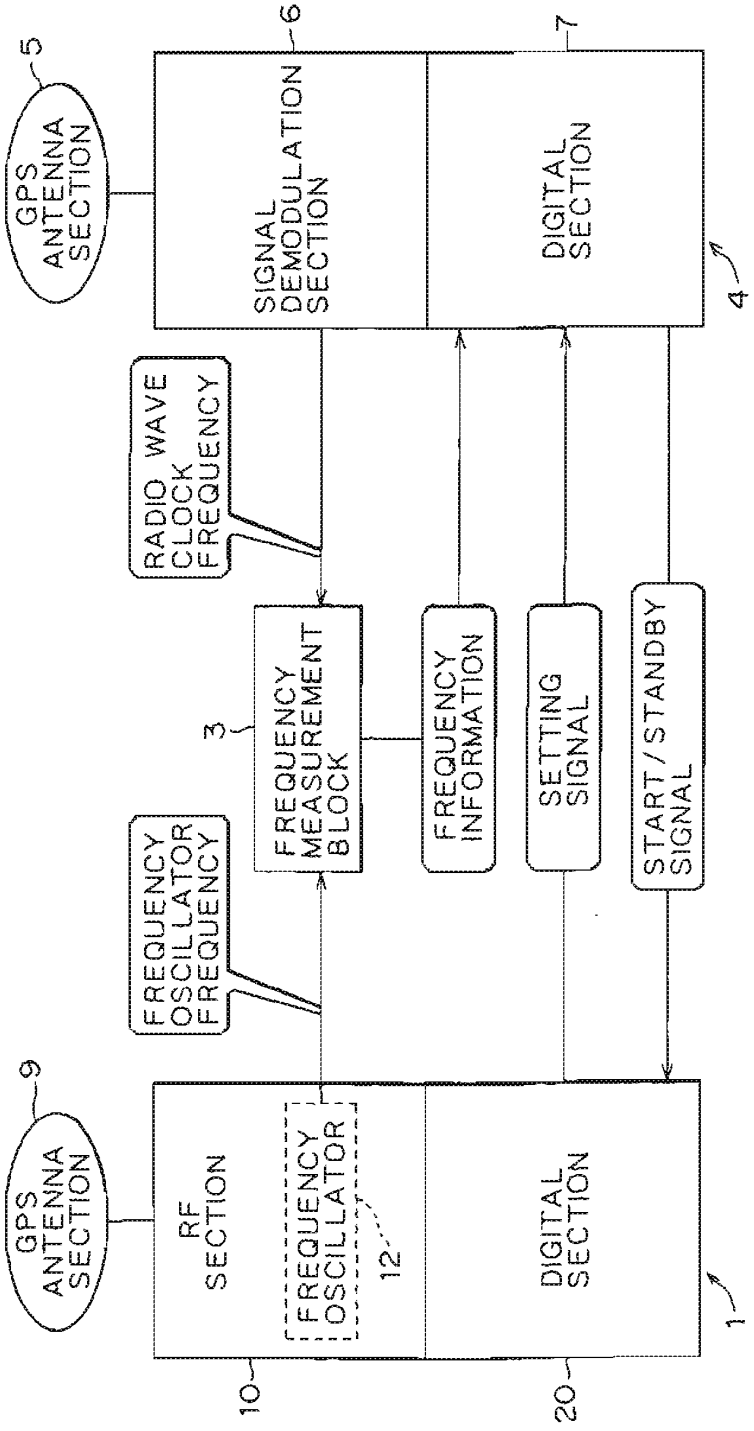

GPS ANTENNA SECTION
5
SIGNAL DEMODULATION SECTION
6
DIGITAL SECTION
7
4
RADIO WAVE CLOCK FREQUENCY
FREQUENCY MEASUREMENT BLOCK
3
FREQUENCY INFORMATION
SETTING SIGNAL
START / STANDBY SIGNAL
FREQUENCY OSCILLATOR FREQUENCY
GPS ANTENNA SECTION
9
RF SECTION
FREQUENCY OSCILLATOR
12
DIGITAL SECTION
1
10
20

FIG.9A

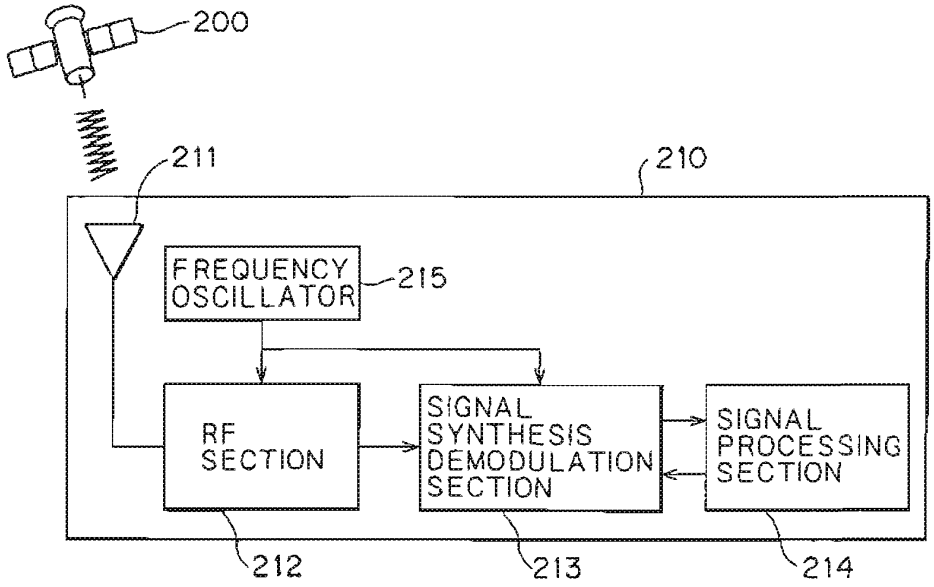
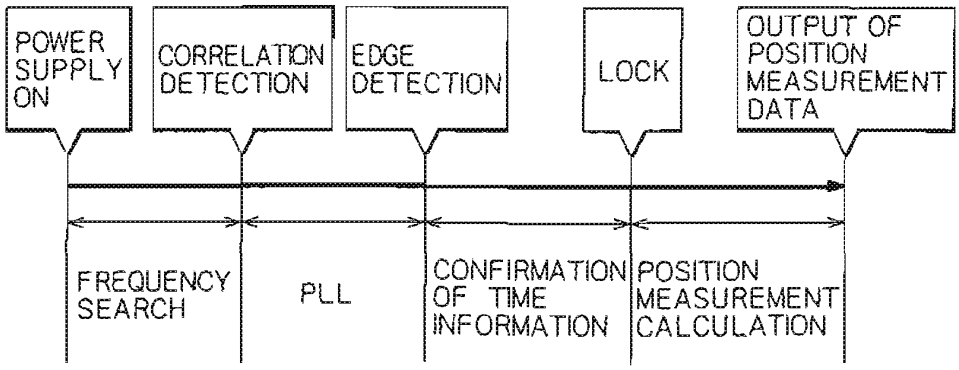

200
211
210
FREQUENCY OSCILLATOR
215
RF SECTION
SIGNAL SYNTHESIS DEMODULATION SECTION
SIGNAL PROCESSING SECTION
212
213
214

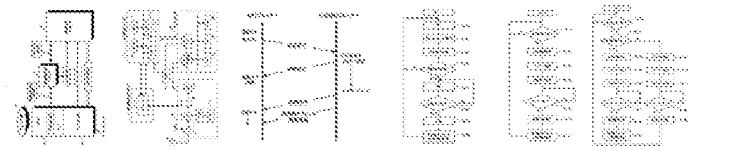
FIG.9B


POWER SUPPLY ON
CORRELATION DETECTION
EDGE DETECTION
LOCK
OUTPUT OF POSITION MEASUREMENT DATA
FREQUENCY SEARCH
PLL
CONFIRMATION OF TIME INFORMATION
POSITION MEASUREMENT CALCULATION

Patents jp4543480

Gps receiver, and gps positioning method

Images (9)



Classifications

G01S19/235 Calibration of receiver components

View 1 more classifications

JP4543480B2
Japan

Download PDF Find Prior Art Similar

Other languages: Japanese

Inventor: 浩二 長谷川

Worldwide applications

2000 JP 2001 EP DE US

Application JP2000057814A events

2000-03-02 Application filed by ソニー株式会社
2000-03-02 Priority to JP2000057814A
2001-09-07 Publication of JP2001242235A
2010-09-15 Application granted
2010-09-15 Publication of JP4543480B2
2019-08-27 Application status is Active
2020-03-02 Anticipated expiration

Info: Patent citations (18), Cited by (50), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Claims (4)

Hide Dependent
translated from Japanese

1. It updates the navigation message performs positioning based on signals transmitted from GPS satellites, a GPS block repeating startup and standby,
Holds the frequency information and time information, and an external clock block for outputting a start signal to the GPS block in the standby state on the basis of the frequency information held and the relevant time information,
Said external clock block, based on the accuracy of the frequency and the time information corresponding external clock block for holding said GPS block set by switching the time interval until the start after waiting, the frequency and the if time information is more accurate than the predetermined degree is the frequency and the time information after the time interval transmitted to the GPS block, when the frequency and the time information is not accurate than the extent of the predetermined is, GPS receiver, characterized in that it is the frequency and the time information after the time interval transmitted to the GPS block.

2. Based on the frequency information held in said external clock block, a deviation in a frequency offset between the frequency oscillator in which the GPS block has measured, and outputs the measured the frequency offset relative to the external clock block GPS receiver according to claim 1, characterized in that further comprises a frequency measurement block.

3. Said external clock block, GPS receiver according to claim 2, characterized in that to control the startup and standby of said GPS block based on the frequency offset outputted from said frequency measurement block.

4. Receiving a hierarchical navigation messages from a plurality of GPS satellites,
The received the navigation message stored in the memory,
Held in the external clock with a frequency and time information to the constantly operating state,
Based on the accuracy of the frequency and the time information the external clock is held, it is set to switch the time interval between start after waiting,
Wherein when the external the frequency and the time information held in the clock is not accurate than the predetermined degree does not receive the frequency and the time information after the time interval from the external clock, held in the external clock been if the frequency and the time information is more accurate than the extent of the predetermined is the frequency and the time information after the time interval received from the external clock,
GPS positioning method, wherein the perform positioning from the GPS satellites by repeating started every time interval, updating the navigation message stored in the memory.

Description

translated from Japanese

[0001]

BACKGROUND OF THE INVENTION

The present invention relates to a navigation system in a mobile car navigation or the like, in particular GPS: about GPS receiver or the like having a reduced positioning time (Global Positioning System Global Positioning System).

[0002]

BACKGROUND OF THE INVENTION

GPS system, car and aircraft by using the GPS satellites that orbit the sky, the moving body such as a ship is a developed position measurement system to be able to determine the position and velocity of the earth in real time, near when, this in addition to the positioning by the mobile, it is also widely used in the fields such as static surveying for measuring the distance and direction between a point on the Earth. When utilizing such GPS systems have GPS receiver is used for receiving radio waves transmitted from GPS satellites.

[0003]

Figure 9 (a), (b) is a schematic configuration of a general GPS system used is an explanatory view showing a conventional GPS positioning operation. As shown in FIG. 9 (a), from the GPS satellites 200, signal 1.57542GHz subjected to a spectrum spread is emitted. The outgoing signals are received by the antenna section 211 of the GPS receiver 210 after a propagation time corresponding to the distance. Signal received by the antenna 211 is down-converted to a predetermined intermediate frequency by the RF unit 212, into the signal synchronous demodulation section 213. Thereafter, the signal despread synchronization signal by the demodulator 213 is performed, the data is demodulated. The demodulated data is used for the positioning calculation by the signal processing unit 214. In this way, the signal transmitted from the GPS satellites 200 is received by the GPS receiver 210, the positioning calculation is performed.

[0004]

FIG. 9 (b) shows a conventional GPS positioning operation being performed at GPS receiver 210. First, the frequency search is performed when the power is turned on (ON). The frequency search is made from the GPS receiver 210 internal frequency oscillator 215, a low precision frequency having an error, it is performed to synchronize the highly accurate signal frequency GPS satellites 200 is transmitting. Here, when it is detected a certain degree of correlation, by performing a PLL (Phase Lock Loop) narrowing combined phase completely to phase lock the signals and internal signals from GPS satellites 200. Then, the detected edge bit boundaries and so capture the data, confirmed the time information. That is, stored in the second word in the subframe hierarchical navigation message, TOW representing the signal time of up to 1 week at 6 second period (Time Of Week) is taken. When the TOW is incorporated moves the positioning calculation. When positioning calculation is completed, the positioning data is output, finally the current position is calculated.

[0005]

[Problems that the invention is to Solve

Thus, in the GPS positioning method, it is necessary frequency oscillator 215 for capturing a signal from the GPS satellites 200 in order to synchronize the highly accurate signal frequency GPS satellites 200 is transmitting, the it is requested frequency oscillator 215 is accurate. However, the frequency oscillator 215, the oscillation frequency fluctuates generally by temperature and aging. It can not be easily capture signals from the GPS satellites 200 using a frequency oscillator 215 for this variation, as described above, separately mechanism called frequency search, it is necessary to provide. Usually, this since the frequency search takes time, it takes a considerable time until finally the current position is calculated.

[0006]

In the conventional GPS positioning method, after signal acquisition from the GPS satellites 200, the absolute time information included in the signal to acquire all, and six seconds have the best conditions at the most short time hot-start , and the in the normal it takes a long time of several tens of seconds. Then, to perform the positioning calculation using the acquired absolute time information, it takes a considerable time until the current position is calculated.

Further, in the conventional GPS positioning method, after the elapse of a certain time or more, again, in the case of performing positioning, it requires a time for capturing a navigation message newly, much time until the current position is calculated it was at stake.

[0007]

If you take a long time to GPS positioning at the reasons described above, for example, in the car navigation system, after the power is turned on, since it is not possible to immediately know the current position, or not able to know quickly the way to the destination, current position for the errors of the self-contained navigation becomes uncertain, time to return to the correct position is that the longer has been a problem. In the device such as built-in or connected to the GPS receiver, such as a recent portable information terminals, from the inability to quickly see the current position, primarily to assume the use of walking, move while holding the device that it is necessary to wait until the positioning in the field, it was very inconvenient without.

[0008]

On the other hand, always it is conceivable to perform positioning in a state where the power is turned on, the current consumption in that case is greatly increased. For example, as such as a car navigation system or a portable navigation system, when the power consumption is particularly limited, always undesirable that you turn on the power.

Further, even when configured to perform discontinuous reception of GPS is repeated a predetermined standby / activation to the GPS receiver, in order to maintain the accuracy of the frequency and time, to shorten the intermittent reception interval frequently it is necessary to the positioning Te, power consumption is large.

[0009]

The present invention was made in order to solve such technical problems, and an object, without waiting for the periodic time information from GPS satellites, stable the GPS positioning time it is to quickly Te.

Another object of the present invention, by selecting a listen interval of optimal GPS, when shortened positioning time also is to provide a significantly reduced the GPS receiver power consumption.

[0010]

In order to solve the problems]

The above object, GPS receiver to which the present invention is applied is configured to update the navigation message performs positioning based on signals transmitted from GPS satellites, a GPS block repeating startup and standby, high-precision frequency holds the information and time information, it is characterized in that an external clock block for outputting a start signal to the GPS block in the standby state on the basis of the retained frequency information and time information.

[0011]

Here, based on the frequency information stored in the external clock block measures the deviation in a frequency offset between the frequency oscillator with the GPS block, and outputs the measured the frequency offset relative to the external clock block it can be characterized by further comprising a frequency measurement block. In addition, the external clock block is always an activation state, if the control means controls the standby and startup of the GPS block based on the output frequency offset from the frequency measurement block, the deviation of the frequency oscillator optimal GPS intermittent receiving interval can be obtained, preferable in that it enables the further reduction of improving the power consumption of the performance based on.

[0012]

When obtaining the bunch of the present invention from another aspect, GPS receiver to which the present invention is applied, it includes a frequency oscillator, a positioning execution means for positioning based on signals transmitted from GPS satellites, the radio clock broadcasting station features of the radio clock receiving means for receiving the carrier wave, that a frequency measuring means for measuring an error of said frequency oscillator with the positioning execution means based on the frequency with the carrier received by the radio clock receiver it is set to.

Also, the frequency measurement means outputs the error of the measured frequency oscillator with respect to wave clock reception means, the radio clock receiver means, the positioning execution means based on the error of the frequency oscillator output by the frequency measuring means it is characterized by controlling the start / wait. With this configuration, for example, the intermittent reception interval of the GPS receiver, it can be extended to the effective time of the navigation message,

that the intermittent receiving interval can be further further reduce power consumption to extend in are excellent.

[0013]

Meanwhile, in order to achieve the above object, GPS positioning method to which the present invention is applied, retain the received navigation message stratified from a plurality of GPS satellites, the received the navigation message in the memory, a high-precision such a frequency and time information stored in the external clock at constantly operating state, the positioning from the GPS satellites by repeating startup and standby by using the frequency and the time information held in the external clock within a predetermined time calculated was carried out, it is characterized by updating the navigation message stored in the memory.

Here, if and changes the start and the time interval of the standby based on the accuracy of the frequency or time information external clock is held, regardless of the status of the external clock, for example, ensure accurate frequency it is possible to hold the time information and the navigation message.

Incidentally, the accuracy of the frequency or time information external clock is held, for example, if the external clock them configured to receive a carrier wave from wave clock broadcasting station, have a high-precision real-time clock (RTC) in the GPS receiver without, maximize the intermittent receiving interval, it is possible to lengthen, preferably in that it can be kept even lower average power consumption.

[0014]

DETAILED DESCRIPTION OF THE INVENTION

◎ embodiment 1

Hereinafter, the present invention will be described in detail with reference to embodiments shown in the accompanying drawings.

Figure 1 is an explanatory diagram showing a schematic configuration of a GPS receiver in this embodiment. As shown in FIG. 1, GPS receiver in this embodiment is greater GPS block 1 and the external clock block 2, and a frequency measurement block 3. The GPS block 1, GPS antenna section 9 for receiving radio waves 1575.42MHz originating from an altitude of about 20,000 km on the GPS satellites, the radio waves received from the GPS antenna unit 9 by using the frequency of the oscillator 12 RF unit 10 and, for lowering the intermediate frequency Te, consists digital (digital) unit 20 for the RF unit 10 demodulates the radio wave is lowered to an intermediate frequency, it calculates the current position by extracting the required data ing.

[0015]

On the other hand, the external clock block 2, as described later, and a clock or a microcomputer having a built-in clock function, can transmit a predetermined signal at a predetermined cycle. The external clock block 2 from the GPS block 1, then set signal indicating a time interval until the start is sent. External Clock Block 2 receives this signal, sets a period for sending an activation signal. Further, the external clock block 2 to the GPS block 1 activation / standby signal is sent. Upon receipt of the start / wait signal, GPS block 1 is configured to start or standby.

[0016]

Further, in this embodiment, has a frequency measurement block 3, the frequency of the frequency oscillator 12 of the GPS block 1, based on the high precision frequency held in the external clock block 2 or the frequency of the external clock block 2, the frequency offset is a deviation amount from the measured and is configured to send the values to the external clock block 2.

[0017]

2, GPS block 1, a further detailed block diagram of the configuration of the external clock block 2 and a frequency measurement block 3. Signal received from the GPS antenna 9 is amplified by the amplifier 11 in the RF unit 10 of the GPS block 1. On the other hand, the interior of the RF section 10 includes a frequency oscillator (TCXO) 12, is mixed with the amplified signal by the amplifier 11 in the mixer 14 after being N times, is converted into an intermediate frequency signal. The intermediate frequency signal is amplified by the amplifier 15, it is digitally converted is inputted to the digital section 20 by an AD converter (ADC) 16.

[0018]

The digital section 20 includes, in addition to the CPU21 for controlling the GPS block 1, a demodulator 22 for demodulating the intermediate frequency signal, and a real time clock (RTC) 23 for generating a clock. Also it includes a RAM 24, and stores the difference between the high frequency and internal frequency oscillator of the GPS satellite as an offset, and is configured to be held the acquired navigation message. And various control information are stored in the ROM 25.

[0019]

On the other hand, the external clock block 2, a CPU31 for controlling the external clock block 2, a real time clock (RTC) 32 having connected to the crystal oscillator (XTAL) 33 clock function. Another ROM34 for storing control information, and a RAM35 for storing time information, and the like.

Also includes a power supply 30 for suppiying power to the GPS block 1 and the external clock block 2 or the like, the power source 30 is controlled power on / off for the GPS block 1 by CPU 21, the standby / activation of the GPS block 1 repeated, thereby enabling a so-called discontinuous reception (sleep reception).

[0020]

Furthermore, the frequency measurement block 3 includes a counter 41 therein. The counter 41, the external clock is obtained by the reference frequency signal from the block 2 is operated in accurate clock, at a given time made with this clock, it counts the measured frequency signal from the RF unit 10 of the GPS block 1 It is configured to be output to the external clock block 2 and the count value as the frequency measurement data (frequency information).

[0021]

Figure 3 is a diagram for explaining a communication content between the block operation. From GPS block 1, first, then set signal indicating a time interval until the start is transmitted to the external clock block 2, the external clock block 2 that has received the transmission sent a wait signal to the GPS block 1 to. Then, to start the timer in RTC 32, after a lapse of a predetermined time is determined by the check of the timer, the start signal is transmitted from the external clock block 2 to the GPS block 1. Further, in this case, the external clock block 2 is in the case of holding a high-precision frequency and time information is also frequency and time information is transmitted to the GPS block 1.

[0022]

Figure 4 is a flowchart showing a flow of processing in the GPS block 1.

GPS block 1 in which a power supply is turned on, first performs positioning of the first (step 101). If this positioning is done, it updates the navigation message stored in the RAM 24 (step 102). Thereafter, GPS block 1 with respect to the external clock block 2 transmits a setting signal (step 103). The setting signal is transmitted at this time, the effective time of the navigation message (usually within about 2 hours), retention time, or the GPS receiver to fit a constant value there is an error in the clock held in the GPS receiver contains time falls at a certain value there is an error of the frequency oscillator 12 you are. Then, waiting for a wait signal from an external clock block 2 (step 104). If the standby signal is received, repeated positioning. If the wait signal is received, it enters a standby state when the power is turned off (step 105).

[0023]

Then, within the time set by the setting signal, the time selected by the state of the external clock block 2 has elapsed, the start signal from the external clock block 2 is received (step 106). And while activating the GPS block 1 (step 107), while the activation signal is not received continues to wait state. At this time, when the external clock block 2 holds a precise frequency and time information, also receives the frequency and time information. Then, a re-positioning (step 101), updating the navigation message (step 102), enters a standby state in the same manner (step 103 to step 105). When the external clock block 2 does not hold a precise frequency and time information are not transmitted the information is the GPS block 1, frequency and time information GPS block 1 is held inside it performs positioning using. In this way, GPS block 1 in the present embodiment, according to the condition of the external clock block 2, and when to perform positioning using the frequency and time information from the external clock block 2, held inside running an intermittent positioning divided when performing positioning using frequency and time information.

[0024]

Figure 5 is a flowchart showing the flow of the first processing in the external clock block 2. External Clock Block 2 in the present embodiment, always continues to operate, holding the highly accurate frequency and time information. The external clock block 2 first waits for a setting signal transmitted from the GPS block 1 (step 111). When the setting signal is received, to update the set time in the RTC32 based on accurate time sent from the GPS block 1 (step 112), starts the timer (step 113). Then, it transmits the standby signal to the GPS block 1 (step 114). Thereafter, the external clock block 2 continues to operate, it is determined whether the timer has

ended (step 115). Then, after the timer time has passed, that is, the lapse of a time interval set by the GPS block 1, it transmits an activation signal to the GPS block 1 (step 116). GPS block 1 receives the activation signal activates solving the standby state as described above. At this time, the measured frequency or frequency offset in the frequency measurement block 3, the time information retained even together to send to the GPS block 1 (step 117). GPS block 1 in this manner, repeatedly start / wait at a predetermined interval, that the frequency offset, time, continues to update the navigation message, hold high precision frequency reference, time information, the latest navigation message it is the can.

[0025]

Figure 6 is a flowchart showing a flow of the second processing in the external clock block 2. Here, a case where the processing depending on whether or not some accuracy the frequency and time accuracy is different. External clock block 2 waits for setting signal transmitted from the GPS block 1 (step 121). When the setting signal is received, it checks the accuracy of the frequency and time information that can be to have, or obtain retention (step 122). If the frequency and time accuracy is somewhat accurate updates the setting time of the timer 1 (step 123). Then it starts a timer 1 (step 124), transmits a standby signal to the GPS block 1 (step 125). After reply waiting signal, when the elapse of time of the timer 1 which is updated by the setting signal (step 126), transmits an activation signal to the GPS block 1 (step 127). At this time, the frequency and the time information held also transmitted to the GPS block 1 (step 128).

[0026]

On the other hand, in step 122, when the frequency and the time information that can be held, or obtained is incorrect, it updates the setting time of the timer 2 (step 129). Then, start the timer 2 (step 130), transmits a standby signal to the GPS block 1 (step 131). After reply waiting signal, when the elapse of time the timer 2 that are updated by the setting signal (step 132), transmits an activation signal to the GPS block 1 (step 133). In this way, what the accuracy of the held or obtained frequency and time information that can alter the spacing of the wait signal and activation signal for transmitting GPS block 1 f, and transmits to the GPS block 1 at startup signal transmission it is possible to also change.

[0027]

The frequency measurement block 3, based on the high precision frequency held in the external clock block 2, the frequency oscillator 12 in the GPS block 1 frequency, or the frequency offset is a deviation from the frequency of the external clock block 2 measured, they are sending their values to the external clock block 2.

[0028]

As described above, according to this embodiment, always operates the external clock block 2, GPS block 1, always highly accurate frequency and time information, and it is possible to hold the navigation message. When such information the GPS receiver holds a can significantly reduce the time required for GPS positioning.

Also, always operates the external clock block 2, the accuracy of the frequency and the time information can be obtained or that the held, be configured to vary the interval of the intermittent reception of the GPS block 1, GPS block 1 , it is possible regardless of the status of the external clock block 2, holds securely precise frequency and time information and the navigation message. The external clock block 2, when it is possible to obtain holding or an accurate frequency and time accuracy may be extended to the effective time of the navigation message. Therefore, it is possible to lengthen the intermittent receiving interval of the GPS block 1, power consumption can be reduced.

[0029]

Figure 7 is an explanatory view showing a positioning operation in the present embodiment. In a typical GPS receiver, as shown in FIG. 9 (b), it is performed first frequency search when power is placed. And the frequency search, as described above, using a frequency which is made at a frequency oscillator 215 in the GPS receiver 210 is that synchronizing signal and the frequency of the GPS satellite 200. Normally, the accuracy of the frequency oscillator 215 in the GPS receiver 210 is deteriorated by temperature and aging, it may deviate from the correct frequency. in such a case, since it is not possible to synchronize the signals from the GPS satellites 200, shifting the frequency of the frequency oscillator 215 in the GPS receiver 210 stepwise, synchronized with the signal from the precise GPS satellites 200 than applying a is. Then, enter the phasing using PLL when the correlation is detected to some extent by the frequency search. When it is possible to match the phases, the range data is acquired is the distance from the GPS satellites 200 also allows the demodulation of the data. Ready to acquire the demodulated data, wait until the time information in the data can be obtained, it performs a positioning calculation when the data can be acquired, and outputs the position data. Therefore, if a frequency shift due to temperature and aging to obtain a high accuracy of the frequency does not occur, but there is no longer need for frequency search as shown in FIG. 6, to obtain a high precision time information at the same time if possible, it is to come no longer need to check the time information.

That is, as shown in FIG. 7, according to this embodiment, no longer requires a portion of the operations necessary GPS positioning, it is possible to immediately enter the phase alignment with PLL, also, immediately it is possible to migrate to the positioning operation. As a result, time is not required was required for its operation, it is not positioning time can be greatly shortened.

[0030]

Also, if you do not have a navigation message at the start of the positioning, or if the navigation message is disappeared effective because of the time elapsed further need time to get navigation message to GPS positioning operation Become. As in this embodiment, GPS is by updating always the latest navigation message starts with a predetermined period, for capable of performing positioning without obtaining the navigation message can be considerably shortened positioning time .

[0031]

◎ Embodiment 2

In the first embodiment, the provided frequency measurement block 3, and configured to change the GPS intermittent receiving interval by the accuracy of the external clock block 2 holding that or the resulting frequency, time information,. In the second embodiment, instead of the external clock block 2 is to vary the GPS intermittent receiving interval by using the radio clock block using radio clock to an external clock.

Incidentally, the same structure as in the first embodiment, like reference numerals described with reference to, the detailed description thereof will be omitted here.

[0032]

Figure 8 is an explanatory diagram showing a schematic configuration of a GPS receiver according to the second embodiment.

In the second embodiment, in which the GPS block 1 and a frequency measurement block 3 described above, with a radio clock block 4. The radio clock block 4 includes a GPS antenna section 5 for receiving the carrier wave of 40KHz is a standard radio wave MPT Communications Research Laboratory is operated, a signal for detecting and amplifying the carrier wave received by the GPS antenna section 5 a demodulator 6, and a digital portion 7 for reading the time information from the detection waveform by the signal demodulation unit 6.

[0033]

Radio clock block 4 in this embodiment is always powered has entered, time information and precise frequency reference precision by receiving a signal from a wave clock broadcasting station continues to always hold. Radio clock block 4 outputs the frequency before detection amplified by the signal demodulating section 6 a carrier of 40KHz to frequency measurement block 3, a frequency measurement block 3, the GPS block 1 using a counter 41 described above detecting the error of the frequency oscillator 12. Radio clock block 4 that has received the frequency information an error of the frequency oscillator 12, appropriate waiting time based on the frequency information, is set, it performs the intermittent reception by controlling the standby / activation of the GPS block 1. GPS block 1 periodically activated by the control updates the ephemeris data necessary for positioning calculation is the position information of the GPS satellites. The acquisition of the ephemeris data has been entered in sleep (standby). By repeating this start-up / stand-by, always it is possible to continue to hold the latest ephemeris data.

To perform positioning, at the moment of powered on GPS Block 1, receive a time and frequency information (error) from the radio clock block 4. GPS receiver using these information, it is possible to perform a high-speed positioning shown in FIG.

[0034]

Here, when adopting the present embodiment, always required in order to achieve high-speed positioning Sleep reception (DRX) interval, consider the average power consumption.

First, Wgps the power consumption of the GPS block 1, the waiting time Tk, the startup time When Ton, average power consumption Wavg is

Wavg = (Wgps × Ton) / Tk

In can be calculated.

In this embodiment, the sleep reception is not used only to acquire the ephemeris data can be thought of as requiring updating period of ephemeris data is interval sleep received intact. Usually, since the life of the ephemeris data is approximately 2 hours, the update time at the maximum considered to 2 hours (7200 seconds). Also, starting time (ephemeris data acquisition time) Ton 1 minute (60 seconds), if the power consumption of the GPS block 1 and 580mW of Wgps, average power consumption Wavg required sleep reception,

Wavg = (580mW × 60s) / 7200s = 4.8 (mW)

To become. When the power consumption of the radio wave clock block 4 and 15 mW, the total power consumption, it is possible to reduce 4.8 + 15 = 19.8 (mW), and the power consumption increases.

[0035]

Further, according to the present embodiment, need not have a high-precision real-time clock (RTC) in the interior of the GPS receiver, the sleep reception interval of the GPS receiver maximum can be increased, since this it becomes possible to reduce the average power consumption. Further, since it is possible to utilize a highly accurate frequency reference from radio clock block 4, as the frequency oscillator of the GPS receiver is having a large error, it is possible to realize a reliable high-speed positioning.

[0036]

【Effect of the invention】

As described above in detail, according to the present invention, it is possible to quickly dramatically the GPS positioning time, also, since it is not necessary to wait for the periodic time information from GPS satellites, to positioning time is fast and stable.

Also, the status of the external clock, it is possible to select a listen interval of optimal GPS, power consumption can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an explanatory diagram showing a schematic configuration of a GPS receiver in this embodiment.

[Figure 2] GPS block 1, a further detailed block diagram of the configuration of the external clock block 2 and a frequency measurement block 3.

3 is a diagram for explaining a communication content between the block operation.

4 is a flowchart showing a flow of processing in the GPS block 1.

5 is a flowchart showing a flow of the first process in the external clock block 2.

6 is a flowchart showing a flow of the second processing in the external clock block 2.

7 is an explanatory view showing a positioning operation in the present embodiment.

8 is an explanatory diagram showing a schematic configuration of a GPS receiver according to the second embodiment.

9 (a), (b) is a schematic configuration of a GPS system commonly used is an explanatory view showing a conventional GPS positioning operation.

DESCRIPTION OF SYMBOLS

1 ... GPS block, 2 ... external clock block, 3 ... frequency measurement block, 4 ... wave clock block, 5 ... GPS antenna unit, 6 ... signal demodulator, 7 ... digital section, 9 ... GPS antenna unit, 10 ... RF unit , 11 ... amplifier, 12 ... frequency oscillator (TCXO), 14 ... mixer, 15 ... amplifier, 16 ... AD converter (ADC), 20 ... digital (digital) unit, 21 ... CPU, 22 ... demodulator, 23 ... Real Time clock (RTC), 24 ... RAM, 25 ... ROM, 30 ... power supply, 31 ... CPU, 32 ... real-time clock (RTC), 33 ... crystal oscillator (XTAL), 34 ... ROM, 35 ... RAM, 41 ... counter

Patent Citations (18)

Publication number	Priority date	Publication date	Assignee	Title
JPH05297105A *	1992-04-21	1993-11-12	Japan Radio Co Ltd	Gps signal reception processing device
JPH09312584A *	1996-03-18	1997-12-02	Mitsubishi Materials Corp	Reference oscillator
JPH1082875A *	1996-09-09	1998-03-31	Furuno Electric Co Ltd	Electronic watch and clocking content correcting method
JPH10170626A *	1996-12-05	1998-06-26	Matsushita Electric Ind Co Ltd	Gps receiver
Family To Family Citations				
JP3115084B2 *	1992-03-16	2000-12-04	パイオニア株式会社	Initial offset setting method oscillator in Gps receiver
US5592173A *	1994-07-18	1997-01-07	Trimble Navigation, Ltd	GPS receiver having a low power standby mode
JP3085511B2 *	1994-11-24	2000-09-11	株式会社アドバンテスト	The reference frequency generator
JPH08327718A *	1995-05-31	1996-12-13	Furuno Electric Co Ltd	Apparatus and method for position measurement
US5841396A *	1996-03-08	1998-11-24	Snaptrack, Inc.	GPS receiver utilizing a communication link
US5945944A *	1996-03-08	1999-08-31	Snaptrack, Inc.	Method and apparatus for determining time for GPS receivers
GB9624742D0 *	1995-12-02	1996-02-07	Plessey Semiconductors Ltd	GPS receiver
US5663735A *	1996-05-20	1997-09-02	Trimble Navigation Limited	GPS receiver using a radio signal for improving time to first fix
US5854605A *	1996-07-05	1998-12-29	Trimble Navigation	GPS receiver using data bit timing to achieve a fast time to first fix

			Limited	
US5949812A *	1996-12-12	1999-09-07	Trimble Navigation Limited	Method and system for conserving battery reserves in a navigation receiver by slowing and/or stopping the system clock during low demand
US5893044A *	1997-01-21	1999-04-06	Motorola Inc.	Real time clock apparatus for fast acquisition or GPS signals
US5864315A *	1997-04-07	1999-01-26	General Electric Company	Very low power high accuracy time and frequency circuits in GPS based tracking units
US6327473B1 *	1998-09-08	2001-12-04	Qualcomm Incorporated	Method and apparatus for increasing the sensitivity of a global positioning satellite receiver
JP2001116821A *	1999-10-15	2001-04-27	Sony Corp	Method of positioning gps, and device for receiving gps

* Cited by examiner, † Cited by third party

Cited By (50)

Publication number	Priority date	Publication date	Assignee	Title
US7925426B2 *	2005-11-17	2011-04-12	Motility Systems	Power management systems and devices
US9682624B1	2005-11-17	2017-06-20	Invent.Ly, Llc	Power management using route information for a hybrid electric vehicle
US9792736B1	2005-11-17	2017-10-17	Invently Automotive Inc.	Telemetry device for capturing vehicle environment and operational status history
Family To Family Citations				
US7949362B2	2000-05-18	2011-05-24	Sirf Technology, Inc.	Satellite positioning aided communication system selection
US7929928B2	2000-05-18	2011-04-19	Sirf Technology Inc.	Frequency phase correction system
US7970411B2	2000-05-18	2011-06-28	Sirf Technology, Inc.	Aided location communication system
US8078189B2	2000-08-14	2011-12-13	Sirf Technology, Inc.	System and method for providing location based services over a network
US7970412B2	2000-05-18	2011-06-28	Sirf Technology, Inc.	Aided location communication system
US6668158B1 *	2001-02-28	2003-12-23	Sirf Technology, Inc.	Method for aiding a global positioning system
US7668554B2	2001-05-21	2010-02-23	Sirf Technology, Inc.	Network system for aided GPS broadcast positioning
US6462708B1	2001-04-05	2002-10-08	Sirf Technology, Inc.	GPS-based positioning system for mobile GPS terminals
JP2003028946A *	2001-07-12	2003-01-29	Mitsui & Co Ltd	Method and apparatus for position measurement
DE60238496D1 *	2001-10-02	2011-01-13	Sirf Tech Inc	GPS apparatus and method of using a temperature-compensated oscillator for carrying out a position fixing
US6957056B2 *	2002-03-28	2005-10-18	Motorola, Inc.	Receiver and method for determining an intermediate frequency in a wireless communication device
US6724342B2	2002-04-19	2004-04-20	Sirf Technology, Inc.	Compensation for frequency adjustment in mobile communication-positioning device with shared oscillator
US7747384B1 *	2002-06-06	2010-06-29	Trimble Navigation, Ltd.	Method for substituting at least one high quality position measurement taken before an interrupting event with a set of upgraded low quality position measurements provided by the same source of measurements after the interrupting event
US6810324B1 *	2002-06-06	2004-10-26	Trimble Navigation, Ltd.	Substitution of high quality position measurements with upgraded low quality position measurements
US7415243B2	2003-03-27	2008-08-19	Honda Giken Kogyo	System, method and computer program product for receiving data from a satellite radio network

			Kabushiki Kaisha	
US7139225B2 *	2003-03-27	2006-11-21	Qualcomm, Incorporated	Virtual real-time clock based on time information from multiple communication systems
US7818380B2	2003-12-15	2010-10-19	Honda Motor Co., Ltd.	Method and system for broadcasting safety messages to a vehicle
US8041779B2	2003-12-15	2011-10-18	Honda Motor Co., Ltd.	Method and system for facilitating the exchange of information between a vehicle and a remote location
GB2409362B	2003-12-19	2006-07-19	Nokia Corp	A GPS device
JP2005201737A *	2004-01-14	2005-07-28	Sony Corp	Communication device
JP2005292082A *	2004-04-05	2005-10-20	Denso Corp	Controller for satellite navigation
JP2007533004A	2004-04-06	2007-11-15	本田技研工業株式会社	Method and system for controlling the exchange of vehicle-related messages of the application information
US7518530B2	2004-07-19	2009-04-14	Honda Motor Co., Ltd.	Method and system for broadcasting audio and visual display messages to a vehicle
US8022870B2 *	2004-09-02	2011-09-20	Nariste Networks Pty Ltd	Self monitoring GPS on mobile device
US7643788B2	2004-09-22	2010-01-05	Honda Motor Co., Ltd.	Method and system for broadcasting data messages to a vehicle
JP4769452B2 *	2004-12-20	2011-09-07	古野電気株式会社	Positioning signal reception apparatus
US7889125B2 *	2005-03-15	2011-02-15	Honeywell International Inc.	Adjusting processor clock information using a clock drift estimate
US7562049B2	2005-03-29	2009-07-14	Honda Motor Co., Ltd.	Payment system and method for data broadcasted from a remote location to vehicles
US7949330B2	2005-08-25	2011-05-24	Honda Motor Co., Ltd.	System and method for providing weather warnings and alerts
JP2007108030A *	2005-10-14	2007-04-26	Kenwood Corp	Gps device and portable electronic device
AT439608T *	2005-10-21	2009-08-15	Qualcomm Inc	Receiver and signal processor for radio radiolocation
US8046162B2	2005-11-04	2011-10-25	Honda Motor Co., Ltd.	Data broadcast method for traffic information
US20070124306A1 *	2005-11-09	2007-05-31	Honda Motor Co., Ltd.	Method and system for transmitting data to vehicles over limited data links
JP4844108B2 *	2005-12-07	2011-12-28	ソニー株式会社	The information processing apparatus, and a power supply control method, and computer program
JP4525578B2	2005-12-07	2010-08-18	ソニー株式会社	Imaging device, and a gps control method, and computer program
JP2008129706A *	2006-11-17	2008-06-05	Nakamura Tome Precision Ind Co Ltd	Startup control system of machine tool
DE102007012344B4 *	2007-03-14	2009-04-09	Siemens Ag Österreich	Method and device to minimize the position error of navigation devices
US7668653B2	2007-05-31	2010-02-23	Honda Motor Co., Ltd.	System and method for selectively filtering and providing event program information
US20100023228A1 *	2007-07-13	2010-01-28	Montgomery James L	Apparatus and method for the positioning of a tool of a ground engaging vehicle
US8099308B2	2007-10-02	2012-01-17	Honda Motor Co., Ltd.	Method and system for vehicle service appointments based on diagnostic trouble codes
JP2009109338A *	2007-10-30	2009-05-21	Seiko Epson Corp	Time information management system, electronic apparatus, time information management method, and program
US8106821B2 *	2008-06-27	2012-01-31	Qualcomm Incorporated	Methods and apparatuses for use with mode-switchable navigation radio
US7986263B2 *	2008-09-22	2011-07-26	Sierra Wireless, Inc.	Method and apparatus for a global navigation satellite system receiver coupled to a host computer system

KR101564938B1	2008-09-30	2015-11-02	삼성전자주식회사	High-speed positioning method and apparatus using the Gps
US7986267B2 *	2008-10-13	2011-07-26	Broadcom Corporation	Method and system for customized full ephemeris compatible with standard AGPS network devices
US20140192793A1 *	2013-01-04	2014-07-10	Qualcomm Incorporated	Systems and methods for hierarchical time source usage in near-me area network discovery and synchronization
RU2583706C1 *	2014-12-23	2016-05-10	Акционерное общество "Воентелеком"	Method of receiving noise-like phase-shift keyed signals

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
ES2293347T3	2008-03-16	System for establishing approximate GPS time a mobile station within a wireless network asynchronously.
US5663734A	1997-09-02	GPS receiver and method for processing GPS signals
CN101488007B	2011-07-27	Electronic timepiece and control method for an electronic timepiece
CN104076371B	2017-08-15	Internet hotspot satellite positioning system
CN100375005C	2008-03-19	Calibrated real time clock for acquisition of GPS signals during low power operation
EP2063329B1	2011-06-15	Satellite signal reception device, timekeeping device, and satellite signal reception method for a satellite signal reception device
EP1436909B1	2013-09-04	Satellite positioning system receiver with reference oscillator circuit and methods therefor
US6384777B1	2002-05-07	User-controlled GPS receiver
US6121923A	2000-09-19	Fixed site and satellite data-aided GPS signal acquisition method and system
US20030085837A1	2003-05-08	Method and apparatus for receiving a global positioning system signal using a cellular acquisition signal
JP4287476B2	2009-07-01	Transfer of calibration time information in the mobile terminal
US8493816B2	2013-07-23	Electronic timepiece, time adjustment method for an electronic timepiece, and control program for an electronic timepiece
EP1586916B1	2011-06-01	GPS receiver and method for processing GPS signals
JP5646575B2	2014-12-24	Determination of time of Gps receiver
CN103424760B	2015-11-25	Location Request formula
US7570208B2	2009-08-04	Unassisted indoor GPS receiver
US7616153B2	2009-11-10	Electronic device and time adjustment method
CN102369455B	2014-11-05	System and method for operating a GPS device in micro power mode
US7786930B2	2011-01-04	Method and apparatus for real time clock (RTC) brownout detection
CN1256809C	2006-05-17	Method and apparatus for compensating local oscillatory frequency error through environmental control
US6882308B2	2005-04-19	Portable device for determining horizontal and vertical positions and method for operating the same
EP2093634B1	2011-11-09	Satellite signal reception device and control method for a satellite signal reception device
EP0885492B1	2007-10-17	An improved gps receiver utilizing a communication link
EP2309290A1	2011-04-13	Satellite positioning system receivers and methods
US7660572B2	2009-10-20	Apparatus and method for controlling autonomous and assisted GPS modes in a wireless mobile terminal

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
JP2000057814A	2000-03-02	2000-03-02	Gps receiver, and gps positioning method

Applications Claiming Priority (4)

Application	Filing date	Title
JP2000057814A	2000-03-02	Gps receiver, and gps positioning method
DE2001612346	2001-03-01	GPS receiver and method for position determination by means of GPS
EP20010301887	2001-03-01	GPS receiver and GPS position measurement method
US09/797,025	2001-03-01	GPS receiver and GPS position measurement method

Legal Events

Date	Code	Title	Description
2006-12-29	A621	Written request for application examination	**Free format text**: JAPANESE INTERMEDIATE CODE: A621 **Effective date**: 20061228
2008-12-22	A977	Report on retrieval	**Free format text**: JAPANESE INTERMEDIATE CODE: A971007 **Effective date**: 20081222
2009-01-07	A131	Notification of reasons for refusal	**Free format text**: JAPANESE INTERMEDIATE CODE: A131 **Effective date**: 20090106
2009-03-07	A521	Written amendment	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20090306
2009-04-01	A131	Notification of reasons for refusal	**Free format text**: JAPANESE INTERMEDIATE CODE: A131 **Effective date**: 20090331
2009-05-29	A521	Written amendment	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20090528
2009-12-15	RD03	Notification of appointment of power of attorney	**Free format text**: JAPANESE INTERMEDIATE CODE: A7423 **Effective date**: 20091214
2010-06-01	TRDD	Decision of grant or rejection written	
2010-06-09	A01	Written decision to grant a patent or to grant a registration (utility model)	**Free format text**: JAPANESE INTERMEDIATE CODE: A01 **Effective date**: 20100608
2010-06-10	A01	Written decision to grant a patent or to grant a registration (utility model)	**Free format text**: JAPANESE INTERMEDIATE CODE: A01
2010-07-08	A61	First payment of annual fees (during grant procedure)	**Free format text**: JAPANESE INTERMEDIATE CODE: A61 **Effective date**: 20100621
2010-07-09	FPAY	Renewal fee payment (event date is renewal date of database)	**Free format text**: PAYMENT UNTIL: 20130709 **Year of fee payment**: 3
2010-07-12	FPAY	Renewal fee payment (event date is renewal date of database)	**Free format text**: PAYMENT UNTIL: 20130709 **Year of fee payment**: 3
2013-07-09	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2014-07-08	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2015-07-07	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250
2016-07-05	R250	Receipt of annual fees	**Free format text**: JAPANESE INTERMEDIATE CODE: R250

2017-07-04	R250	Receipt of annual fees	Free format text: JAPANESE INTERMEDIATE CODE: R250

Data provided by IFI CLAIMS Patent Services

About Send Feedback Public Datasets Terms Privacy Policy

(19)日本国特許庁(JP)　(12)特　許　公　報(B2)　(11)特許番号
特許第4543480号
(P4543480)
(45)発行日　平成22年9月15日(2010.9.15)　(24)登録日　平成22年7月9日(2010.7.9)

(51)Int.Cl.　F I
G01S 5/14 (2006.01)　G01S 5/14
G01S 19/23 (2010.01)　G01S 5/14　540
G01S 19/34 (2010.01)　G01S 5/14　552
G01C 21/00 (2006.01)　G01C 21/00　A

請求項の数 4　(全 13 頁)

(21)出願番号　特願2000-57814(P2000-57814)
(22)出願日　平成12年3月2日(2000.3.2)
(65)公開番号　特開2001-242235(P2001-242235A)
(43)公開日　平成13年9月7日(2001.9.7)
審査請求日　平成18年12月28日(2006.12.28)

(73)特許権者　000002185
ソニー株式会社
東京都港区港南１丁目７番１号
(74)代理人　100095957
弁理士　亀谷　美明
(74)代理人　100096389
弁理士　金本　哲男
(74)代理人　100101557
弁理士　萩原　康司
(74)代理人　100104880
弁理士　古部　次郎
(72)発明者　長谷川　浩二
東京都品川区北品川６丁目７番３５号　ソニー株式会社内

最終頁に続く

(54)【発明の名称】ＧＰＳ受信機、およびＧＰＳ測位方法

(57)【特許請求の範囲】
【請求項1】
ＧＰＳ衛星から発信される信号に基づいて測位を行い航法メッセージを更新すると共に、待機と起動を繰り返すＧＰＳブロックと、
周波数情報と時刻情報とを保持すると共に、保持された当該周波数情報と当該時刻情報とに基づいて待機状態にある前記ＧＰＳブロックに対して起動信号を出力する外部時計ブロックと、を備え、
前記外部時計ブロックは、当該外部時計ブロックが保持する前記周波数および前記時刻情報の正確さに基づいて、前記ＧＰＳブロックが待機してから起動するまでの時間間隔を切り替えて設定し、当該周波数および当該時刻情報が所定の程度よりも正確な場合には、当該時間間隔の後に当該周波数および当該時刻情報を当該ＧＰＳブロックに送信し、当該周波数および当該時刻情報が当該所定の程度よりも正確でない場合には、当該時間間隔の後に当該周波数および当該時刻情報を当該ＧＰＳブロックに送信しないことを特徴とするＧＰＳ受信機。
【請求項2】
前記外部時計ブロックで保持している前記周波数情報を基準に、前記ＧＰＳブロックが有する周波数発振器とのずれである周波数オフセットを測定し、測定された当該周波数オフセットを当該外部時計ブロックに対して出力する周波数測定ブロックと、を更に備えたことを特徴とする請求項１記載のＧＰＳ受信機。
【請求項3】

前記外部時計ブロックは、前記周波数測定ブロックから出力された前記周波数オフセットに基づいて前記ＧＰＳブロックの待機と起動を制御することを特徴とする請求項２記載のＧＰＳ受信機。
【請求項４】
複数のＧＰＳ衛星から階層化された航法メッセージを受信し、
受信された前記航法メッセージをメモリに保持し、
周波数と時刻情報とを常時動作状態にある外部時計に保持し、
前記外部時計が保持する前記周波数および前記時刻情報の正確さに基づいて、待機してから起動するまでの時間間隔を切り替えて設定し、
前記外部時計に保持された前記周波数および前記時刻情報が所定の程度よりも正確でない場合には、前記時間間隔の後に当該周波数および当該時刻情報を当該外部時計から受信せず、当該外部時計に保持された当該周波数および当該時刻情報が当該所定の程度よりも正確な場合には、当該時間間隔の後に当該周波数および当該時刻情報を当該外部時計から受信し、
前記時間間隔ごとに起動を繰り返すことでＧＰＳ衛星から測位を行い、前記メモリに保持されている前記航法メッセージを更新することを特徴とするＧＰＳ測位方法。

【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、カーナビゲーション等の移動体におけるナビゲーションシステムに係り、特にＧＰＳ(Global Positioning System：全地球測位システム)の測位時間を短縮したＧＰＳ受信機等に関する。
【０００２】
【従来の技術】
ＧＰＳシステムは、上空を軌道するＧＰＳ衛星を利用して車や航空機、船舶などの移動体が、地球上の位置や速度をリアルタイムで求めることができるように開発された位置測定システムであり、近時、この移動体による測位以外に、地球上のある地点間の距離や方向を測定するスタティック測量の分野等にも広く利用されている。このようなＧＰＳシステムを利用する場合、ＧＰＳ衛星から発信される電波を受信するためのＧＰＳ受信機が用いられている。
【０００３】
図９(ａ)、(ｂ)は、一般的に用いられるＧＰＳシステムの概略構成と、従来のＧＰＳ測位動作を示した説明図である。図９(ａ)に示すように、ＧＰＳ衛星２００からは、スペクトラム拡散された１、５７５４２ＧＨｚの信号が発信される。この発信された信号は、その距離に応じた伝播時間後にＧＰＳ受信機２１０のアンテナ部２１１にて受信される。このアンテナ部２１１にて受信された信号は、ＲＦ部２１２によって所定の中間周波数にダウンコンバートされ、信号同期復調部２１３に入る。その後、この信号同期復調部２１３にて信号の逆拡散が行われ、データが復調される。復調されたデータは、信号処理部２１４にて測位計算に用いられる。このようにして、ＧＰＳ衛星２００から発信された信号がＧＰＳ受信機２１０にて受信され、測位計算が行われる。
【０００４】
図９(ｂ)は、ＧＰＳ受信機２１０にて行われている従来のＧＰＳ測位動作を示している。まず、電源がオン(ＯＮ)されると周波数サーチがなされる。この周波数サーチは、ＧＰＳ受信機２１０内部の周波数発振器２１５から作られる、誤差を持った低精度な周波数を、ＧＰＳ衛星２００が発信している高精度な信号周波数に同期させるために行われる。ここで、ある程度の相関が検出されると、ＰＬＬ(Phase Lock Loop)を行って位相を合わせ込み、ＧＰＳ衛星２００からの信号と内部の信号とを完全に位相同期させる。そして、ビット境界のエッジが検出され、データが取り込めるようになると、時間情報の確認が行われる。即ち、階層化された航法メッセージ内のサブフレームにおける２ワード目に格納され、６秒周期で１週間までの信号時刻を表すＴＯＷ(Time Of Week)が取り込まれる。このＴ

ＯＷが取り込まれると測位計算に移る。測位計算が終了すると、測位データが出力され、最終的に現在位置が計算される。

【０００５】

【発明が解決しようとする課題】

このように、ＧＰＳの測位方法では、ＧＰＳ衛星２００からの信号を捕捉するための周波数発振器２１５が必要であり、ＧＰＳ衛星２００が発信している高精度な信号周波数に同期させるためには、この周波数発振器２１５が高精度であることが要求される。しかしながら、この周波数発振器２１５は、一般的に温度や経年変化により発振周波数が変動してしまう。この変動のために周波数発振器２１５を用いてＧＰＳ衛星２００からの信号を簡単に捕捉することができず、上述のように、周波数サーチという仕組みを別途、設ける必要があった。通常、この周波数サーチには時間がかかるため、最終的に現在位置が計算されるまでにかなりの時間を要していた。

【０００６】

また、従来のＧＰＳの測位方法では、ＧＰＳ衛星２００からの信号捕捉後、信号に含まれる絶対時間情報を全て取得するまでに、最も短時間なホットスタート時で且つ最も良い条件でも６秒は必要であり、通常では十数秒の時間がかかっていた。そして、その取得した絶対時間情報を用いて測位計算を行なうため、現在位置が計算されるまでにかなりの時間を要していた。

更に、従来のＧＰＳ測位方法において、ある一定時間以上経過した後に、再度、測位を行う場合には、航法メッセージを新たに取り込むための時間が必要となり、現在位置が計算されるまでに多くの時間がかかっていた。

【０００７】

以上のような理由でＧＰＳの測位に時間がかかる場合、例えば、カーナビゲーションシステムでは、電源投入後、直ぐに現在位置を知ることができないため、目的地への道を素早く知ることができなかったり、自立航法の誤差のために現在位置が不確定になって、正しい位置に戻る時間が長くなることが問題となっていた。また、最近の携帯情報端末などにＧＰＳ受信機を内蔵または接続するような機器においては、現在位置を素早く知ることができないことから、主に徒歩での用途を想定すると、機器を持ったまま動けずにその場で測位するまで待つことが必要となり、非常に不便であった。

【０００８】

一方で、常時、電源をオンした状態において測位を行うことも考えられるが、その場合には消費電流が大幅に増加してしまう。例えばカーナビゲーションシステムや携帯型ナビゲーションシステム等のように、消費電力が特に限られている場合には、常に電源をオンしておくことは好ましくない。

また、ＧＰＳ受信機に対して所定の待機/起動を繰り返してＧＰＳの間欠受信を行うように構成した場合であっても、周波数と時刻の精度を維持するためには、間欠受信間隔を短くして頻繁に測位をする必要があり、消費電力が大きくなっていた。

【０００９】

本発明は、このような技術的課題を解決するためになされたものであって、その目的とするところは、ＧＰＳ衛星からの定期的な時間情報を待つことなく、ＧＰＳの測位時間を安定して早くすることにある。

また他の目的は、最適なＧＰＳの間欠受信間隔を選択することによって、測位時間を短縮した場合にも、消費電力を大幅に減らしたＧＰＳ受信機を提供することにある。

【００１０】

【課題を解決するための手段】

かかる目的のもと、本発明が適用されたＧＰＳ受信機は、ＧＰＳ衛星から発信される信号に基づいて測位を行い航法メッセージを更新すると共に、待機と起動を繰り返すＧＰＳブロックと、高精度な周波数情報と時刻情報とを保持すると共に、保持された周波数情報と時刻情報とに基づいて待機状態にあるＧＰＳブロックに対して起動信号を出力する外部時計ブロックとを備えたことを特徴としている。

【００１１】
ここで、この外部時計ブロックで保持している周波数情報を基準に、ＧＰＳブロックが有する周波数発振器とのずれである周波数オフセットを測定し、測定されたこの周波数オフセットを外部時計ブロックに対して出力する周波数測定ブロックとを更に備えたことを特徴とすることができる。更に、この外部時計ブロックは、常時、起動された状態とし、この周波数測定ブロックから出力された周波数オフセットに基づいてＧＰＳブロックの待機と起動を制御することを特徴とすれば、周波数発振器のずれ量に基づいて最適なＧＰＳ間欠受信間隔を得ることができ、性能の向上と消費電力の更なる削減が可能となる点で好ましい。
【００１２】
本発明を他の観点から把えると、本発明が適用されたＧＰＳ受信機は、周波数発振器を備え、ＧＰＳ衛星から発信される信号に基づいて測位を行う測位実行手段と、電波時計放送局からの搬送波を受信する電波時計受信手段と、この電波時計受信手段によって受信された搬送波の有する周波数に基づいて測位実行手段が有する前記周波数発振器の誤差を測定する周波数測定手段とを備えたことを特徴としている。
また、この周波数測定手段は、測定された周波数発振器の誤差を電波時計受信手段に対して出力し、この電波時計受信手段は、周波数測定手段によって出力された周波数発振器の誤差に基づいて測位実行手段の起動/待機を制御することを特徴としている。このように構成することで、例えば、ＧＰＳ受信機の間欠受信間隔を、航法メッセージの有効時間まで延ばすことが可能となり、この間欠受信間隔を更に延長して消費電力を更に削減することができる点で優れている。
【００１３】
一方、上記目的を達成するために、本発明が適用されたＧＰＳ測位方法は、複数のＧＰＳ衛星から階層化された航法メッセージを受信し、受信されたこの航法メッセージをメモリに保持し、高精度な周波数と時刻情報とを常時動作状態にある外部時計に保持し、この外部時計に保持された周波数と時刻情報とを用いて求めた所定時間内に起動と待機を繰り返すことでＧＰＳ衛星から測位を行い、メモリに保持されている航法メッセージを更新することを特徴としている。
ここで、外部時計が保持する周波数または時刻情報の正確さに基づいて起動と待機の時間間隔を変更することを特徴とすれば、外部時計の状況によらずに、例えば確実に高精度な周波数と時刻情報、そして航法メッセージを保持することが可能となる。
尚、外部時計が保持する周波数または時刻情報の正確さは、例えば外部時計が電波時計放送局からの搬送波を受信できるように構成すれば、ＧＰＳ受信機内に高精度のリアルタイムクロック(ＲＴＣ)を持たなくても、間欠受信間隔を最大限、長くすることが可能となり、平均消費電力を更に低く抑えることができる点で好ましい。
【００１４】
【発明の実施の形態】
◎　実施の形態１
以下、添付図面に示す実施の形態に基づいてこの発明を詳細に説明する。
図１は、本実施の形態におけるＧＰＳ受信機の概略構成を示す説明図である。図１に示すように、本実施の形態におけるＧＰＳ受信機は、大きくＧＰＳブロック１と外部時計ブロック２、および周波数測定ブロック３から構成される。このＧＰＳブロック１は、高度約２万ｋｍ上のＧＰＳ衛星から発信された１５７５．４２ＭＨｚの電波を受信するＧＰＳアンテナ部９、このＧＰＳアンテナ部９から受信した電波を周波数発振器１２の周波数を利用して中間周波数に下げるためのＲＦ部１０、そして、ＲＦ部１０によって中間周波数に下げられた電波を復調し、必要なデータを抜き出して現在位置を計算するためのディジタル(Digital)部２０から構成されている。
【００１５】
一方、外部時計ブロック２は、後述するように、所定の信号を所定の周期で送信することのできる時計、または時計機能を内蔵したマイコンから構成されている。ＧＰＳブロック

１から外部時計ブロック２には、次に起動するまでの時間間隔を指示する設定信号が送られる。外部時計ブロック２は、この信号を受信すると、起動信号を送る周期を設定する。また、外部時計ブロック２からＧＰＳブロック１には起動/待機信号が送られる。この起動/待機信号の受信により、ＧＰＳブロック１は起動又は待機できるように構成されている。

【００１６】

また、本実施の形態では、周波数測定ブロック３を備えており、外部時計ブロック２で保持している高精度な周波数を基準にＧＰＳブロック１の周波数発振器１２の周波数、もしくは外部時計ブロック２の周波数からのずれ量である周波数オフセットを測定し、外部時計ブロック２にそれらの値を送るように構成されている。

【００１７】

図２は、ＧＰＳブロック１、外部時計ブロック２および周波数測定ブロック３の構成を更に詳述したブロック図である。ＧＰＳアンテナ部９から受信した信号は、ＧＰＳブロック１のＲＦ部１０におけるアンプ１１にて増幅される。一方、ＲＦ部１０の内部には周波数発振器(ＴＣＸＯ)１２を備え、Ｎ倍された後にミキサ１４でアンプ１１にて増幅された信号と混合され、中間周波数信号に変換される。この中間周波数信号は、アンプ１５にて増幅され、ＡＤ変換器(ＡＤＣ)１６によってディジタル変換されてディジタル部２０に入力される。

【００１８】

ディジタル部２０は、ＧＰＳブロック１を制御するＣＰＵ２１の他に、中間周波数信号を復調する復調器２２、クロックを生成するリアルタイムクロック(ＲＴＣ)２３を備えている。また、ＲＡＭ２４を備え、ＧＰＳ衛星の高度な周波数と内蔵の周波数発振器との差をオフセットとして格納したり、取得された航法メッセージを保持できるように構成されている。ＲＯＭ２５には各種制御情報等が格納されている。

【００１９】

一方、外部時計ブロック２には、この外部時計ブロック２を制御するＣＰＵ３１と、水晶発振子(ＸＴＡＬ)３３に接続され時計機能を有するリアルタイムクロック(ＲＴＣ)３２を備えている。また、制御情報を格納するＲＯＭ３４の他、時刻情報等を格納するＲＡＭ３５を備えている。

また、ＧＰＳブロック１と外部時計ブロック２等に電力を供給する電源３０を備えており、この電源３０は、ＣＰＵ２１によってＧＰＳブロック１に対する電源のオン/オフがコントロールされ、ＧＰＳブロック１の待機/起動を繰り返す、いわゆる間欠受信(スリープ受信)を可能としている。

【００２０】

更に、周波数測定ブロック３は、内部にカウンタ４１を備えている。このカウンタ４１は、外部時計ブロック２からの基準周波数信号で得られる正確なクロックで動作させ、このクロックで作られる所定の時間に、ＧＰＳブロック１のＲＦ部１０からの被測定周波数信号をカウントし、そのカウント値を周波数測定データ(周波数情報)として外部時計ブロック２に出力できるように構成されている。

【００２１】

図３は、各ブロック動作と通信内容を説明するための図である。ＧＰＳブロック１からは、まず、次に起動するまでの時間間隔を指示する設定信号が外部時計ブロック２に送信され、その送信を受けた外部時計ブロック２はＧＰＳブロック１に対して待機信号を送出する。その後、ＲＴＣ３２におけるタイマーを起動させ、タイマーのチェックによって所定時間の経過が判断された後に、外部時計ブロック２からＧＰＳブロック１に対して起動信号が送信される。また、このときに、外部時計ブロック２が高精度な周波数と時刻情報を保持している場合には、周波数と時刻情報もＧＰＳブロック１に対して送信される。

【００２２】

図４は、ＧＰＳブロック１における処理の流れを示すフローチャートである。

電源がオンされた状態にあるＧＰＳブロック１は、まず初回の測位を実行する(ステップ

１０１）。この測位が行われると、ＲＡＭ２４に格納されている航法メッセージを更新する（ステップ１０２）。その後、ＧＰＳブロック１は外部時計ブロック２に対して、設定信号を送信する（ステップ１０３）。このときに送信される設定信号には、航法メッセージの有効時間（通常約２時間以内）、ＧＰＳ受信機で保持している時計の誤差がある一定の値で収まる時間、またはＧＰＳ受信機で保持している周波数発振器１２の誤差がある一定の値で収まる時間が含まれている。その後、外部時計ブロック２から待機信号を待つ（ステップ１０４）。待機信号が受信されなければ、測位を繰り返す。待機信号が受信されると、電源を切って待機状態に入る（ステップ１０５）。

【００２３】

その後、設定信号で設定された時間のうち、外部時計ブロック２の状態により選択された時間が経過すると、外部時計ブロック２からの起動信号が受信される（ステップ１０６）。そして、ＧＰＳブロック１を起動させるが（ステップ１０７）、起動信号が受信されない間は待機状態を継続する。このとき、外部時計ブロック２が高精度な周波数と時刻情報を保持している場合には、周波数と時刻情報も受信する。そして、再び測位を行い（ステップ１０１）、航法メッセージを更新すると（ステップ１０２）、同様にして待機状態に入る（ステップ１０３～ステップ１０５）。外部時計ブロック２が高精度な周波数と時刻情報とを保持していない場合には、ＧＰＳブロック１にはそれらの情報が送信されずに、ＧＰＳブロック１は内部で保持している周波数と時刻情報を用いて測位を行う。このようにして、本実施の形態におけるＧＰＳブロック１は、外部時計ブロック２の状況に応じて、外部時計ブロック２からの周波数と時刻情報を用いて測位を行う場合と、内部に保持している周波数と時刻情報を用いて測位を行う場合に分かれて間欠測位を実行している。

【００２４】

図５は、外部時計ブロック２における第１の処理の流れを示すフローチャートである。本実施の形態における外部時計ブロック２は、常に動作し続け、高精度な周波数と時刻情報を保持している。この外部時計ブロック２は、まず、ＧＰＳブロック１から送信される設定信号を待つ（ステップ１１１）。設定信号が受信されると、ＧＰＳブロック１から送られる正確な時刻に基づいてＲＴＣ３２における設定時間を更新し（ステップ１１２）、タイマーを起動させる（ステップ１１３）。そして、ＧＰＳブロック１に対して待機信号を送信する（ステップ１１４）。その後、外部時計ブロック２は動作を続け、タイマーが終了したか否かを判断する（ステップ１１５）。そして、タイマー時間が経過した後、即ちＧＰＳブロック１から設定された時間間隔が過ぎると、起動信号をＧＰＳブロック１に対して送信する（ステップ１１６）。起動信号を受信したＧＰＳブロック１は、前述のように待機状態を解いて起動する。このとき、周波数測定ブロック３にて測定された周波数または周波数オフセットと、保持している時刻情報も併せてＧＰＳブロック１に送信する（ステップ１１７）。このようにしてＧＰＳブロック１は、所定の間隔で起動/待機を繰り返し、周波数のオフセット、時刻、航法メッセージを更新し続けることで、高精度の周波数基準、時刻情報、最新の航法メッセージを保持することができるのである。

【００２５】

図６は、外部時計ブロック２における第２の処理の流れを示すフローチャートである。ここでは、周波数と時刻精度がある程度正確か否かによって処理が異なる場合を説明する。外部時計ブロック２は、ＧＰＳブロック１から送信される設定信号を待つ（ステップ１２１）。設定信号が受信されると、保持している、または得ることのできる周波数と時刻情報の正確さを調べる（ステップ１２２）。周波数と時刻精度がある程度正確な場合には、タイマー１の設定時間を更新する（ステップ１２３）。そしてタイマー１を起動し（ステップ１２４）、待機信号をＧＰＳブロック１に送信する（ステップ１２５）。待機信号を返信後、設定信号で更新されたタイマー１の時間が経過すると（ステップ１２６）、ＧＰＳブロック１に起動信号を送信する（ステップ１２７）。このとき、保持している周波数と時刻情報もＧＰＳブロック１に送信される（ステップ１２８）。

【００２６】

一方、ステップ１２２で、保持している、または得ることのできる周波数と時刻情報が不

正確な場合には、タイマー２の設定時間を更新する（ステップ１２９）。そして、タイマー２を起動し（ステップ１３０）、待機信号をＧＰＳブロック１に送信する（ステップ１３１）。待機信号を送信後、設定信号で更新されたタイマー２の時間が経過すると（ステップ１３２）、ＧＰＳブロック１に起動信号を送信する（ステップ１３３）。このようにして、保持しているまたは得ることのできる周波数と時刻情報の正確さによって、ＧＰＳブロック１へ送信する待機信号と起動信号の間隔を変え、起動信号送信時にＧＰＳブロック１へ送信する内容も変えることが可能となる。

【００２７】

尚、周波数測定ブロック３は、外部時計ブロック２で保持している高精度な周波数を基準に、ＧＰＳブロック１における周波数発振器１２の周波数、若しくは外部時計ブロック２の周波数からのずれである周波数オフセットを測定し、外部時計ブロック２に対してそれらの値を送っている。

【００２８】

以上説明したように、本実施の形態によれば、外部時計ブロック２が常に動作し、ＧＰＳブロック１は、常に高精度な周波数と時刻情報、そして航法メッセージを保持することが可能となる。このような情報をＧＰＳ受信機が保持している場合には、ＧＰＳの測位にかかる時間を大幅に短縮することができる。

また、外部時計ブロック２が常に動作し、その保持しているまたは得ることができる周波数と時刻情報との正確さにより、ＧＰＳブロック１の間欠受信の間隔を変えるように構成すれば、ＧＰＳブロック１は、外部時計ブロック２の状況によらずに、確実に高精度な周波数と時刻情報、そして航法メッセージを保持することが可能となる。また、外部時計ブロック２が、正確な周波数と時刻精度を保持または得ることができる場合には、航法メッセージの有効時間まで延ばすことができる。そのために、ＧＰＳブロック１における間欠受信間隔を長くすることが可能となり、消費電力の削減が可能となる。

【００２９】

図７は、本実施の形態における測位動作を示した説明図である。通常のＧＰＳ受信機では、図９（ｂ）に示すように、電源が入れられるとまず周波数サーチを行っている。この周波数サーチとは、前述のように、ＧＰＳ受信機２１０内の周波数発振器２１５にて作られた周波数を用いて、ＧＰＳ衛星２００からの信号と周波数の同期を取ることである。通常、ＧＰＳ受信機２１０内の周波数発振器２１５の精度が温度や経年変化で劣化し、正確な周波数からずれる場合がある。このような場合には、ＧＰＳ衛星２００からの信号に同期を取ることが出来ないため、ＧＰＳ受信機２１０内の周波数発振器２１５の周波数を段階的にずらし、正確なＧＰＳ衛星２００からの信号に同期をかけるのである。そして、この周波数サーチにより相関がある程度検出された時点でＰＬＬを使った位相合わせに入る。そして、位相を合わせることができると、各ＧＰＳ衛星２００からの距離であるレンジデータが取得され、データの復調も可能になる。この復調データを取得できる状態で、データ内の時刻情報が取得できるまで待ち、データが取得できると測位計算を行い、位置データを出力している。従って、温度や経年変化による周波数ずれが起きない高精度の周波数を得ることができれば、図６に示したような周波数サーチを行う必要がなくなってくるが、同時に高精度の時刻情報を得ることができれば、時間情報の確認を行う必要がなくなってくるのである。

すなわち、図７に示したように、本実施の形態によれば、ＧＰＳ測位に必要な動作の一部が必要でなくなり、即座にＰＬＬを用いた位相合わせに入ることができ、また、即座に測位動作に移行することができる。その結果、その動作に必要であった時間が不要となり、測位時間が大幅に短縮できるわけである。

【００３０】

また、測位を開始する時点で航法メッセージを保持していない場合、もしくは時間経過のために航法メッセージが有効で無くなってしまった場合には、ＧＰＳの測位動作に航法メッセージを取得する時間がさらに必要になってしまう。本実施の形態のように、ＧＰＳが所定の周期で起動し航法メッセージを常に最新に更新することで、航法メッセージの取得

を行わずに測位が行えるため、測位時間を大幅に短くすることができる。
【００３１】
◎　実施の形態２
実施の形態１では、周波数測定ブロック３を設け、外部時計ブロック２の保持する、または得られる周波数、時刻情報の正確さによってＧＰＳ間欠受信間隔を変えるように構成した。実施の形態２では、外部時計ブロック２の代わりに、外部時計に電波時計を利用した電波時計ブロックを用いてＧＰＳ間欠受信間隔を変えるものである。
尚、実施の形態１と同様の構成については、同様の符号を用いて説明し、ここではその詳細な説明を省略する。
【００３２】
図８は、実施の形態２におけるＧＰＳ受信機の概略構成を示す説明図である。
実施の形態２では、前述したＧＰＳブロック１および周波数測定ブロック３に、電波時計ブロック４を備えたものである。この電波時計ブロック４は、郵政省通信総合研究所が運営している標準電波である４０ＫＨｚの搬送波を受信するＧＰＳアンテナ部５と、ＧＰＳアンテナ部５により受信された搬送波を増幅して検波する信号復調部６と、信号復調部６によって検波された波形から時刻情報を読み取るディジタル部７とを備えている。
【００３３】
本実施の形態における電波時計ブロック４は、常に電源が入っており、電波時計放送局からの信号を受信して高精度の時間情報と高精度な周波数基準を、常時保持し続けている。電波時計ブロック４は、４０ＫＨｚの搬送波であって信号復調部６によって増幅された検波前の周波数を周波数測定ブロック３に出力し、周波数測定ブロック３は、前述のカウンタ４１を用いてＧＰＳブロック１における周波数発振器１２の誤差を検出する。この周波数発振器１２の誤差を周波数情報として受信した電波時計ブロック４は、この周波数情報に基づいて待機時間を適宜、設定し、ＧＰＳブロック１の待機/起動を制御して間欠受信を行う。ＧＰＳブロック１は、この制御によって定期的に起動し、ＧＰＳ衛星の位置情報である測位計算に必要なエフェメリスデータを更新する。このエフェメリスデータの取得が終わるとスリープ(待機)に入る。この起動/待機を繰り返すことで、常に最新のエフェメリスデータを保持し続けることが可能となる。
測位を行うためには、ＧＰＳブロック１に電源が入った瞬間に、電波時計ブロック４から時刻情報と周波数情報(誤差)をもらう。これらの情報を用いてＧＰＳ受信機は、図７に示した高速測位を行うことができるようになる。
【００３４】
ここで、本実施の形態を採用した場合、常に高速測位を実現するために必要なスリープ受信(間欠受信)間隔、平均消費電力について考察する。
まず、ＧＰＳブロック１の消費電力をＷgps、待機時間をＴｋ、起動時間をＴomとすると、平均消費電力Ｗavgは、
Ｗavg ＝ (Ｗgps×Ｔom)/Ｔｋ
で計算できる。
本実施の形態では、スリープ受信はエフェメリスデータの取得にしか用いないため、エフェメリスデータの必要更新周期がそのままスリープ受信の間隔になると考えることができる。通常、エフェメリスデータの寿命は２時間程度とされているので、更新時間も最大で２時間(７２００秒)と考える。また、起動時間(エフェメリスデータ取得の時間)Ｔomを１分(６０秒)、ＧＰＳブロック１の消費電力をＷgpsを５８０ｍＷとすると、スリープ受信に必要な平均消費電力Ｗavgは、
Ｗavg ＝ (５８０ｍＷ×６０ｓ)/７２００ｓ ＝ ４.８(ｍＷ)
となる。電波時計ブロック４の消費電力を１５ｍＷとすると、トータルの消費電力は、
４.８＋１５ ＝ １９.８(ｍＷ)　となり、消費電力を大きく削減することが可能となる。
【００３５】
また、本実施の形態によれば、ＧＰＳ受信機の内部に高精度のリアルタイムクロック(ＲＴＣ)を持たなくても、ＧＰＳ受信機のスリープ受信間隔を最大限、長くすることができ

、このことからも平均消費電力を低く抑えることが可能となる。また、電波時計ブロック４からの高精度な周波数基準を利用することができることから、ＧＰＳ受信機内の周波数発振器が大きな誤差を持ったとしても、確実な高速測位を実現することができる。

【００３６】

【発明の効果】

以上、詳述したように、本発明によれば、ＧＰＳの測位時間を飛躍的に早くすることができ、また、ＧＰＳ衛星からの定期的な時間情報を待つ必要もなくなることから、測位までの時間が安定して早くなる。

また、外部時計の状況によって、最適なＧＰＳの間欠受信間隔を選択することができるので、消費電力の削減が可能となる。

【図面の簡単な説明】

【図１】　本実施の形態におけるＧＰＳ受信機の概略構成を示す説明図である。

【図２】　ＧＰＳブロック１、外部時計ブロック２および周波数測定ブロック３の構成を更に詳述したブロック図である。

【図３】　各ブロック動作と通信内容を説明するための図である。

【図４】　ＧＰＳブロック１における処理の流れを示すフローチャートである。

【図５】　外部時計ブロック２における第１の処理の流れを示すフローチャートである。

【図６】　外部時計ブロック２における第２の処理の流れを示すフローチャートである。

【図７】　本実施の形態における測位動作を示した説明図である。

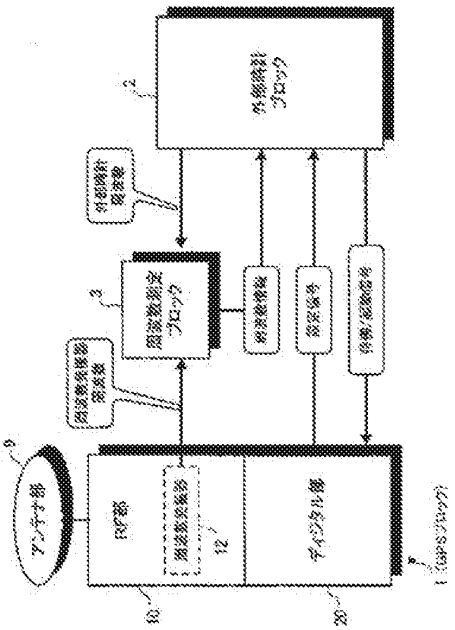
【図８】　実施の形態２におけるＧＰＳ受信機の概略構成を示す説明図である。

【図９】　(a)、(b)は、一般的に用いられるＧＰＳシステムの概略構成と、従来のＧＰＳ測位動作を示した説明図である。

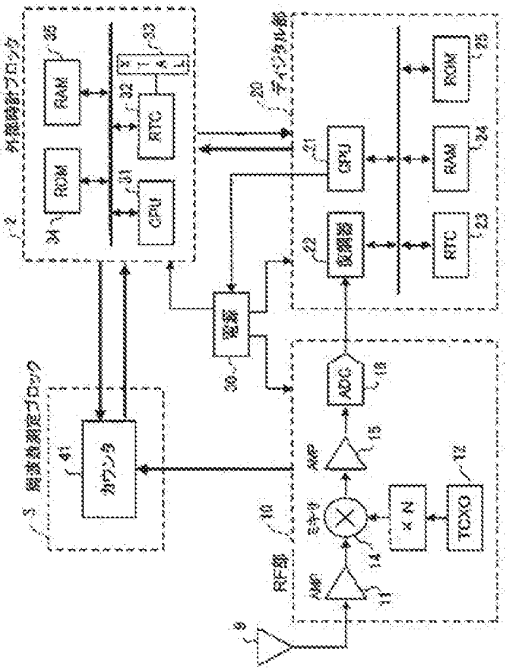
【符号の説明】

１…ＧＰＳブロック、２…外部時計ブロック、３…周波数測定ブロック、４…電波時計ブロック、５…ＧＰＳアンテナ部、６…信号復調部、７…ディジタル部、９…ＧＰＳアンテナ部、１０…ＲＦ部、１１…アンプ、１２…周波数発振器(ＴＣＸＯ)、１４…ミキサ、１５…アンプ、１６…ＡＤ変換器(ＡＤＣ)、２０…ディジタル(Digital)部、２１…ＣＰＵ、２２…復調器、２３…リアルタイムクロック(ＲＴＣ)、２４…ＲＡＭ、２５…ＲＯＭ、３０…電源、３１…ＣＰＵ、３２…リアルタイムクロック(ＲＴＣ)、３３…水晶発振子(ＸＴＡＬ)、３４…ＲＯＭ、３５…ＲＡＭ、４１…カウンタ

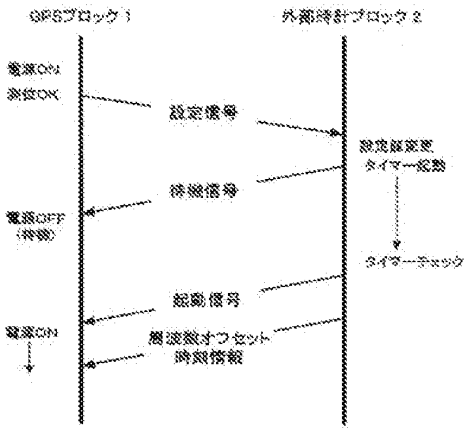
【図１】


外部機器ブロック
RF部
ディジタル部
アンテナ部

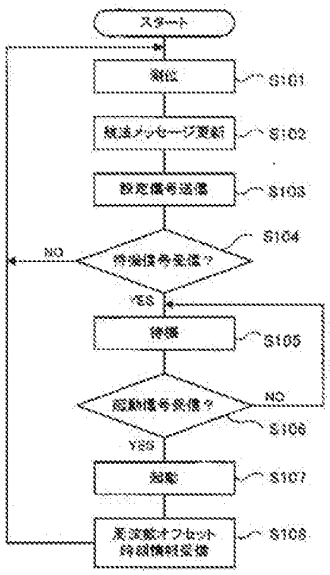
【図２】


RAM
ROM
CPU
RTC
GPU
ADC
AMP
PLL
TCXO
RF部

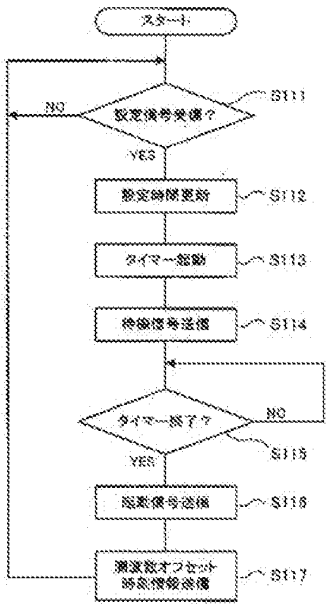
【図３】


GPSブロック１
外部機器ブロック２
設定信号
待機信号
起動信号
タイマーチェック

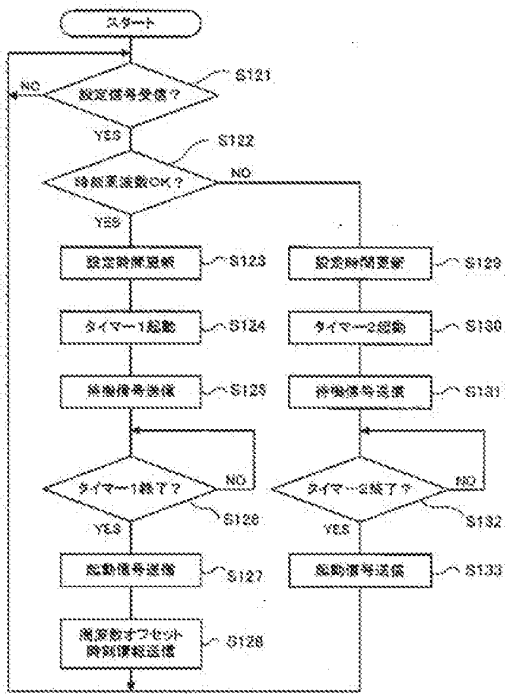
【図４】


スタート
S101
S102
S103
S104
NO
YES
S105
S106
S107
S108

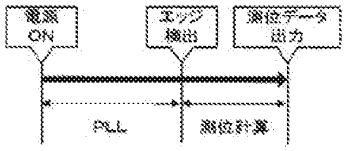
【図５】


スタート
S111
NO
YES
S112
S113
S114
NO
S115
YES
S116
S117

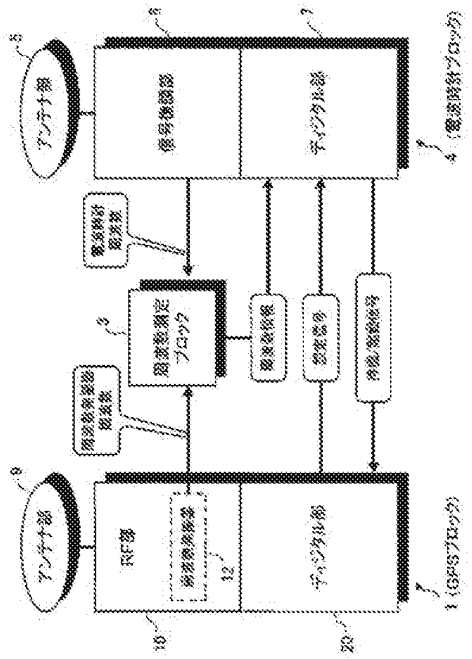
【図６】


スタート
S121
NO
YES
S122
NO
YES
S123
S124
S125
NO
S126
YES
S127
S128
S129
S130
S131
NO
S132
YES
S133

【図７】

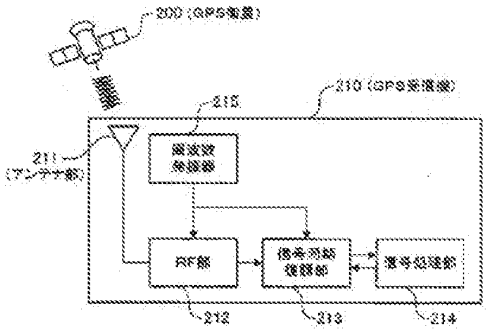

電源
ON
エッジ
検出
測位データ
出力
PLL
測位計算

【図８】

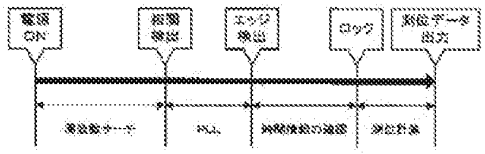

アンテナ部
信号処理部
チャンネル部
(電波時計ブロック)
電波時計
補正情報
測定開始
補正情報
測定結果
測定開始
補正情報
測定結果
アンテナ部
RF部
測定結果保存
チャンネル部
1(GPSブロック)

（１２）　　ＧＰＳ受信機、およびＧＰＳ測位方法

【図９】



(a) GPSシステムの概略構成図



(b) 従来のGPS測位動作

審査官　石井　哲

(56)参考文献　特開平１０－０８２８７５（ＪＰ，Ａ）
特開平１０－１７０６２６（ＪＰ，Ａ）
特開平０５－２９７１０５（ＪＰ，Ａ）
特開平０９－３１２５８４（ＪＰ，Ａ）
特開平０９－１８９７５４（ＪＰ，Ａ）
特開平０５－２５６９２５（ＪＰ，Ａ）
特開平０８－３２７７１８（ＪＰ，Ａ）
米国特許第０５６６３７３５（ＵＳ，Ａ）

(58)調査した分野(Int.Cl.，ＤＢ名)
Ｇ０１Ｓ　５/００－５/１４

Patents JP2004012250

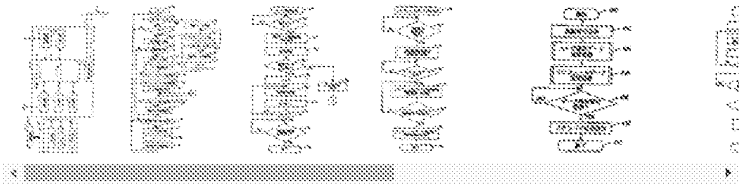
On-vehicle navigation system

Abstract

PROBLEM TO BE SOLVED: To provide an on-vehicle navigation system which restrains meaningless power consumption after processing in advance of data is made possible and start of quick route guidance is enabled after entrainment.
SOLUTION: When an ignition switch IG is at OFF position in the on-vehicle navigation system, power supply to communication equipment 16 is continued, the communication equipment 16 is maintained in an operating state, i.e. a state that a signal can be received (step 106). At this time, when an a starting signal is transmitted from an external terminal, the communication equipment 16 receives it, and a microcomputer starts devices 14, 15 (step 112), and receives and stores schedule data (steps 114, 115). When a waiting terminate signal for receiving is transmitted from the external terminal, the communication equipment 16 receives it. The microcomputer stops power supply to the communication equipment 16, interrupts operation of the equipment 16, and ends receiving waiting of a signal by the communication equipment 16 (step 120).

COPYRIGHT: (C)2004,JPO

Images (8)



Classifications

» *Y02D70/449* Radio transmission systems, i.e. using radiation field for communication between two or more posts at least one of which is mobile

JP2004012250A
Japan

Download PDF Find Prior Art Similar

Other languages: Japanese

Inventor: Satoshi Ogawa, Kunihiro Yamada, 小川 智, 山田 邦博

Worldwide applications

2002 JP

Application JP2002164885A events

2002-06-05 Application filed by Aisin Aw Co Ltd, アイシン・エィ・ダブリュ株式会社
2002-06-05 Priority to JP2002164885A
2004-01-15 Publication of JP2004012250A
2007-09-05 Application granted
2007-09-05 Publication of JP3972738B2
2019-08-27 Application status is Expired - Fee Related
2022-06-05 Anticipated expiration

Info: Cited by (5), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Claims (2)

Hide Dependent
translated from Japanese

1. In-vehicle navigation system that guides the path of the vehicle,
A communication device that receives a signal transmitted wirelessly connected from the external terminal to an external terminal when operated is powered by the onboard power source are in the same operating state,
When the communication device receives the signal from the external terminal and an external signal processing means for executing predetermined processing based on the signal,
The external signal processing means, said communication device to terminate the waiting for receiving a signal from the external terminal by the communication device to stop power supply to the communication device when receiving the reception waiting completion signal from the external terminal in-vehicle navigation system according to claim.

2. In-vehicle navigation system according to claim 1,
The external signal processing means, wherein the communication device and the verification data and the verification to the authentication data the verification data stored in advance the authentication data transmitted from the external terminal when receiving the reception waiting completion signal from the external terminal vehicle navigation system characterized in that only ends the reception waiting for a signal from the external terminal by the communication device to stop power supply to the communication device if a match.

Description

translated from Japanese

[0001]
BACKGROUND OF THE INVENTION
The present invention relates to a vehicle navigation system for guiding a route of the vehicle.
[0002]
BACKGROUND OF THE INVENTION
Conventionally, as this type of system, for example as shown in JP-A-6-243395, from the external terminal is wirelessly connected to the external terminal when operated is powered by the onboard power source are in the same operating conditions a communication device for receiving the transmitted signal, the communication device and an external signal processing means for executing predetermined processing based on the signal when it receives a signal from the external terminal, representing a ride schedule such as destination or route data was something you can start quickly route guidance after boarding of the driver to be able to receive and process from an

external terminal such as a pre-personal computer before boarding the driver's.

[0003]

[Problems that the invention is to Solve

But the above conventional systems, consumer because that had to be kept at all times is operated by feeding the communication device to be able to receive signals from the external terminal, the amount of power unnecessarily if for example not ride long period It had been decided to.

[0004]

SUMMARY OF THE INVENTION

An object of the present invention is to provide a vehicle navigation system to suppress the meaningless consumption of power on which enables the initiation of rapid route guidance after ride as possible pre-processing of data.

[0005]

Features of the embodiment of the present invention is a vehicle navigation system having the communication device and the external signal processing means, the external signal processing means, to the communication device when the communication device receives a reception standby completion signal from the external terminal stop feeding lies in the configured ends the reception waiting for a signal from the external terminal by the communication device.

[0006]

in-vehicle navigation system having the above characteristics, for example, when there is no plan to ride a long period, it is possible to stop power supply to the communication device by transmitting a waiting completion signal from the external terminal. Therefore, in order to enable the start of a rapid route guidance after ride as possible pre-processing of the data, it is possible to suppress the meaningless consumption of power.

[0007]

Features of the other embodiment of the present invention is a vehicle navigation system having the above characteristics, the external signal processing means, advance the authentication data transmitted from the external terminal when the communication device receives a reception standby completion signal from the external terminal it lies in that is configured to end the reception waiting for a signal from the external terminal only by the communication device to stop power supply to the communication device when the authentication against the stored collation data data matches the verified data . According to this, since the caller waiting completion signal is to allow the power supply stop control of the communication apparatus only by power supply stop means when was legitimate user, communication with an unauthorized operation or erroneous operation feeding to apparatus is prevented from being stopped, the safety of the vehicle navigation system can be improved.

[0008]

DETAILED DESCRIPTION OF THE INVENTION

It will be described below with reference to the accompanying drawings, an embodiment of the present invention. Vehicle navigation system 10 shown in FIG. 1 includes a microcomputer 11 connected to the input device 12, an output device 13, a current position detection device 14, storage device 15, a communication device 16, and a power conversion apparatus 17.

[0009]

The input device 12, the date and time, and is used when the destination, the route, data representing the ride schedule such requirements by operating the in-vehicle navigation system 10 directly inputs. The output device 13 is for outputting the guidance information such as the path of the vehicle by an image and audio.

[0010]

Current position detecting device 14, GPS signals, each receiver for receiving the VICS signal, comprising various azimuth sensor such as a gyro sensor or a geomagnetic sensor, a vehicle speed sensor, and the like steering sensor, signal and received by each receiver and it detects the current position of the vehicle based on the detected signals by the sensors. Storage device 15, CD-ROM, is constituted by a storage medium such as a hard disk, with stored map data, various types of road information such as road data, and stores the data representing the ride schedule.

[0011]

Communication device 16 is, for example, those composed by such as a wireless LAN card, is to transmit and receive various signals are wirelessly connected through the communication unit 21 such as a wireless LAN router to the personal computer 20 as an external terminal. Personal computer 20, the operation unit 22, the computer unit 23 and a display unit 24. Operation unit 22 is composed of a keyboard and a mouse, it is used for performing an input operation to the computer unit 23. Computer unit 23 executes a program corresponding to the flowchart shown in Figures 5-8 in accordance with the input from the operation unit 22, the display processing by the display unit 24, various signals to the vehicle navigation system 10 by the communication unit 21 to execute the transmission process. Instead of the personal computer 20, it may be adopted electronic notebook as the external terminal.

[0012]

Power converter 17 is powered and is connected via a direct and ignition switch IG to the on-vehicle power supply B, intended to respectively selectively provide power to the microcomputer 11 and the devices 12 to 16 from the vehicle power supply B is there. Ignition switch IG are those having OFF, ACC (accessory), ON, and the 4-step switching position of START.

[0013]

The microcomputer 11, data input via the communication device 16 from the data or the personal computer 20 input through the input device 11, the current position information detected by the current position detecting device 13, and stored in the storage device 14 run the program corresponding to the flowchart shown in basis view 2 on various road information are, by the output device 13 for guiding the path of the vehicle. The microcomputer 11 controls each operation of the device 13 to 16 to control the power supply to the devices 13-16.

[0014]

Next, the operation of the in-vehicle navigation system 10 constructed as described above according to the flowchart of FIG. First, the microcomputer 11, the power converter 17 is kept at a state of being supplied with minimum power required to run the following program (standby state). The microcomputer 11 starts the execution of the program at step 100 of FIG. 2 determines whether the ignition switch IG is in the ACC or ON position first in step 102. In this case, by, for example, the vehicle is parked in the garage, if the ignition switch IG is in the OFF position, advances the determination and the program of "NO" to after step 104.

[0015]

in step 104, the flag F is determined whether the value "0". Flag F is configured to permit the power supply to the communication device 16 at the value "0" is intended to prohibit the feeding at the value "1". First, the flag F is set to the value "0" by the initial setting (not shown), the microcomputer 11 starts to supply power to the communication device 16 advances the program to step 106 determines as "YES" in step 104 to. Accordingly, the communication device 16 becomes ready to receive a signal transmitted from the personal computer 20 starts to operate.

[0016]

In step 108, the communication device 16 determines whether it has received an activation signal. Activation signal, the destination from the personal computer 20, a signal transmitted prior to transmission of the data when the data such as the route is transmitted, is an indication of the start of each device 14, 15. in this case the communication device 16 has not received an activation signal, the microcomputer 11 advances to step 110 the program determines a "NO".

[0017]

in step 110, the communication device 16 determines whether it has received a reception wait end signal. Waiting completion signal is a signal sent from the personal computer 20 is for instructing to stop power supply to the ends i.e. the communication device 16 waits for reception of signals by the communication device 16. If the communication device 16 at this time has not received the reception standby completion signal, the microcomputer 11 returns to step 102 the program determines a "NO".

[0018]

Thereafter, the microcomputer 11 repeatedly executes the processing in steps 102-110. At this time, the power supply to the communication device 16 is continued, the communication device 16 is maintained in a state capable of receiving signals from the operating state or the personal computer 20. Then, the microcomputer 11, whether the communication device 16 receives the activation signal or the reception waiting completion signal, or wait for the ignition switch IG is operated.

[0019]

During the repeated execution, for example, a personal computer 20 which is located away from the vehicle, such as a room starts to execute the program at step 400 of FIG. 5 in accordance with a predetermined operation input transmits an activation signal at step 402 then, it receives the communication device 16, the microcomputer 11 proceeds with a determination of "YES" at step 108 the program to subsequent step 112. In step 112, starting each device 14 and 15 to start the power supply to the devices 14 and 15.

[0020]

Personal computer 20, after transmission of the start signal, performs user authentication data transmission process shown in detail in FIG. 6 at step 404. On the other hand, the microcomputer 11 responds to the user authentication data transmission process, executes a user authentication process shown in detail in FIG. 3 at step 113.

[0021]

In the personal computer 20, after the start of execution of the user authentication data transmission process in step 500, the variable data n is cleared to the value "0" at step 501. Next, at step 502, the user ID and password for identifying the user of the vehicle is transmitted to the vehicle navigation system 10 as the authentication data. After the transmission, the value "1" to the variable data n are summed in step 503, it is determined that based on the n ≦ 3 at step 504 is "NO". Here, the n> 3 was employed as the criterion, in consideration of the influence of disturbance such as the microcomputer 11 can reliably receive via the communication device 16 to transmit authentication data from the personal computer 20 in order to be.

[0022]

Thereafter, the personal computer 20, the authentication data is repeatedly transmitted circulation process of steps 502-504 is repeated. Thus, when a variable data n is added updated to the value "4" in step 503, the determination in step 504 becomes "YES". Thus, the transmission of the authentication data is completed.

[0023]

In-vehicle navigation system 10, the communication device 16 receives the authentication data transmitted from the personal computer 20 as described above, the microcomputer 11 starts executing the user authentication process in step 200 of FIG. 3, the step 210 it determines "YES" Te. This is repeated under the transmission of the authentication data from the personal computer 20, it means that the transmitting authentication data is received reliably in-vehicle navigation system 10.

[0024]

With the determination of "YES" in step 210, at step 211, authentication data reception confirmation signal indicating that it has confirmed the reception of the authentication data is output. When the authentication data reception confirmation signal is transmitted by the communication device 16 to the personal computer 20, the personal computer 20 determines a "YES" in step 510 of FIG. 6. Thus, the user of the vehicle, while staying away from the vehicle, under the control of the computer unit 23 based on an operation input of the operation unit 22, the display unit 24, ensuring of the authentication data in the vehicle navigation system 10 You can check the Do not received.

[0025]

When the process at step 211 as described above is completed, in step 212, the authentication data is matched with previously stored already matching data in the ROM of the microcomputer 11 (consisting of a user ID and password). The result of this verification, if the authentication data match with the verified data, the authentication data because it is not a legitimate, the determination is "NO" at step 220, at step 221, that the above authentication data is not legitimate irregular signal representative of is transmitted to the personal computer 20 by the communication device 16. After the transmission, the program proceeds to subsequent step 117 of FIG. 2 to be described later.

[0026]

On the other hand, if they match the authentication data and the verification data, since the authentication data is legitimate, it is judged as "YES" in step 220, at step 222, the variable data m has a value "0" to be clear. Next, in step 223, the normal signal representing that the authentication data is normalized is transmitted to the personal computer 20 by the communication device 16. After step 223, in step 224, it is added to the value "1" to the variable data m, is determined to be "NO" at step 225 based on the m ≦ 3. Here, was adopted m> 3 as a criterion in Step 225, in consideration of the influence of disturbance, reliably entered into the personal computer 20 through a transmission normal signal communication unit 21 of the in-vehicle navigation system 10 in order to thus be.

[0027]

Thereafter, the normalized signal is repeated circulation process of steps 223 to 225 is is repeatedly transmitted to the personal computer 20. Thus, when a variable data m is added updated to the value "4" at step 224, the determination in step 225 becomes "YES". Thus, the output from the microcomputer 11 of the normal signal is ended.

[0028]

As described above determines, when the normal signal transmitted from the communication device 16 is input to the personal computer 20 is received by the communication unit 21, the personal computer 20 is "YES" in step 520. This is based on the results of the verification means that the normal signal from the vehicle navigation system 10 is reliably received in the personal computer 20. After determination of "YES" at step 520, at step 521, it sends a normal reception confirmation signal indicating that it has confirmed the reception of the normal signal to the in-vehicle navigation system 10, the user authentication at step 532 it ends the data transmission process.

[0029]

Further, when the non-regular signal transmitted from the communication device 16 as described above is input to the personal computer 20 is received by the communication unit 21, after the determination of "NO" in step 520, "YES in step 530 is determined to be "standby signal in step 531 is transmitted to the in-vehicle navigation instantiation device 10. incidentally, when the normal reception confirmation signal, as described above is transmitted to the communication device 16, the microcomputer 11 ends the user authentication process at step 231 determines as "YES" in step 230.

[0030]

When the user authentication data transmission process and the user authentication process is completed as described above, in the personal computer 20, at step 406 of FIG. 5, schedule data transmission processing shown in detail in FIG. 7 is executed. On the other hand, the microcomputer 11 responds to the schedule data transmission processing, executes the schedule data reception processing shown in detail in FIG. 4 at step 114.

[0031]

In the personal computer 20, after the execution start of the schedule data transmission processing in the step 600, the variable data P are cleared to the value "0" at step 601. Then, based on the required input operation on the operation unit 22, in step 602, the transmission start request signal to scheduled data is transmitted to the vehicle navigation system 10. After the transmission, is added to the value "1" to the variable data P in step 603, it is determined that based on the P ≦ 3 at step 604 is "NO". Here, as was adopted P> 3 as a criterion, considering also the effect of disturbance or the like, the microcomputer 11 may reliably receive via the transmission start request signal to the communication device 16 from the personal computer 20 This is to.

[0032]

Thereafter, the personal computer 20, the circulation process of steps 602 to 604 is transmitted repeatedly repeated with the transmission start request signal. Thus, when a variable data P is added updated to the value "4" in step 603, the determination in step 604 becomes "YES". Thus, transmission of the transmission start request signal is completed.

[0033]

In-vehicle navigation system 10, the communication device 16 receives a transmission start request signal transmitted from the personal computer 20 as described above, the microcomputer 11 starts the execution of the schedule data reception process at step 300 in Figure 4, it determines "YES" at step 310. This is repeated under

the transmission of the transmission start request signal from the personal computer 20, it means that the transmission start request signal is received reliably in-vehicle navigation system 10.

[0034]

With the determination of "YES" in step 310, at step 311, the transmission start request reception confirmation signal indicating that it has confirmed the reception of the transmission start request signal is output. When the transmission start request acknowledgment signal is transmitted by the communication device 16 to the personal computer 20, the personal computer 20 determines a "YES" in step 610 of FIG. Thus, at step 611, schedule data is transmitted to the in-vehicle navigation instantiation device 10.

[0035]

Thus, storage when the communication device 16 receives the schedule data, the computer 107 determines a "YES" in step 320, the schedule data the received at step 321 is a work area inside the DRAM of the microcomputer 11 it is.

[0036]

In the personal computer 20, the transmission of schedule data in step 611 is completed, the determination becomes "YES" in step 620, schedule data transmission end signal indicating the end of transmission of schedule data in step 621 to the in-vehicle navigation system 10 it is sent for. Upon receiving this schedule data transmission end signal communication device 16, the microcomputer 11 makes a judgment of "YES" in step 330, schedule data indicating that it has confirmed the reception of the schedule data transmission end signal at step 331 at transmits a transmission end acknowledgment signal to the personal computer 20 step 332 ends the schedule data reception processing. When the transmission schedule data transmission end acknowledgment signal the personal computer 20 receives the personal computer 20 ends the schedule data transmission process at step 631 determines as "YES" in step 630.

[0037]

When schedule data transmission process and schedule data reception processing is finished as described above, the microcomputer 11 executes a schedule data storage processing in step 115. In this process, it stores the schedule data thus received in a predetermined area of the storage device 15, the first output unit 13 from among the road information required to guide a route to a destination represented by the same schedule data storing outputs in a predetermined area of the microcomputer 11 inside the DRAM. In this case, if schedule data thus received were those that do not contain route information, to a destination based on various road information stored in the current position information and the storage device 14 detected by the current position detecting device 14 route is calculated, the route of the calculated is also stored in a predetermined area of the DRAM. Thus, the vehicle-mounted navigation system 10 will be able to quickly start route guidance after boarding of the driver to be described later.

[0038]

After completion of the schedule data storage processing, the microcomputer 11 transmits a data storage signal indicating that storing the schedule data is completed at step 116 to the personal computer 20. When receiving the data storing signal, the personal computer 20, and determines as "YES" in step 408, sends a standby signal to the in-vehicle navigation system 10 at step 410. When receiving the standby signal, the microcomputer 11 determines that "YES" at step 117, to stop power supply to the devices 14 and 15 at step 118 to stop the operation of the devices 14 and 15 .

[0039]

On the other hand, during the repetitive execution of steps 102 to 110, the personal computer 20 transmits a reception waiting completion signal in step 702 to start the execution of the program at step 700 in FIG. 8 in accordance with a predetermined operation input, the communication device 16 receives this, the microcomputer 11 proceeds with a determination of "YES" at step 110 the program to step 119 and later. In step 119, in response to a user authentication data transmission process similar to step 704 and the step 404 in the personal computer 20 executes the same user authentication process as in step 113. If this time authentication data transmitted from the personal computer 20 is authenticated as legitimate, the microcomputer 11 is set to the value "1" to prohibit the feeding of the flag F to the communication device 16 at step 120 . In step 121, it stops the power supply to the communication device 16. Accordingly, the communication device 16 ends the reception waiting of the signal transmitted from the personal computer 20 stops the operation.

[0040]

After the above treatment, the microcomputer 11 returns the program to step 102, since the flag F is set to the value "1" in step 120, the microcomputer 11 during the execution of the next and subsequent steps 104 "NO" it is determined that will return back to step 102 to program without executing the processes in steps 106-121. Thereafter, the microcomputer 11 repeatedly performs the processes of steps 102 and 104, while maintaining the communication device 16 inoperative, wait for the ignition switch IG is operated.

[0041]

On the other hand, during the repetitive execution of steps 102 to 110, or repeating during execution of steps 102 and 104, riding the driver, when the ignition switch IG is switched to the operated by ACC or ON position, the microcomputer 11 step based determines a "YES" in 102 the program proceeds to step 122 and later. In step 122, starting each device 13 to 15 to start power supply to the devices 13-15.

[0042]

Thereafter, the microcomputer 11, the ignition switch IG is while being kept at ACC or ON position, repeatedly performs based on the processing of steps 124 and 126 determines a "YES" in step 126. In step 124, it executes the navigation processing. The navigation process is a process for performing route guidance to the driver based on the data transmitted from the data or the personal computer 20 input in advance from the input device 12. For example, when a destination of the data is input from the input device 13, a current position detecting device 14 detects the current position information and the input destination on the basis of various road information stored in the storage device 14 by calculating a route to be guided to successively output to the driver by the output device 13 with the road information representing the path to the progression of the vehicle. On the other hand, if the advance path is calculated or input by the processing of step 114 and 115, to guide to sequentially output to the driver by the output device 13 road information representative of the path that is provided with pre-calculated or input . it should be noted that this navigation process, without stopping the progression of the program, is executed at any time during the repetitive execution of step 124 and 126 and performs the above processing.

[0043]

Repeatedly executing the steps 124 and 126, the ignition switch IG is switched to the OFF position, the microcomputer 11 advances the program to the original determination of "NO" in step 126 to step 128 and later. In step 128, it stops the operation of each device 13 to 15 to stop power supply to the devices 13-15. Then, at step 126, upon setting the value "0" to permit feeding of the flag F to the communication device 16 and returns the program to step 106. Thus, hereinafter, the microcomputer 11, and executes again repeats the processing of steps 102-110. At this time, the power supply to the communication device 16 is resumed, the communication device 16 is maintained in a state capable of receiving signals from the operating state or the personal computer 20 again. Then, the microcomputer 11, whether the communication device 16 receives the activation signal or the reception waiting completion signal, or wait for the ignition switch IG is operated.

[0044]

State as described above, in the above embodiment, when the ignition switch IG is in the OFF position, the microcomputer 11 is capable of receiving the first, the operating state or signal communication device 16 continues the power supply to the communication device 16 keep to. At this time, perform the communication device 16 receives various signals transmitted from the personal computer 20, the microcomputer 11 is the processing in steps 112~~118,119~~121 in response to a signal the received (external signal processing means) to. When receiving the activation signal, it executes the schedule data reception process and schedule data storage processing to start each device 14, 15. On the other hand, when receiving the reception waiting completion signal ends the waiting for receiving a signal from the personal computer 20 by the communication apparatus 16 to stop power supply to the communication device 16. Thus, for example, in a case do not plan to ride a long period, by sending a reception waiting completion signal from the personal computer 20, it is possible to stop power supply to the communication device 16. Thus, upon which it enables the initiation of rapid route guidance after ride as possible pre-processing of data, so that it is possible to suppress a meaningless consumption of

power.

[0045]

Further, at the time of reception of the reception waiting completion signal of the communication device 16, when collating the authentication data and verification data obtained by preliminarily storing authentication data transmitted from the personal computer 20 is coincident with the verification data by the user authentication process in step 119 only because you have to permit stop control of power supply to the communication device 16, have been prevented from power supply to the communication device 16 by incorrect operation or improper operation is stopped, the vehicle navigation system bRIEF dESCRIPTION oF tHE dRAWINGS the safety of have been kept high

1 is an overall schematic diagram of a vehicle navigation system according to an embodiment of the present invention.

is a flowchart showing a program executed by the FIG. 2 microcomputer of FIG.

3 is a flowchart showing details of the user authentication process shown in FIG. 2.

4 is a flowchart showing details of schedule data reception process of FIG.

[5] the personal computer of FIG. 1 is a flowchart showing a program to be executed when transmitting scheduled data.

6 is a flowchart showing the details of the user authentication data transmission process in FIG.

7 is a flowchart showing details of schedule data transmission processing of FIG.

it is a flowchart showing a program to be executed when the 8 personal computer of FIG. 1 transmits reception waiting completion signal.

DESCRIPTION OF SYMBOLS

10 ... vehicle navigation system, 11 ... microcomputer, 16 ... communication device, 20 ... personal computer, IG ... ignition switch, B ... onboard power supply.

Cited By (5)

Publication number	Priority date	Publication date	Assignee	Title
JP2005257666A *	2004-02-10	2005-09-22	Mitsubishi Electric Corp	In-vehicle terminal, terminal with communication function, key, card for keyless entry, and vehicle information acquisition/transmission system using foregoing components
US7925426B2 *	2005-11-17	2011-04-12	Motility Systems	Power management systems and devices
US9682624B1	2005-11-17	2017-06-20	Invent Ly, Llc	Power management using route information for a hybrid electric vehicle
US9792736B1	2005-11-17	2017-10-17	Invently Automotive Inc.	Telemetry device for capturing vehicle environment and operational status history
KR101852363B1 *	2018-01-09	2018-04-27	이승호	Method for scheduling to efficient management of power in positioning device of vehicle

Family To Family Citations

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
US8306739B2	2012-11-06	System and method for tracking a vehicle based on driver status
US6226570B1	2001-05-01	Motor vehicle with an automatic vehicle driving and electronic communication devices
JP4628885B2	2011-02-09	System for programming a characteristic of customizable vehicle
US20060143463A1	2006-06-29	Keyless entry system and keyless entry method
JP4317861B2	2009-08-19	The travel mode setting device for a hybrid vehicle
US6591172B2	2003-07-08	Automatic vehicle guidance system, control apparatus in automatic vehicle guidance system, automatic vehicle guidance method, and computer-readable data recorded medium in which automatic vehicle guidance system program is recorded
JP4228930B2	2009-02-25	Security system for a vehicle
JP4384208B2	2009-12-16	Biometric authentication device
JPH10322766A	1998-12-04	Transmission regulation device, radio transmission/ reception temrinal equipment, and transmission regulation system using them
EP2665181B1	2015-04-22	Information providing method for mobile terminal and apparatus thereof
JP2000224663A	2000-08-11	Dial lock setting system in voice and its release system
JP2000113400A	2000-04-21	Automatic tracking travel system
JP4862515B2	2012-01-25	Information providing device and the information providing method
JP2008033688A	2008-01-10	In-vehicle communication system and in-vehicle radio communication equipment
JP3434934B2	2003-08-11	Wireless vehicle control system
JPH10122892A	1998-05-15	Device and method for allowing fellow passenger to make access to on-vehicle navigator

JP2003252130A	2003-09-10	Vehicle agent system and ecu
WO2015151862A1	2015-10-08	Automobile and automobile program
US20040006479A1	2004-01-08	Voice control system
US20170147959A1	2017-05-25	Controlling autonomous vehicles in connection with transport services
US20020059532A1	2002-05-16	Device and method for authentication
JP2001262891A	2001-09-26	Vehicle key system
JP4825698B2	2011-11-30	Communication program and a portable terminal device
JP2005299098A	2005-10-27	Locking/unlocking remote control device for vehicle
JP2009002111A	2009-01-08	Human body motion detection type electronic key system of human body mount type electronic key

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
JP2002164885A	2002-06-05	2002-06-05	In-vehicle navigation system

Applications Claiming Priority (1)

Application	Filing date	Title
JP2002164885A	2002-06-05	In-vehicle navigation system

Legal Events

Date	Code	Title	Description
2005-03-31	A621	Written request for application examination	**Free format text**: JAPANESE INTERMEDIATE CODE: A621 **Effective date**: 20050330
2006-09-28	A977	Report on retrieval	**Free format text**: JAPANESE INTERMEDIATE CODE: A971007 **Effective date**: 20060928
2006-10-11	A131	Notification of reasons for refusal	**Free format text**: JAPANESE INTERMEDIATE CODE: A131 **Effective date**: 20061010
2006-12-12	A521	Written amendment	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20061211
2007-01-25	A521	Written amendment	**Free format text**: JAPANESE INTERMEDIATE CODE: A523 **Effective date**: 20070124
2007-05-16	TRDD	Decision of grant or rejection written	
2007-05-23	A01	Written decision to grant a patent or to grant a registration (utility model)	**Free format text**: JAPANESE INTERMEDIATE CODE: A01 **Effective date**: 20070522
2007-06-21	A61	First payment of annual fees (during grant procedure)	**Free format text**: JAPANESE INTERMEDIATE CODE: A61 **Effective date**: 20070604
2007-06-22	R150	Certificate of patent or registration of utility model	**Free format text**: JAPANESE INTERMEDIATE CODE: R150
2007-06-25	FPAY	Renewal fee payment (event date is renewal date of database)	**Free format text**: PAYMENT UNTIL: 20100622 **Year of fee payment**: 3
2010-03-23	FPAY	Renewal fee payment (event date is renewal date of database)	**Free format text**: PAYMENT UNTIL: 20110622

			Year of fee payment: 4
2011-02-17	FPAY	Renewal fee payment (event date is renewal date of database)	Free format text: PAYMENT UNTIL: 20110622 Year of fee payment: 4
2011-02-22	FPAY	Renewal fee payment (event date is renewal date of database)	Free format text: PAYMENT UNTIL: 20120622 Year of fee payment: 5
2012-03-01	FPAY	Renewal fee payment (event date is renewal date of database)	Free format text: PAYMENT UNTIL: 20120622 Year of fee payment: 5
2012-03-06	FPAY	Renewal fee payment (event date is renewal date of database)	Free format text: PAYMENT UNTIL: 20130622 Year of fee payment: 6
2013-02-26	FPAY	Renewal fee payment (event date is renewal date of database)	Free format text: PAYMENT UNTIL: 20140622 Year of fee payment: 7
2015-06-22	LAPS	Cancellation because of no payment of annual fees	

Concepts

machine-extracted

Download Filter table

Name	Image	Sections	Count	Query match
communication		Abstract	6	0

Data provided by IFI CLAIMS Patent Services

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2004-12250
(P2004-12250A)
(43)公開日　平成16年1月15日(2004.1.15)

(51)Int.Cl.[7]	F I		テーマコード（参考）
G01C 21/00	G01C 21/00	G	2C032
G08G 1/137	G08G 1/137		2F029
G09B 29/00	G09B 29/00	A	5H180
G09B 29/10	G09B 29/10	A	5K067
H04B 7/26	H04B 7/26	M	

審査請求 未請求　請求項の数 2　OL　（全 12 頁）

(21)出願番号　特願2002-164885(P2002-164885)
(22)出願日　平成14年6月5日(2002.6.5)

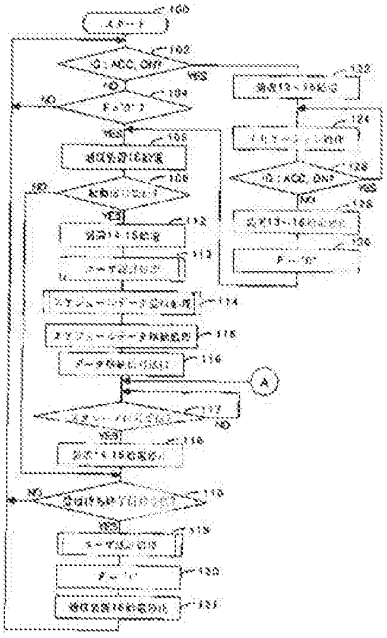
(71)出願人　000100768
アイシン・エィ・ダブリュ株式会社
愛知県安城市藤井町高根１０番地
(74)代理人　100064724
弁理士　長谷　照一
(72)発明者　山田　邦博
愛知県岡崎市岡町原山６番地１８　アイシン・エィ・ダブリュ株式会社内
(72)発明者　小川　智
愛知県岡崎市岡町原山６番地１８　アイシン・エィ・ダブリュ株式会社内

Ｆターム(参考)　2C032 HB03 HB22 HB23 HB25 HC08 HD21
2F029 AA02 AB01 AB07 AB13 AC02 AC04 AC14

最終頁に続く

(54)【発明の名称】車載ナビゲーションシステム

(57)【要約】
【課題】車載ナビゲーションシステムにおいて、データの事前処理を可能として乗車後の速やかな経路案内の開始を可能とした上で電力の無意味な消費を抑える。
【解決手段】この車載ナビゲーションシステムにおいては、イグニッションスイッチＩＧがＯＦＦ位置にあるとき、最初、通信装置１６への給電は継続されて、通信装置１６は作動状態すなわち信号を受信できる状態に保たれる（ステップ１０６）。このとき、外部端末から起動信号が送信されると、通信装置１６がこれを受信し、マイクロコンピュータは各装置１４，１５を起動して（ステップ１１２）スケジュールデータを受信及び格納する（ステップ１１４，１１５）。一方、このとき外部端末から受信待ち終了信号が送信されると、通信装置１６がこれを受信し、マイクロコンピュータは通信装置１６への給電を停止して通信装置１８の作動を停止し通信装置１６による信号の受信待ちを終了する（ステップ１２０）。
【選択図】　図２



【特許請求の範囲】
【請求項１】
車両の経路を案内する車載ナビゲーションシステムにおいて、
車載電源により給電されて作動し同作動状態にあるとき外部端末に無線接続されて同外部端末から送信された信号を受信する通信装置と、
前記通信装置が前記外部端末からの信号を受信したとき同信号に基づき所定処理を実行する外部信号処理手段とを備え、
前記外部信号処理手段は、前記通信装置が前記外部端末から受信待ち終了信号を受信したとき前記通信装置への給電を停止して同通信装置による前記外部端末からの信号の受信待ちを終了することを特徴とする車載ナビゲーションシステム。
【請求項２】
前記請求項１に記載の車載ナビゲーションシステムにおいて、
前記外部信号処理手段は、前記通信装置が前記外部端末から受信待ち終了信号を受信したとき前記外部端末から送信された認証データを予め記憶した照合データと照合して前記認証データが前記照合データと一致した場合にのみ前記通信装置への給電を停止して同通信装置による前記外部端末からの信号の受信待ちを終了することを特徴とする車載ナビゲーションシステム。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】
本発明は、車両の経路を案内するための車載ナビゲーションシステムに関する。
【０００２】
【従来の技術】
従来、この種のシステムとしては、例えば特開平６－２４３３９５号公報に示されているように、車載電源により給電されて作動し同作動状態にあるとき外部端末に無線接続されて同外部端末から送信された信号を受信する通信装置と、通信装置が外部端末からの信号を受信したとき同信号に基づき所定処理を実行する外部信号処理手段とを備え、目的地又は経路などの乗車スケジュールを表すデータを運転者の乗車前に予めパーソナルコンピュータなどの外部端末から受信して処理できるようにして運転者の乗車後に速やかに経路案内を開始できるようにしたものがあった。
【０００３】
【発明が解決しようとする課題】
しかし上記従来システムにおいては、外部端末からの信号を受信できるように通信装置を常に給電して作動させておかなければならなかったため、例えば長期間乗車しない場合には無意味に多量の電力を消費することとなっていた。
【０００４】
【発明の概要】
本発明の目的は、データの事前処理を可能として乗車後の速やかな経路案内の開始を可能とした上で電力の無意味な消費を抑える車載ナビゲーションシステムを提供することにある。
【０００５】
本発明の構成上の特徴は、前記通信装置及び外部信号処理手段を備えた車載ナビゲーションシステムにおいて、外部信号処理手段を、通信装置が前記外部端末から受信待ち終了信号を受信したとき通信装置への給電を停止して同通信装置による外部端末からの信号の受信待ちを終了するように構成したことにある。
【０００６】
上記特徴を有する車載ナビゲーションシステムにおいては、例えば長期間乗車する予定のない場合などに、外部端末から受信待ち終了信号を送信することにより通信装置への給電を停止することができる。したがって、データの事前処理を可能として乗車後の速やかな経路案内の開始を可能とした上で、電力の無意味な消費を抑えることができる。

【０００７】
本発明の他の構成上の特徴は、上記特徴を有する車載ナビゲーションシステムにおいて、外部信号処理手段を、通信装置が外部端末から受信待ち終了信号を受信したとき外部端末から送信された認証データを予め記憶した照合データと照合して認証データが照合データと一致した場合にのみ通信装置への給電を停止して同通信装置による外部端末からの信号の受信待ちを終了するように構成したことにある。これによれば、受信待ち終了信号の発信者が正規のユーザであった場合にのみ給電停止手段による通信装置への給電停止制御を許容することになるため、不正な操作又は誤った操作により通信装置への給電が停止されることが防止され、当該車載ナビゲーションシステムの安全性が向上する。
【０００８】
【発明の実施の形態】
以下、本発明の一実施形態について図面を参照して説明する。図１に示した車載ナビゲーションシステム１０は、マイクロコンピュータ１１に接続された入力装置１２、出力装置１３、現在位置検出装置１４、記憶装置１５、通信装置１６、及び電源変換装置１７を備えている。
【０００９】
入力装置１２は、日時、目的地、経路、要件などの乗車スケジュールを表すデータを当該車載ナビゲーションシステム１０を直接操作して入力するとき用いられるものである。出力装置１３は、車両の経路などの案内情報を画像及び音声により出力するものである。
【００１０】
現在位置検出装置１４は、ＧＰＳ信号、ＶＩＣＳ信号を受信するための各受信器、ジャイロセンサ若しくは地磁気センサなどの各種方位センサ、車速センサ、並びにステアリングセンサなどを備え、各受信器により受信した信号及び各センサにより検出した信号に基づき車両の現在位置を検出するものである。記憶装置１５は、ＣＤ－ＲＯＭ、ハードディスクなどの記憶媒体により構成され、地図データ、道路データなどの各種道路情報を記憶しているとともに、上記乗車スケジュールを表すデータを記憶するものである。
【００１１】
通信装置１６は、例えば無線ＬＡＮカードなどにより構成されるものであり、外部端末としてのパーソナルコンピュータ２０に無線ＬＡＮルータなどの通信部２１を介して無線接続されて各種信号を送受信するものである。パーソナルコンピュータ２０は、操作部２２、コンピュータ部２３、表示部２４により構成されている。操作部２２は、キーボードやマウスにより構成され、コンピュータ部２３に対し入力操作を行うためのものである。コンピュータ部２３は、操作部２２からの入力に応じて図５～８に示したフローチャートに対応するプログラムを実行し、表示部２４による表示処理、通信部２１による車載ナビゲーションシステム１０への各種信号の送信処理を実行する。なお、このパーソナルコンピュータ２０に代えて、外部端末として電子手帳を採用するようにしてもよい。
【００１２】
電源変換装置１７は、車載電源Ｂに直接及びイグニッションスイッチＩＧを介して接続されて給電され、その車載電源Ｂからの電力をマイクロコンピュータ１１及び各装置１２～１６にそれぞれ選択的に供給するものである。イグニッションスイッチＩＧは、ＯＦＦ、ＡＣＣ（アクセサリ）、ＯＮ、及びＳＴＡＲＴの４段切換位置を有するものである。
【００１３】
マイクロコンピュータ１１は、入力装置１１により入力されたデータ又はパーソナルコンピュータ２０から通信装置１６を介して入力されたデータ、現在位置検出装置１３により検出された現在位置情報、並びに記憶装置１４に記憶されている各種道路情報に基づき図７に示したフローチャートに対応したプログラムを実行し、出力装置１３により車両の経路を案内する。また、マイクロコンピュータ１１は、各装置１３～１６への給電を制御し各装置１３～１６の作動をそれぞれ制御する。
【００１４】
次に、上記のように構成した車載ナビゲーションシステム１０の動作を図２のフローチャ

ートに沿って説明する。最初、マイクロコンピュータ１１は、電源実検装置１７により、下記プログラムの実行に必要な最小限の電力を供給された状態（スタンバイ状態）に保たれている。マイクロコンピュータ１１は、図２のステップ１００にてプログラムの実行を開始し、まずステップ１０２にてイグニッションスイッチＩＧがＡＣＣ又はＯＮ位置にあるか否かを判定する。このとき、車両がガレージ内に駐車されているなどして、イグニッションスイッチＩＧがＯＦＦ位置にあれば、「ＮＯ」と判定してプログラムをステップ１０４以降へ進める。

【００１５】

ステップ１０４においては、フラグＦが値"０"であるか否かを判定する。フラグＦは、値"０"にて通信装置１５への給電を許容するとともに、値"１"にて同給電を禁止するものである。最初、フラグＦは図示しない初期設定により値"０"に設定されており、マイクロコンピュータ１１は、ステップ１０４にて「ＹＥＳ」と判定してプログラムをステップ１０６へ進め通信装置１６への給電を開始する。これにより、通信装置１６は作動を開始してパーソナルコンピュータ２０から送信される信号を受信できる状態となる。

【００１６】

ステップ１０８においては、通信装置１６が起動信号を受信したか否かを判定する。起動信号は、パーソナルコンピュータ２０から目的地、経路などのデータが送信されるとき同データの送信に先立って送信される信号であり、各装置１４，１５の起動を指示するものである。このとき通信装置１６が起動信号を受信していなければ、マイクロコンピュータ１１は「ＮＯ」と判定してプログラムをステップ１１０へ進める。

【００１７】

ステップ１１０においては、通信装置１６が受信待ち終了信号を受信したか否かを判定する。受信待ち終了信号は、パーソナルコンピュータ２０から送信される信号であり、通信装置１６による信号の受信待ちの終了すなわち通信装置１６への給電の停止を指示するものである。このとき通信装置１６が受信待ち終了信号を受信していなければ、マイクロコンピュータ１１は「ＮＯ」と判定してプログラムをステップ１０２へ戻す。

【００１８】

以後、マイクロコンピュータ１１は、上記ステップ１０２～１１０の処理を繰り返し実行する。このとき、通信装置１６への給電は継続されて、通信装置１６は作動状態すなわちパーソナルコンピュータ２０からの信号を受信できる状態に保たれる。そして、マイクロコンピュータ１１は，通信装置１６が起動信号もしくは受信待ち終了信号を受信するか、又はイグニッションスイッチＩＧが操作されるのを待つ。

【００１９】

上記繰り返し実行中，例えば部屋などの車両から離れた場所に設置されたパーソナルコンピュータ２０が所定の操作入力に応じて図５のステップ４００にてプログラムの実行を開始しステップ４０２にて起動信号を送信すると、通信装置１６がこれを受信し、マイクロコンピュータ１１はステップ１０８にて「ＹＥＳ」と判定してプログラムをステップ１１２以降へ進める。ステップ１１２においては、各装置１４，１５への給電を開始して各装置１４，１５を起動する。

【００２０】

パーソナルコンピュータ２０は、上記起動信号の送信後、ステップ４０４にて図６に詳細に示すユーザ認証データ送信処理を実行する。一方、マイクロコンピュータ１１は、上記ユーザ認証データ送信処理に応答して、ステップ１１３にて図３に詳細に示すユーザ認証処理を実行する。

【００２１】

パーソナルコンピュータ２０においては、ステップ５００におけるユーザ認証データ送信処理の実行開始後，ステップ５０１にて変数データｎが値"０"にクリアされる。ついで，ステップ５０２にて、当該車両のユーザを特定するユーザＩＤ及びパスワードが認証データとして車載ナビゲーションシステム１０に対し送信される。同送信後、ステップ５０３にて変数データｎに値"１"が加算され、ステップ５０４にて図３に基づき「ＮＯ」

と判定される。ここで、n＞3を判定基準として採用したのは、外乱等の影響をも考慮して、マイクロコンピュータ11がパーソナルコンピュータ20からの送信認証データを通信装置16を介し確実に受信し得るようにするためである。

【0022】

以後、パーソナルコンピュータ20においては、ステップ502～504の循環処理が繰り返されて上記認証データが繰り返し送信される。しかして、ステップ508において変数データnが値"4"に加算更新されたとき、ステップ504での判定が「YES」となる。これにより、上記認証データの送信が終了する。

【0023】

車載ナビゲーションシステム10において、通信装置18が上述のようにパーソナルコンピュータ20から送信された認証データを受信すると、図3のステップ200にてユーザ認証処理の実行を開始したマイクロコンピュータ11は、ステップ210にて「YES」と判定する。このことは、パーソナルコンピュータ20からの認証データの送信の繰り返しのもと、同送信認証データが車載ナビゲーションシステム10において確実に受信されたことを意味する。

【0024】

ステップ210における「YES」との判定に伴い、ステップ211にて、上記認証データの受信を確認したことを表す認証データ受信確認信号が出力される。この認証データ受信確認信号が通信装置15によりパーソナルコンピュータ20に送信されると、パーソナルコンピュータ20は、図6のステップ510において「YES」と判定する。これにより、当該車両のユーザは、車両から離れた場所にいながらにして、操作部22の操作入力に基づくコンピュータ部23による制御のもと、表示部24により、車載ナビゲーションシステム10での上記認証データの確実な受信を確認できる。

【0025】

上述のようにステップ211での処理が終了すると、ステップ212において、上記認証データが、マイクロコンピュータ11のROMに予め格納済みの照合データ（ユーザID及びパスワードからなる）と照合される。この照合の結果、上記認証データが上記照合データと一致しなければ、上記認証データは正規でないことから、ステップ220での判定が「NO」となり、ステップ221にて、上記認証データが正規でないことを表す非正規信号が通信装置16によりパーソナルコンピュータ20に対して送信される。同送信後、プログラムは後述する図2のステップ117以降へ進められる。

【0026】

一方、上記認証データが上記照合データと一致すれば、当該認証データは正規のものであることから、ステップ220にて「YES」と判定され、ステップ222にて、変数データmが値"0"とクリアされる。ついで、ステップ223において、上記認証データが正規であることを表す正規信号が通信装置18によりパーソナルコンピュータ20に対して送信される。ステップ228の処理後、ステップ224において、変数データmに値"1"が加算され、m≦3に基づきステップ225にて「NO」と判定される。ここで、ステップ225にてm＞3を判定基準として採用したのは、外乱などの影響をも考慮して、車載ナビゲーションシステム10の送信正規信号が通信部21を介しパーソナルコンピュータ20に確実に入力され得るようにするためである。

【0027】

以後、ステップ223～225の循環処理が繰り返されて上記正規信号がパーソナルコンピュータ20に対して繰り返し送信される。しかして、ステップ224にて変数データmが値"4"に加算更新されたとき、ステップ225での判定が「YES」となる。これにより、上記正規信号のマイクロコンピュータ11からの出力が終了する。

【0028】

上述のように、通信装置16から送信される正規信号が通信部21により受信されてパーソナルコンピュータ20に入力されると、パーソナルコンピュータ20はステップ520にて「YES」と判定する。このことは、上記照合の結果に基づき、車載ナビゲーション

システム１０からの正規信号がパーソナルコンピュータ２０において確実に受信されたことを意味する。ステップ５２０での「ＹＥＳ」との判定後、ステップ５２１にて、当該正規信号の受信を確認したことを表す正規受信確認信号を車載ナビゲーションシステム１０に対して送信し、ステップ５２２にてこのユーザ認証データ送信処理を終了する。

【００２９】

また、上述のように通信装置１６から送信される非正規信号が通信部２１により受信されてパーソナルコンピュータ２０に入力されると、ステップ５２０における「ＮＯ」との判定後、ステップ５３０にて「ＹＥＳ」と判定され、ステップ５３１にてスタンバイ信号が車載ナビエーション装置１０に対して送信される。なお、上述のように正規受信確認信号が通信装置１６に送信されると、マイクロコンピュータ１１はステップ２３０にて「ＹＥＳ」と判定してステップ２３１にてこのユーザ認証処理を終了する。

【００３０】

以上のようにユーザ認証データ送信処理及びユーザ認証処理が終了すると、パーソナルコンピュータ２０においては、図５のステップ４０６にて、図７に詳細に示すスケジュールデータ送信処理が実行される。一方、マイクロコンピュータ１１は、上記スケジュールデータ送信処理に応答して、ステップ１１４にて図４に詳細に示すスケジュールデータ受信処理を実行する。

【００３１】

パーソナルコンピュータ２０においては、ステップ６００におけるスケジュールデータ送信処理の実行開始後、ステップ６０１にて変数データＰが値“０”にクリアされる。ついで、操作部２２における所要の入力操作のもと、ステップ６０２において、スケジュールデータの送信開始要求信号が車載ナビゲーションシステム１０に対し送信される。同送信後、ステップ６０３にて変数データＰに値“１”が加算され、ステップ６０４にてＰ≦３に基づき「ＮＯ」と判定される。ここで、Ｐ＞３を判定基準として採用したのは、外乱等の影響をも考慮して、マイクロコンピュータ１１がパーソナルコンピュータ２０からの送信開始要求信号を通信装置１６を介し確実に受信し得るようにするためである。

【００３２】

以後、パーソナルコンピュータ２０においては、ステップ６０２～６０４の循環処理が繰り返されて上記送信開始要求信号が繰り返し送信される。しかして、ステップ６０３において変数データＰが値“４”に加算更新されたとき、ステップ６０４での判定が「ＹＥＳ」となる、これにより、上記送信開始要求信号の送信が終了する。

【００３３】

車載ナビゲーションシステム１０において、通信装置１６が上述のようにパーソナルコンピュータ２０から送信される送信開始要求信号を受信すると、図４のステップ３００にてスケジュールデータ受信処理の実行を開始したマイクロコンピュータ１１は、ステップ３１０にて「ＹＥＳ」と判定する。このことは、パーソナルコンピュータ２０からの送信開始要求信号の送信の繰り返しのもと、同送信開始要求信号が車載ナビゲーションシステム１０において確実に受信されたことを意味する。

【００３４】

ステップ３１０における「ＹＥＳ」との判定に伴い、ステップ３１１にて、上記送信開始要求信号の受信を確認したことを表す送信開始要求受信確認信号が出力される。この送信開始要求受信確認信号が通信装置１６によりパーソナルコンピュータ２０に送信されると、パーソナルコンピュータ２０は、図７のステップ６１０において「ＹＥＳ」と判定する。これにより、ステップ６１１にて、スケジュールデータが車載ナビエーション装置１０に対して送信される。

【００３５】

しかして、通信装置１６が上記スケジュールデータを受信すると、ステップ３２０における「ＹＥＳ」との判定のもとに、ステップ３２１にて同受信したスケジュールデータがマイクロコンピュータ１１の内部のＤＲＡＭの作業領域に格納される。

【００３６】

パーソナルコンピュータ２０において、ステップ６１１におけるスケジュールデータの送信が完了すると、ステップ６２０での判定が「ＹＥＳ」となり、ステップ６２１にてスケジュールデータの送信の終了を表すスケジュールデータ送信終了信号が車載ナビゲーションシステム１０に対して送信される。このスケジュールデータ送信終了信号を通信装置１６が受信すると、マイクロコンピュータ１１は、ステップ３３０にて「ＹＥＳ」と判定し、ステップ３３１にて上記スケジュールデータ送信終了信号の受信を確認したことを表すスケジュールデータ送信終了受信確認信号をパーソナルコンピュータ２０に対し送信しステップ３３２にてこのスケジュールデータ受信処理を終了する。上記送信されたスケジュールデータ送信終了受信確認信号をパーソナルコンピュータ２０が受信すると、パーソナルコンピュータ２０はステップ６３０にて「ＹＥＳ」と判定してステップ６３１にてこのスケジュールデータ送信処理を終了する。

【００８７】

以上のようにスケジュールデータ送信処理及びスケジュールデータ受信処理が終了すると、マイクロコンピュータ１１は、ステップ１１５にてスケジュールデータ格納処理を実行する。同処理においては、上記受信したスケジュールデータを記憶装置１５の所定領域に格納するとともに、同スケジュールデータの表す目的地までの経路を案内するために必要な経路情報のうちから最初に出力装置１３により出力するものをマイクロコンピュータ１１内部のＤＲＡＭの所定領域に格納する。このとき、上記受信したスケジュールデータが経路情報を含んでいないものであったならば、現在位置検出装置１４により検出した現在位置情報及び記憶装置１４に記憶されている各種道路情報に基づき目的地までの経路が算出されて、同算出した経路も上記ＤＲＡＭの所定領域に格納される。これにより、車載ナビゲーションシステム１０は、後述する運転者の乗車後に速やかに経路案内を開始できるようになる。

【００８８】

上記スケジュールデータ格納処理の終了後、マイクロコンピュータ１１は、ステップ１１６にてスケジュールデータの格納が完了したことを表すデータ格納信号をパーソナルコンピュータ２０に対して送信する。このデータ格納信号を受信すると、パーソナルコンピュータ２０は、ステップ４０８にて「ＹＥＳ」と判定して、ステップ４１０にてスタンバイ信号を車載ナビゲーションシステム１０に対して送信する。このスタンバイ信号を受信すると、マイクロコンピュータ１１は、ステップ１１７にて「ＹＥＳ」と判定して、ステップ１１８にて各装置１４、１５への給電を停止して各装置１４、１５の作動を停止する。

【００８９】

一方、上記ステップ１０２～１１０の繰り返し実行中、パーソナルコンピュータ２０が所定の操作入力に応じて図８のステップ７００にてプログラムの実行を開始しステップ７０２にて受信待ち終了信号を送信すると、通信装置１６がこれを受信し、マイクロコンピュータ１１はステップ１１０にて「ＹＥＳ」と判定してプログラムをステップ１１９以降へ進める。ステップ１１９においては、パーソナルコンピュータ２０における前記ステップ４０４と同様のステップ７０４のユーザ認証データ送信処理に応答して、前記ステップ１１３と同様のユーザ認証処理を実行する。このときパーソナルコンピュータ２０から送信された認証データが正規のものであると認証されれば、マイクロコンピュータ１１はステップ１２０にてフラグＦを通信装置１６への給電を禁止する値“１”に設定する。ステップ１２１においては、通信装置１６への給電を停止する。これにより、通信装置１６は作動を停止してパーソナルコンピュータ２０から送信される信号の受信待ちを終了する。

【００９０】

上記各処理後、マイクロコンピュータ１１はプログラムをステップ１０２へ戻すが、上記ステップ１２０にてフラグＦが値“１”に設定されたため、次回以降のステップ１０４の実行の際マイクロコンピュータ１１は「ＮＯ」と判定して上記ステップ１０６～１２１の処理を実行することなくプログラムを再びステップ１０２へ戻すようになる。以後、マイクロコンピュータ１１は、ステップ１０２、１０４の処理を繰り返し実行して、通信装置１６を非作動状態に保ったまま、イグニッションスイッチＩＧが操作されるのを待つ。

【００４１】
一方、上記ステップ１０２～１１０の繰り返し実行中、又はステップ１０２，１０４の繰り返し実行中，運転者が乗車して、イグニッションスイッチ１Ｇが操作されてＡＣＣ又はＯＮ位置に切り換えられると、マイクロコンピュータ１１はステップ１０２における「ＹＥＳ」との判定のもとにプログラムをステップ１２２以降へ進める。ステップ１２２においては、各装置１３～１５への給電を開始して各装置１３～１５を起動する。
【００４２】
以後、マイクロコンピュータ１１は、イグニッションスイッチ１ＧがＡＣＣ又はＯＮ位置に保たれている間，ステップ１２５における「ＹＥＳ」との判定のもとにステップ１２４，１２６の処理を繰り返し実行する。ステップ１２４においては、ナビゲーション処理を実行する。ナビゲーション処理は、入力装置１２から入力された又は上記パーソナルコンピュータ２０から事前に送信されたデータに基づき運転者に対して経路案内を行う処理である。例えば，入力装置１３から目的地のデータが入力された場合には、現在位置検出装置１４により検出した現在位置情報及び記憶装置１４に記憶されている各種道路情報に基づいて同入力された目的地までの経路を算出し、同経路を表す道路情報を車両の進行に伴い出力装置１３により順次出力して運転者に対し案内する。一方，上記ステップ１１４，１１５の処理により予め経路が算出又は入力されている場合は、同予め算出又は入力されている経路を表す道路情報を出力装置１３により順次出力して運転者に対し案内する。なお、このナビゲーション処理は，プログラムの進行を止めることなく、上記ステップ１２４，１２６の繰り返し実行中に随時実行されて上記各処理を行うものである。
【００４３】
上記ステップ１２４，１２６の繰り返し実行中，イグニッションスイッチ１ＧがＯＦＦ位置に切り換えられると、マイクロコンピュータ１１はステップ１２６における「ＮＯ」との判定のもとにプログラムをステップ１２８以降へ進める。ステップ１２８においては、各装置１３～１５への給電を停止して各装置１３～１５の作動を停止する。そして、ステップ１２６にて、フラグＦを通信装置１６への給電を許容する値「０」に設定した上で、プログラムをステップ１０６へ戻す。これにより、以後，マイクロコンピュータ１１は、再び上記ステップ１０２～１１０の処理を繰り返し実行することとなる。このとき，通信装置１６への給電は再開されて，通信装置１６は再び作動状態すなわちパーソナルコンピュータ２０からの信号を受信できる状態に保たれる。そして、マイクロコンピュータ１１は，通信装置１６が起動信号若しくは受信待ち終了信号を受信するか、又はイグニッションスイッチ１Ｇが操作されるのを待つ。
【００４４】
上述のように，上記実施形態においては、イグニッションスイッチ１ＧがＯＦＦ位置にあるとき、マイクロコンピュータ１１は，最初、通信装置１６への給電を継続して通信装置１６を作動状態すなわち信号を受信できる状態に保つ。このとき、通信装置１６がパーソナルコンピュータ２０から送信された各種信号を受信すると、マイクロコンピュータ１１は同受信した信号に応じてステップ１１２～１１８，１１９～１２１の各処理（外部信号処理手段）を実行する。起動信号を受信した場合には，各装置１４，１５を起動してスケジュールデータ受信処理及びスケジュールデータ格納処理を実行する。一方、受信待ち終了信号を受信した場合には，通信装置１６への給電を停止して通信装置１６によるパーソナルコンピュータ２０からの信号の受信待ちを終了する。したがって、例えば長期間乗車する予定のない場合などには、パーソナルコンピュータ２０から受信待ち終了信号を送信することにより、通信装置１６への給電を停止することができる。これにより、データの事前処理を可能として乗車後の速やかな経路案内の開始を可能とした上で、電力の無意味な消費を抑えることができることになる。
【００４５】
また、上記通信装置１６の受信待ち終了信号の受信時には、ステップ１１９のユーザ認証処理によりパーソナルコンピュータ２０から送信された認証データを予め記憶した照合データと照合して認証データが照合データと一致した場合にのみ上記通信装置１６への給電

の停止制御を許容するようにしているため、不正な操作又は誤った操作により通信装置１６への給電が停止されることが防止されていて、当該車載ナビゲーションシステムの安全性が高く保たれている

【図面の簡単な説明】

【図１】本発明の一実施形態に係る車載ナビゲーションシステムの全体概略図である。

【図２】図１のマイクロコンピュータにて実行されるプログラムを示すフローチャートである。

【図３】図２のユーザ認証処理の詳細を示すフローチャートである。

【図４】図２のスケジュールデータ受信処理の詳細を示すフローチャートである。

【図５】図１のパーソナルコンピュータがスケジュールデータを送信するとき実行するプログラムを示すフローチャートである。

【図６】図５のユーザ認証データ送信処理の詳細を示すフローチャートである。

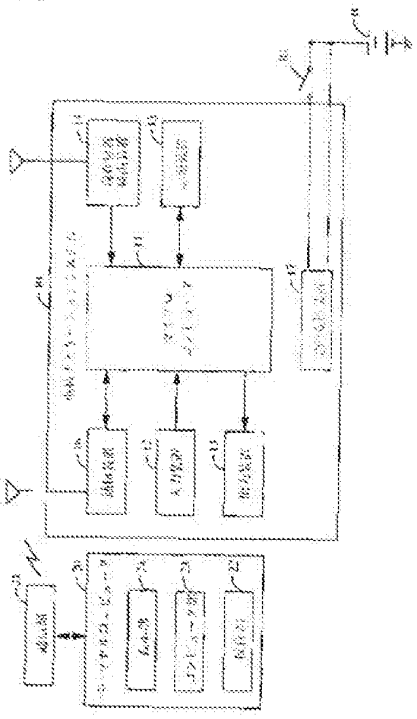
【図７】図５のスケジュールデータ送信処理の詳細を示すフローチャートである。

【図８】図１のパーソナルコンピュータが受信待ち終了信号を送信するとき実行するプログラムを示すフローチャートである。

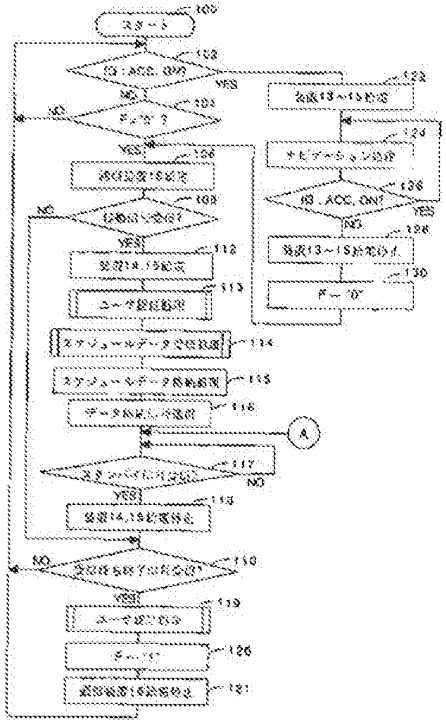
【符号の説明】

１０　車載ナビゲーションシステム、１１　マイクロコンピュータ、１６　通信装置、２０　パーソナルコンピュータ、ＩＧ　イグニッションスイッチ、Ｂ　車載電源。

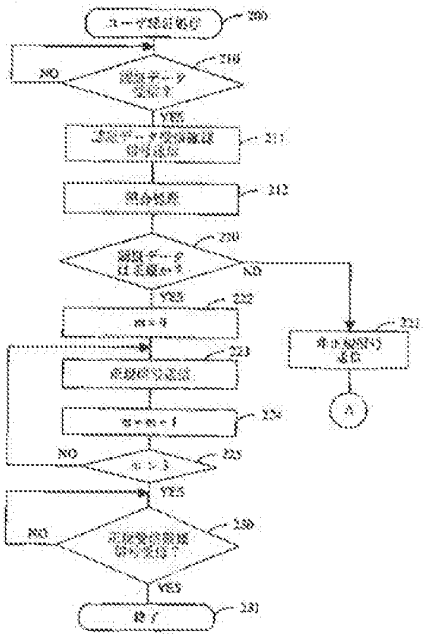
【図１】



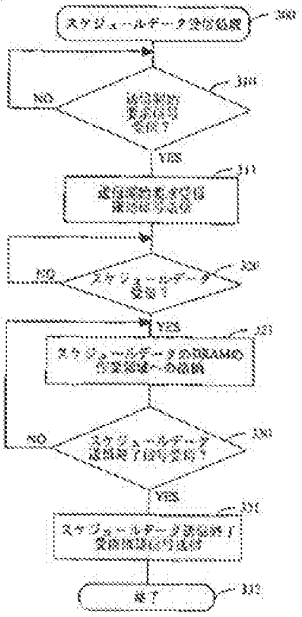
【図２】



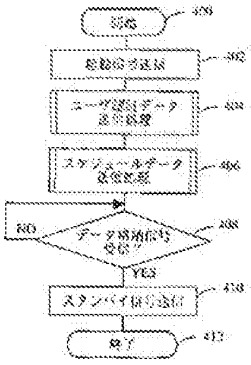
【図３】



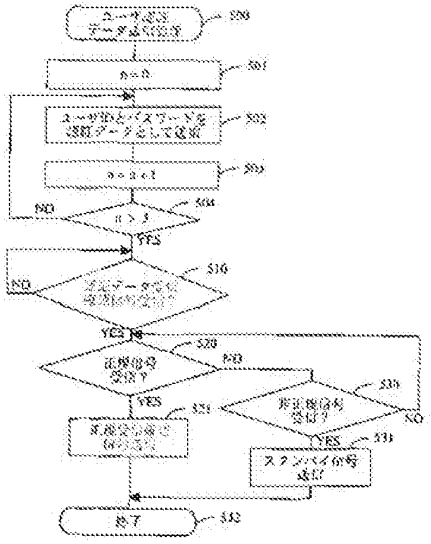
【図４】



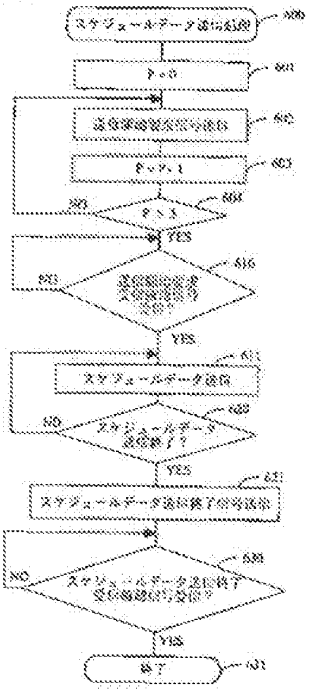
【図５】



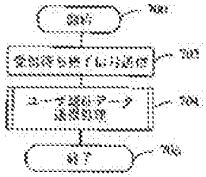
【図６】



【図７】



【図８】



フロントページの続き

Fターム(参考) 5H180 AA01 BB02 BB04 BB05 CC12 FF05 FF12 FF13 FF22 FF27
FF32
5K067 AA34 AA43 BB26 DD17 DD27 DD51 EE02 EE12 HH22

Patents jp2007155695

Mobile communication device positioning system and method

Abstract

PROBLEM TO BE SOLVED: To provide a mobile communication device positioning system which is not necessary to compare and calculate a positioning signal.
SOLUTION: The mobile communication device comprises a control device, a signal transmitter/receiver, a positioning receiver, a display part. In this case, the positioning receiver receives the positioning signal transmitting from a global positioning system (GPS). The signal transmitter/receiver, combined with the positioning receiver, is constituted so that the positioning signal is transmitted to external device. The signal transmitter/receiver receives positioning related information which is decided by the positioning signal from external device. The control device is connected to each of the signal transmitter/receiver, the positioning receiver, and the display part. Furthermore, the display part is used for display of the positioning related information.
COPYRIGHT: (C)2007,JPO&INPIT

Images (3)



Classifications

» G01S5/0036 Transmission from mobile station to base station of measured values, i.e. measurement on mobile and position calculation on base station

JP2007155695A
Japan

Download PDF Find Prior Art Similar

Other languages: Japanese

Inventor: 紹祖 ▲ホ▼ ▲ホ▼, Ko-Chien Chuang, Shao-Tsu Kung, 克紹 孫

Worldwide applications

2005 TW 2006 US DE JP

Application JP2006102818A events

2005-12-05 Priority to TW094142748A

2006-04-04 Application filed by Compal Electronics Inc, 仁寶▼電▲腦工業股▼分▲有限公司

2007-06-21 Publication of JP2007155695A

2019-08-27 Application status is Pending

Info: Patent citations (19), Cited by (6), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Claims (11)

Hide Dependent
translated from Japanese

1. A mobile communication device for the system for positioning the mobile communication device, the system for the mobile communication device,
A positioning receiver for receiving a positioning signal corresponding transmitted by Global Positioning System (GPS),
Is coupled to the positioning receiver, the received positioning signals the corresponding transmits to the outside of the mobile communications device, the positioning related information determined in response to positioning signals the corresponding externally of the mobile communication device system for mobile communication device comprising a signal transceiver for.

2. A mobile communication device for the system of claim 1, the mobile communication device for system further said signal transceiver mobile communication device for the system that comprises a control unit for controlling the transmission and reception operation.

3. A mobile communication device for the system of claim 1, the mobile communication device for system further corresponding the positioning related information the mobile communication device for the system that includes a display unit for displaying.

4. A mobile communication device for the system according to claim 1, wherein the signal transceiver further sends out a "partner position request signal", corresponding to the positioning signal of the mobile communication device corresponding to the "destination location request signal" system for mobile communication apparatus having a function of receiving positioning-related information determined from outside the mobile communication device Te.

5. A mobile communication device system according to claim 4, the mobile communication device for the system in which the positioning related information has an address.

6. A process of receiving the positioning signal using a mobile communication device,
A process of generating the positioning related information by sending this positioning signal to the external device,
The mobile communication device positioning method and a process of receiving the positioning related information from the external device.

7. A mobile communication device positioning method according to claim 6, a mobile communication device positioning method in the positioning related information to have an address.

8. A mobile communication device positioning method according to claim 6, wherein the mobile or communication devices short positioning related information received messages, and voice, the mobile communication device positioning method to be transmitted by using the method of transmitting any graphic image .

9. A method of mobile communication device position according to claim 6, the method further
A step of sending the "destination location request signal" for requesting the other party positioning related information of the counterpart of the mobile communication device by using the previous year mobile communication device,
The mobile communication device positioning method having the steps of receiving a mating positioning related information of which is determined according to the opponent positioning signals of the other mobile communication device using the mobile communication device.

10. A mobile communication device positioning method according to claim 9, a mobile communication device positioning method in positioning related information of the other party to have an address

11. A mobile communication device positioning method according to claim 9, wherein the mobile party or positioning related information a short message of the communication device receives, or voice, the mobile communication device positioning method of transmitting by a method of transmitting one of the graphic image.

Description

translated from Japanese

The present invention relates to global positioning system (GPS), to a system for particular positioning mobile communication device.

Global Positioning System (GPS) are generally either used in satellite navigation system of a vehicle, a device built into a personal digital assistant (PDA). GPS receives a positioning signal from a satellite positioning, it is necessary to compare the signal and associated map data, the electronic device GPS is incorporated, previously loaded map data, high-speed to obtain the multimedia computing power is generally high-resolution satellite positioning and density memory is required. In the conventional method for positioning a mobile communication device, a large amount of map data stored in the mobile communication device, the positioning signal is compared to these map data. The method of positioning this kind not only to use a large amount of computational resources, increase the work load and power consumption of the mobile communication device, significantly affects the time used that are available for mobile communication devices thereby. Further, by requiring high-density memory and computing systems, and complex in more advanced mobile communications device, thereby increasing the overall cost of the mobile communication device. Furthermore, this type of system operations, require a number of operations process for obtaining the desired positioning data, the rather complex. For users who are not familiar with the electronic device interface or a software user interface, the method of this kind is very inconvenient. For example, the operation of this kind of address search and positioning, it is quite difficult for children or the elderly.

Accordingly, an object of the present invention is to provide a mobile communication device positioning system adapted to compute a positioning signal received obtain the desired positioning related information. According to the present invention, the mobile communication device, so that there is no need to compare and calculate the positioning signal, i.e. so that there is no need to accumulate a large amount of map data. Accordingly, the mobile communication apparatus of the present invention, not only the operation is easy, as compared with the conventional mobile communication device is inexpensive, the power consumption is also reduced.

To provide a mobile communication device positioning system in accordance with the above objects and other objects of the present invention. The system is introduced into the mobile communication device. The mobile communication apparatus comprises a positioning receiver, a signal transceiver, a controller, and a display unit. In this case, the positioning system, the high frequency low output positioning signals transmitted from satellites to obtain position-related information. Furthermore, the positioning receiver receives a corresponding positioning signal transmitted from a GPS. A signal transceiver which joins the positioning receiver sends positioning signal to a device external to the mobile communication device, in accordance with the positioning signal transmitted from the apparatus or other devices external to the mobile communication device it is configured to receive the determined position related information.

Device outside of the above-described mobile communication device, one of the short external device is comprises a positioning processing system. The positioning processing system compares the position signal, the position-related data obtained after this comparison, short messages and, or graphic images, sound and, in the mobile communication device using the method of transmitting one text Send. In this case, the positioning related information includes address. Furthermore, the control apparatus in a mobile communication device controls the transmission and reception processing of the positioning receiver and a signal transceiver. Controller is to send to and process the received data. Control apparatus further has comprises a keypad. A signal transceiver is controlled directly in response to a key operation, and transmits a positioning signal to an external device, it receives the positioning related information corresponding to the positioning signal from the external device. Display unit is for displays positioning related information received. Interface according to one of the key operations of this type significantly reduces the complexity of the operation, the result positioning system becomes more user-friendly.

in one example of the present invention, a signal transceiver of the above-described mobile communication device uses a specific protocol of each mobile communication device, it transmits a "party location request" signal, the mobile communication device or the above-described opponent from the external device to obtain a function of receiving positioning-related information of the other mobile communication device. In this case, the positioning related information is obtained by calculation processing corresponding to the positioning signal transmitted from the mobile communication device of the other party. This feature is very useful for children of safety, also to be useful to track the current whereabouts of the person or the like having the elderly and mental disorders with memory impairment.

According to another aspect of the present invention provides a method of positioning a mobile communication device. The positioning method comprises the following process. First, the mobile communication device receives a positioning signal. Next, the mobile communication device transmits the positioning signal received to an external device, and generates positioning related information. Here, the positioning related information including an address, a short message and, or voice, it is transmitted by a method of transmitting one of the graphic image. Next, the mobile communication device receives the positioning related information from an external device, displays the positioning related information the receiver on the display unit of the mobile communication device.

in one example of the present invention, the mobile communication device sends a "counterpart location request" signal to request positioning related information of the mobile communication device of the other party, then sends the former mobile communication device from the mobile communication device of the other party receiving positioning-related information of the mobile communication device of the other party that corresponds to has been positioned signals.

Therefore, according to the present invention, for positioning the processing system to obtain the desired positioning related information, so as to calculate the positioning signals received. Accordingly, the mobile communication device, you need not be or calculate and compare the positioning signals received, i.e. there is no need to accumulate a large amount of map data. Accordingly, the mobile communication apparatus of the present invention, not only the operation is easy, as compared with the conventional mobile communication device, a low cost, power consumption is reduced. Moreover, functionality and a single key operation to search for positioning related information of another mobile communication device, thereby significantly reducing the complexity of use. Accordingly, the positioning system provided by the present invention are very useful for the child-safety, is also useful for tracking the current whereabouts of the person or the like having elderly and psychiatric disorders with memory impairment.

Accompanying drawings are intended to provide a further understanding of the present invention are those which form a part hereof. The drawings illustrate embodiments of the present invention, serve to explain the principles of the present invention. The preferred embodiment of the present invention illustrating a number of example in the accompanying drawings Referring in detail.

Embodiments of the present invention will be described in detail below in detail with reference to FIG. Figure 1 is a block diagram showing a system for locating a mobile communication device according to an embodiment of the present invention. The mobile communication device 100 includes a positioning receiver 110, a signal transceiver 120, a controller 130, and comprises a display unit 140. In this case, the control unit 130 includes a signal transceiver 120, a positioning receiver 110, are coupled respectively to the display unit 140. A signal transceiver 120 is further coupled to the positioning receiver 110. Furthermore, the positioning processing system 150 is installed in a specific position of the base station capable of communicating with a signal transceiver 120. Mobile communication device 100 receives positioning

signals sent via the positioning receiver 110 from GPS, a signal transceiver 120 sends a positioning signal to the positioning processing system 150. In this case, positioning the processing system 150 is installed systems external to the mobile communication device 100. Positioning processing system is configured to accumulate map data related compares / calculates the positioning signals sent from the signal transceiver 120, and is configured to generate the positioning related information corresponding to the positioning signal. In this case, the positioning related information, including address, etc. clear landmarks or buildings. Furthermore, the positioning related information, short messages and, or graphic images, sound and are transmitted to a signal transceiver 120 using a method for transmitting text. When a signal transceiver 120 receives the positioning related information, the positioning related information is displayed by the display unit 140. Furthermore, in order to signal the transceiver 120 to control the signal transceiver 120 to receive the positioning related information and transmits the positioning signal, the control device 130, the mobile communication device 100 can be installed. A signal transceiver 120, the signal transmitted between the external devices, including positioning processing system 150, to be noted that it is possible to pass through the another transmission path which comprises a further transmission component there is. Therefore, an external device that receives a signal from the signal transceiver 120 does not necessarily have to be an external device to send a signal to the signal transceiver 120.

In this embodiment of the present invention, it can control the controlled device 130 by the key. Specifically, in response to a key operation, the mobile communication device 100 is adapted to receive and transmit positioning signals, receives the positioning related information of the mobile communication device 100 from the positioning system 150 and displays. In other words, the user, without additional manipulation processes such as conventional mobile communication device, using the key operation only once this kind, it is possible to obtain the positioning related information of the mobile communication device 100. Furthermore, if the user wishes to obtain positioning related information of the other party, a signal transceiver 120 to request positioning related information of the mobile communication device 100 of the other party by the communication protocol used between different mobile communication device 100 , it is possible to send a "party location request" signal. Next, alignment processing system 150, with the positioning signal of the mobile communication device 100 of the other party in accordance with the request signal, transmits the positioning related information corresponding to the mobile communication device 100 of the other party to the user of the signal transceiver 120. Then, a signal transceiver 120 receives a positioning-related information of the mobile communication device 100 of the other party, the information is displayed on the display unit 140. Positioning related information described above corresponds to the positioning signal sent by the other party's mobile communication device.

For a better understanding of those skilled in the art, the following examples are described in detail below with reference to FIG.

Figure 2 is a flow diagram illustrating a method in a diagrammatical positioning the mobile communication device according to an embodiment of the present invention. The positioning method comprises the following steps. First, in step 210, the mobile communication device 100 receives a positioning signal by the positioning receiver 110. Next, in step 220, the mobile communication device 100, a positioning signal received through the signal transceiver 120 transmits the positioning processing system 150. In step 230, the positioning processing system 150 compares / calculates the positioning related information corresponding accordance positioning signal sent by the mobile communication device 100, a short message or voice and, or graphic images, one of the text using the method of transmitting transmits the positioning related information to the mobile communication device 100. Positioning related information has been described above includes address. Next, in step 240, the mobile communication device 100 uses the signal transceiver 120 receives the positioning related information sent by the positioning processing system 150 in step 230. Finally, in step 250, the display unit 140 displays the positioning related information received by the signal transceiver 120.

Figure 3 is a flowchart illustrating a method of diagrammatically positioning the mobile communication device of the other party according to an embodiment of the present invention. This method of positioning is comprising the following steps. First, in step 310, the mobile communication device 100 uses the signal transceiver 120 sends a "counterpart location request" signal for requesting the positioning related information of the mobile communication device 100 of the other party. Next, in step 320, the positioning processing system 150, the positioning related information generating of the other mobile communication device in accordance with the positioning signal of the mobile communication device of the other party, the positioning related information, and short messages, and audio, graphics images and transmits using the method of transmitting one text. In that case, the positioning related information, corresponding to the positioning signal sent by the other party's mobile communication device. Finally, in step 340, the positioning related information of the other mobile communication device that has received, is displayed on the display unit 140.

In short, the mobile communication apparatus of the present invention not only operates easily, as compared with the conventional mobile communication device, does not or need a memory or calculating device a large amount of map data, it becomes a cheap, consumption power is also reduced. Furthermore, a function of searching for positioning related information of another mobile communication device, a single key operation and significantly reduces the complexity of use. Accordingly, the positioning system provided by the present invention is very useful for children safety, also to track the real-time location of a person or the like such as those having elderly and psychiatric disorders with memory impairment it is useful.

The present invention has been described with respect to specific embodiments without departing from the spirit of the present invention, it will be apparent to those skilled in the art that variations to the embodiments described above. Accordingly, the scope of the present invention, rather than by the foregoing description, but should be defined by the appended claims.

Figure 1 is a block diagram of a system for locating a mobile communication device according to an embodiment of the present invention. Figure 2 is a flowchart illustrating a method of diagrammatically positioning the mobile communication device according to an embodiment of the present invention. Figure 3 is a flowchart illustrating a method of diagrammatically positioning the mobile communication device of the other party according to an embodiment of the present invention.

DESCRIPTION OF SYMBOLS

100 mobile communication device 110 positioned receiver 120 a signal transceiver 130 the controller 140 display unit 150 positioning processing system

Patent Citations (19)

Publication number	Priority date	Publication date	Assignee	Title
Family To Family Citations				
US5043736B1 *	1990-07-27	1994-09-06	Cae Link Corp	Cellular position location system
JP3133770B2 *	1991-01-18	2001-02-13	マツダ株式会社	Automobile travel system of
GB2323693B *	1997-02-06	2001-10-03	Fujitsu Ltd	Portable radio terminal
US6266614B1 *	1997-12-24	2001-07-24	Wendell	Travel guide

			Alumbaugh	
US6222483B1 *	1998-09-29	2001-04-24	Nokia Mobile Phones Limited	GPS location for mobile phones using the internet
US20080026589A1 *	1999-07-29	2005-02-03	Bryan Holland	Remote locator system using A E911-enabled wireless system
US7260448B2 *	2000-05-18	2007-08-28	Sirf Technology, Inc.	Satellite based positioning method and system for coarse location positioning
US7474896B2 *	2000-07-14	2009-01-06	Norman Mohi	Locating system and method
US20030141973A1 *	2001-07-24	2003-07-31	Hen-Geul Yeh	Smart object locator
KR100814251B1 *	2000-09-20	2008-03-17	엔엑스피 비 브이	A method of determining the position of a mobile unit
US20050288034A1 *	2001-11-15	2005-12-29	Judson Bruce A	Method and apparatus for using position location to direct narrow beam antennas
US20020164998A1 *	2001-05-01	2002-11-07	Saed Younis	System and method for providing position-based information to a user of a wireless device
JP4278952B2 *	2001-11-08	2009-06-17	ヤマハ株式会社	Mobile terminal
DE10156832B4 *	2001-11-20	2004-01-29	Siemens Ag	Method and apparatus for displaying information
US6885337B2 *	2003-09-10	2005-04-26	Sony Ericsson Mobile Communications Ab	Methods and apparatus for determining the position of a mobile terminal using localized source assistance information
US7245255B2 *	2004-03-16	2007-07-17	Global Locate, Inc	Method and apparatus for determining absolute time-of-day in a mobile-assisted satellite positioning system
JP3870952B2 *	2004-04-15	2007-01-24	セイコーエプソン株式会社	Monitoring system, a terminal device, a mobile object monitoring method, control method of a terminal device, a control program of the terminal device, and computer readable recording medium a control program of the terminal device, the management device, control method for a management device, the management device control program
US7642958B2 *	2005-06-21	2010-01-05	Motorola, Inc.	Satellite positioning system receivers and methods
US20070069946A1 *	2005-09-27	2007-03-29	Diego Kaplan	Systems and methods for position based services in a mobile device

* Cited by examiner, † Cited by third party

Cited By (6)

Publication number	Priority date	Publication date	Assignee	Title
US7925426B2 *	2005-11-17	2011-04-12	Motility Systems	Power management systems and devices
CN104918326A *	2015-05-11	2015-09-16	上海网罗电子科技有限公司	Indoor positioning system and method
US9682624B1	2005-11-17	2017-06-20	Invent.Ly, Llc	Power management using route information for a hybrid electric vehicle
US9792736B1	2005-11-17	2017-10-17	Invently Automotive Inc.	Telemetry device for capturing vehicle environment and operational status history
Family To Family Citations				
CN102967878B	2011-08-30	2014-10-29	国际商业机器公司	Method and apparatus for determining the location of a mobile device
CN105549045A	2015-12-14	2016-05-04	联想(北京)有限公司	Information processing method and electronic devices

* Cited by examiner, † Cited by third party, ‡ Family to family citation

Similar Documents

Publication	Publication Date	Title
US8350721B2	2013-01-08	Geographically specific emergency notification
US7529537B2	2009-05-05	System and method for providing personal and emergency service hailing in wireless network
EP1388246B1	2016-07-20	Context sensitive web services
JP4246698B2	2009-04-02	How wireless information device and the wireless information device to access the geographic data
RU2462832C2	2012-09-27	System to render services to mobile device in personal network

US10009756B2	2018-06-26	Functional management of mobile devices
US9232356B2	2016-01-05	Locator system
US7289813B2	2007-10-30	Using signal-generated location information to identify and list available devices
CN100417047C	2008-09-03	Position information searching method and mobile phone system
CA2379232C	2010-04-13	Portable locator system and method
CN1279784C	2006-10-11	Method and mobile station for route guidance
EP1139116A1	2001-10-04	Distributed search method
US20020002592A1	2002-01-03	Data output controller
CN1247033C	2006-03-22	Communication management system for personalized mobility management of wireless services and method thereof
US20080319653A1	2008-12-25	Navigation system and methods for route navigation
US20080319652A1	2008-12-25	Navigation system and methods for map navigation
CN101171798B	2015-02-18	Apparatus and method for displaying availability of wireless lan
US7574222B2	2009-08-11	Method and system for location management and location information providing system
US20120315923A1	2012-12-13	Apparatus for providing location information of hand-held device and method thereof
US9014973B2	2015-04-21	Methods for obtaining a navigation track between a first and a second location at a client device using location information obtained from a server device and related devices and computer program products
US7349705B1	2008-03-25	Wireless remote location system and method
US7236126B2	2007-06-26	AGPS system using NTP server and method for determining the location of a terminal using a NTP server
US9759566B2	2017-09-12	Methods for obtaining a navigation track between a first and a second location based on location information shared between peer devices and related devices and computer program products
CN1245807C	2006-03-15	System and method for locating mobile device
JP4951673B2	2012-06-13	Tracking of the mobile terminal group

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
TW094142748A	2005-12-05	2005-12-05	System for positioning mobile communication apparatus and method thereof

Legal Events

Date	Code	Title	Description
2008-08-05	A977	Report on retrieval	**Free format text:** JAPANESE INTERMEDIATE CODE: A971007 **Effective date:** 20080805
2008-08-20	A131	Notification of reasons for refusal	**Free format text:** JAPANESE INTERMEDIATE CODE: A131 **Effective date:** 20080819
2009-02-04	A02	Decision of refusal	**Free format text:** JAPANESE INTERMEDIATE CODE: A02 **Effective date:** 20090203

Concepts

machine-extracted

Download Filter table

Name	Image	Sections	Count	Query match
mobile communication		Abstract,Title	3	0
transmitter		Abstract	4	0

Data provided by IFI CLAIMS Patent Services

About Send Feedback Public Datasets Terms Privacy Policy

(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2007-155695
(P2007-155695A)
(43)公開日　平成19年6月21日(2007.6.21)

(51)Int.Cl.			F I			テーマコード（参考）
G01S	5/14	(2006.01)	G01S	5/14		5J062
H04Q	7/34	(2006.01)	H04B	7/26	106A	5K067
H04Q	7/38	(2006.01)	H04B	7/26	109M	

審査請求 有　請求項の数 11　OL　（全 8 頁）

(21)出願番号　特願2006-102818(P2006-102818)
(22)出願日　平成18年4月4日(2006.4.4)
(31)優先権主張番号　094142748
(32)優先日　平成17年12月5日(2005.12.5)
(33)優先権主張国　台湾(TW)

(71)出願人　504253706
仁寶▼電▲腦工業股▼分▲有限公司
台湾台北市内湖區瑞光路５８１號
(74)代理人　100072051
弁理士　杉村　興作
(74)代理人　100107227
弁理士　藤谷　史朗
(74)代理人　100114292
弁理士　来間　清志
(74)代理人　100096845
弁理士　笹倉　静孝
(72)発明者　▲きょう▼　紹祖
台湾台北市内湖區瑞光路５８１號
(72)発明者　莊　克裕
台湾台北市内湖區瑞光路５８１號
最終頁に続く

(54)【発明の名称】移動通信装置位置決めシステム及び方法

(57)【要約】
【課題】位置決め信号を比較及び計算する必要がないようにした移動通信装置位置決めシステムを提供することにある。
【解決手段】この移動通信装置は、制御装置と、信号送受信機と、位置決め受信機と、表示部を具える。この場合、位置決め受信機はグローバルポジショニングシステム（ＧＰＳ）から送信される位置決め信号を受信する。位置決め受信機に結合している信号送受信機は位置決め信号を外部デバイスに送信するように構成される。信号送受信機は外部デバイスから位置決め信号によって決定する位置決め関連情報も受信する。制御装置は信号送受信機と、位置決め受信機と、表示部にそれぞれ接続する。更に表示部は位置決め関連情報を表示するためにある。
【選択図】図１

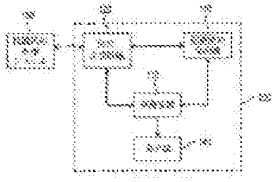


FIG. 1

【特許請求の範囲】
【請求項1】
移動通信装置を位置決めするための移動通信装置用システムであって、この移動通信装置用システムは、
グローバルポジショニングシステム（ＧＰＳ）によって送信された対応する位置決め信号を受信する位置決め受信機と、
この位置決め受信機に結合されており、前記対応する位置決め信号を前記移動通信装置の外部に送信するとともに、前記対応する位置決め信号に応じて決定された位置決めの関連情報を前記移動通信装置の外部から受信する信号送受信機と
を具える移動通信装置用システム。
【請求項2】
請求項１に記載の移動通信装置用システムにおいて、この移動通信装置用システムが更に、前記信号送受信機の送信及び受信動作を制御する制御装置を具えている移動通信装置用システム。
【請求項3】
請求項１に記載の移動通信装置用システムにおいて、この移動通信装置用システムが更に、対応する前記位置決めの関連情報を表示する表示部を具えている移動通信装置用システム。
【請求項4】
請求項１に記載の移動通信装置用システムにおいて、前記信号送受信機が更に、「相手位置要求信号」を送出するとともに、この「相手位置要求信号」に対応する前記移動通信装置の位置決め信号に応じて決定された位置決めの関連情報を移動通信装置の外部から受信する機能を有する移動通信装置用システム。
【請求項5】
請求項４に記載の移動通信装置用システムにおいて、前記位置決めの関連情報がアドレスを有している移動通信装置用システム。
【請求項6】
移動通信装置を用いて位置決めの信号を受信する過程と、
この位置決め信号を外部デバイスに送信して位置決めの関連情報を発生させる過程と、
前記外部デバイスから前記位置決めの関連情報を受信する過程と
を有する移動通信装置位置決め方法。
【請求項7】
請求項６に記載の移動通信装置位置決め方法において、前記位置決めの関連情報がアドレスを有するようにする移動通信装置位置決め方法。
【請求項8】
請求項６に記載の移動通信装置位置決め方法において、前記移動通信装置が受信した位置決めの関連情報を短いメッセージや、音声や、グラフィック画像のいずれかを送信する方法を用いて送信する移動通信装置位置決め方法。
【請求項9】
請求項６に記載の移動通信装置位置決めする方法において、この方法が更に、
前記移動通信装置を用いて相手の移動通信装置の相手の位置決め関連情報を要求する「相手位置要求信号」を送出する過程と、
前記移動通信装置を用いて相手の移動通信装置の相手位置決め信号に応じて決定した相手の位置決めの関連情報を受信する過程と
を有する移動通信装置位置決めの方法。
【請求項10】
請求項９に記載の移動通信装置位置決め方法において、前記相手の位置決めの関連情報がアドレスを有するようにする移動通信装置位置決め方法
【請求項11】

請求項９に記載の移動通信装置位置決め方法において、前記移動通信装置が受信した相手の位置決め関連情報を短いメッセージや、音声や、グラフィック画像のいずれか送信す

【発明の詳細な説明】移動通信装置位置決め方法。

【技術分野】

【０００１】

本発明は、グローバルポジショニングシステム（ＧＰＳ）に関するものであり、特に移動通信装置を位置決めするシステムに関するものである。

【背景技術】

【０００２】

グローバルポジショニングシステム（ＧＰＳ）は、一般的に、車両の衛星ナビゲーションシステムに用いられているか、携帯情報端末（ＰＤＡ）に組込まれている装置である。ＧＰＳは、位置決め用の衛星から位置決め信号を受信して、この信号を関連の地図データと比較する必要があるため、ＧＰＳが組み込まれている電子装置が、地図データを予めローディングして、高速のマルチメディア計算能力を得るようにするには通常、高解像度の衛星位置決め及び高密度のメモリが必要となる。移動通信装置を位置決めする従来の方法では、多量の地図データが移動通信装置に蓄積され、位置決め信号がこれらの地図データと比較される。この種の位置決め方法は多量の計算資源を使用するだけではなく、移動通信装置の作業負荷及び消費電力を増大させ、これにより移動通信装置の利用できる使用時間に著しく影響を及ぼす。更に、高密度のメモリ及び計算システムを必要とすることにより、移動通信装置をより一層高機能で複雑にし、これにより移動通信装置の総原価を増大させる。更に、この種のシステム操作は、所望の位置決めデータを得るためのいくつかの操作過程を必要として、かなり複雑となる。電子装置インターフェースまたはソフトウェアユーザーインターフェースに精通していないユーザにとって、この種の方法は、非常に不便である。たとえば、アドレス検索や位置決めというこの種の操作は、児童または高齢者にとってかなり困難である。

【発明の開示】

【発明が解決しようとする課題】

【０００３】

従って、本発明の目的は、受信した位置決め信号を計算して所望の位置決め関連情報を得るようにした移動通信装置位置決めシステムを提供することにある。本発明によれば、移動通信装置は、位置決め信号を比較及び計算する必要がないようにする。すなわち多量の地図データを蓄積する必要がないようにする。従って、本発明の移動通信装置は、操作が容易なだけでなくて、従来の移動通信装置と比較して、廉価であり、消費電力も小さくなる。

【課題を解決するための手段】

【０００４】

本発明の上述した目的及びその他の目的に応じた移動通信装置位置決めのシステムを提供する。このシステムを、移動通信装置に導入する。移動通信装置は、位置決め受信機と、信号送受信機と、制御装置と、表示部とを具えている。この場合、位置決めシステムは、衛星から送信された高周波低出力の位置決め信号から、位置決め関連情報を得る。更に、位置決め受信機が、ＧＰＳから送信された対応する位置決め信号を受信する。位置決め受信機と結合している信号送受信機は、移動通信装置の外部にある装置に位置決め信号を送信し、移動通信装置の外部にあるこの装置かその他の装置から送信された位置決め信号に応じて決定された位置決め関連情報を受信するように構成されている。

【０００５】

上述した移動通信装置の外部にあるデバイス、要するに外部デバイスの１つは位置決め処理システムを具えている。この位置決め処理システムは、位置決め信号を比較して、この比較後に得られた位置関連データを、短いメッセージや、グラフィック画像や、音声や、テキストのいずれかを送信する方法を用いて移動通信装置に送信する。この場合、位置決め関連情報はアドレスを含む。更に、移動通信装置における制御装置は、位置決め受信

機及び信号送受信機の送受信処理を制御する。制御装置は、受信データを送信し且つ処理するためにある。制御装置は更に、キーパッドを具えている。信号送受信機はキー操作に応答して直接制御されて、外部デバイスに位置決め信号を送信するとともに、外部デバイスからこの位置決め信号に対応する位置決めの関連情報を受信する。表示部は、受信した位置決めの関連情報を表示するためにある。この様の一回のキー操作によるインターフェースは操作の複雑性を著しく低減させ、その結果位置決めシステムはよりユーザーフレンドリーになる。

【0006】

本発明の一例においては、上述した移動通信装置の信号送受信機は、個々の移動通信装置の特定のプロトコルを使用して、「相手位置要求」信号を送信するとともに、相手の移動通信装置または上述した外部デバイスから相手の移動通信装置の位置決めの関連情報を受信する機能を得るようにする。この場合、位置決め関連情報は、相手の移動通信装置より送信される位置決め信号に応じた計算処理により得られる。この機能は、児童の安全のために非常に有用であり、また記憶障害を有する高齢者や精神障害を有する人等の現在の居場所を追尾するのにも有用である。

【0007】

本発明の他の観点によれば、移動通信装置を位置決めする方法を提供する。この位置決め方法は、以下の過程を有する。最初に、移動通信装置が位置決め信号を受信する。次に、移動通信装置は受信したこの位置決め信号を外部デバイスに送信して、位置決め関連情報を発生させる。ここで、アドレスを含む位置決め関連情報を、短いメッセージや、音声や、グラフィック画像のいずれかを送信する方法によって送信する。次に、移動通信装置が外部デバイスから位置決め関連情報を受信し、この受信した位置決め関連情報を移動通信装置の表示部に表示する。

【0008】

本発明の一例においては、移動通信装置が相手の移動通信装置の位置決め関連情報を要求するために「相手位置要求」信号を送出し、次に前者の移動通信装置が相手の移動通信装置から送信された位置決めの信号に対応する相手の移動通信装置の位置決め関連情報を受信する。

【0009】

従って、本発明によれば、位置決め処理システムが所望の位置決め関連情報を得るために、受信した位置決め信号を計算するようになっている。従って、移動通信装置は、受信した位置決め信号を比較したり計算したりする必要はない、すなわち多量の地図データを蓄積する必要がない。従って、本発明の移動通信装置は、操作が容易なだけでなくて、従来の移動通信装置と比較して、安価で、消費電力が小さくなる。更に、他の移動通信装置の位置決め関連情報を検索する機能と一回のキー操作とが、使用の複雑性を著しく低減させる。従って、本発明により提供される位置決めシステムは、児童の安全のために非常に有用で、記憶障害を有する高齢者や精神障害を有する人等の現在の居場所を追尾するのにも有用である。

【実施例】

【0010】

添付図面は、本発明を更に理解するためのものであり、本明細書の一部を成すものである。図面は、本発明の実施例を示しており、本発明の原理を説明するためのものである。添付図面に実例を示す本発明の好適実施例を詳細に参照する。

【0011】

本発明の実施例を、図１を参照して以下に詳細に詳述する。図１は、本発明の一実施例による移動通信装置を位置決めするシステムを示すブロック線図である。移動通信装置１００は、位置決め受信機１１０と、信号送受信機１２０と、制御装置１３０と、表示部１４０とを具えている。この場合、制御装置１３０は、信号送受信機１２０と、位置決め受信機１１０と、表示部１４０とにそれぞれ結合されている。信号送受信機１２０は、更に、位置決め受信機１１０に結合している。更に、位置決め処理システム１５０が、信号送

受信機１２０と通信することができる基地局の特定の位置に設置されている。移動通信装置１００が、ＧＰＳから位置決め受信機１１０を介して送られた位置決の信号を受信すると、信号送受信機１２０は位置決の処理システム１５０に位置決め信号を送る。この場合、位置決の処理システム１５０は、移動通信装置１００の外部に装置されたシステムである。位置決の処理システムは、関連した地図データを蓄積するとともに、信号送受信機１２０から送られる位置決の信号を比較／計算し、且つ、位置決の信号に対応する位置決の関連情報を発生するように構成されている。この場合、位置決の関連情報は、アドレス、明確な目印または建物などを含む。更に、位置決の関連情報は、短いメッセージや、グラフィック画像や、音声や、テキストを送信する方法を用いて信号送受信機１２０に送信される。信号送受信機１２０が位置決の関連情報を受信すると、この位置決の関連情報が表示部１４０により表示される。更に、信号送受信機１２０が位置決の信号を送信するとともに位置決の関連情報を受信するようにこの信号送受信機１２０を制御するために、制御装置１３０を、移動通信装置１００内に、設置することができる。信号送受信機１２０と、位置決の処理システム１５０を含む外部デバイスとの間に送信される信号は、別の送信機成素子を具えている別の伝送路を通るようにすることができる点に留意する必要がある。従って、信号送受信機１２０から信号を受ける外部デバイスは、必ずしも信号送受信機１２０に信号を送る外部デバイスとする必要はない。

【００１２】

本発明の本実施例においては、制御装置１３０をキーによって制御できる。具体的には、キー操作に応答して、移動通信装置１００は、位置決の信号を受信及び送信するとともに、位置決めシステム１５０からの移動通信装置１００の位置決の関連情報を受信し且つ表示する。換言すれば、ユーザは、従来の移動通信装置のような付加的な操作過程なしに、この種の一個のみのキー操作を用いて、移動通信装置１００の位置決の関連情報を得ることができる。更に、ユーザが相手の位置決の関連情報を得ることを望む場合、信号送受信機１２０は、異なる移動通信装置１００の間で使用される通信プロトコルによって相手の移動通信装置１００の位置決め関連情報を要求するために、「相手位置要求」信号を送信することができる。次に、位置決め処理システム１５０は、この要求信号に従って相手の移動通信装置１００の位置決め信号を得て、相手の移動通信装置１００に対応する位置決め関連情報をユーザの信号送受信機１２０に送信する。その後、信号送受信機１２０は相手の移動通信装置１００の位置決の関連情報を受信し、この情報が表示部１４０に表示される。上述した位置決め関連情報は、相手の移動通信装置によって送られる位置決め信号に対応している。

【００１３】

当業者のさらなる理解のために、以下の実施例を、図１を参照して以下に詳細に説明する。

【００１４】

図２は、本発明の一実施例による移動通信装置を位置決めする方法を概略的に示す流れ図である。この位置決め方法は、以下のステップを具えている。最初に、ステップ２１０で、移動通信装置１００は、位置決め受信機１１０で位置決め信号を受信する。次に、ステップ２２０で、移動通信装置１００は、受信した位置決め信号を、信号送受信機１２０を介して、位置決め処理システム１５０に送信する。ステップ２３０においては、位置決め処理システム１５０が、移動通信装置１００によって送られた位置決め信号に従って対応する位置決め関連情報を比較／計算して、短いメッセージや、音声や、グラフィック画像や、テキストのいずれかを送信する方法を用いて、位置決め関連情報を移動通信装置１００に送信する。上述した位置決め関連情報はアドレスを含む。次に、ステップ２４０で、移動通信装置１００が信号送受信機１２０を使用して、ステップ２３０において位置決め処理システム１５０によって送られた位置決め関連情報を受信する。最後に、ステップ２５０で、表示部１４０が、信号送受信機１２０によって受けた位置決め関連情報を表示する。

【００１５】

図３は、本発明の一実施例による相手の移動通信装置を位置決めする方法を線図的に示す流れ図である。この位置決めの方法は、以下のステップを具えている。最初に、ステップ３１０で、移動通信装置１００が信号送受信機１２０を使用して、相手の移動通信装置１００の位置決め関連情報を要求するための「相手位置要求」信号を送出する。次に、ステップ３２０で、位置決め処理システム１５０が、相手の移動通信装置の位置決め信号に従って相手の移動通信装置の位置決め関連情報を発生して、この位置決め関連情報を、短いメッセージや、音声や、グラフィック画像や、テキストのいずれかを送信する方法を用いて送信する。その場合、この位置決め関連情報は、相手の移動通信装置によって送られる位置決め信号に対応する。最後に、ステップ３４０で、受け取った相手の移動通信装置の位置決め関連情報を、表示部１４０に表示させる。

【００１６】

要するに、本発明の移動通信装置は容易に動作するだけでなく、従来の移動通信装置と比較して、多量の地図データを記憶したり計算装置を必要としたりしないので、軽量になるとともに、消費電力も少なくなる。更に、他の移動通信装置の位置決め関連情報を検索する機能と、一回のキー操作とが使用上の複雑性を著しく低減させる。従って、本発明によって提供される位置決めシステムは、児童の安全のために非常に有用で、また、記憶障害を有する高齢者や精神障害を有するような人等の実時間位置を追尾するのにも有用である。

【００１７】

本発明をその特定の実施例に関して説明したが、本発明の精神から逸脱することなく、上述した実施例に対する変形が可能であることは当業者にとって明らかである。従って、本発明の範囲は、上述の説明によってではなく、特許請求の範囲によって規定されるものである。

【図面の簡単な説明】

【００１８】

【図１】図１は本発明の実施例による移動通信装置を位置決めするシステムのブロック線図である。

【図２】図２は本発明の実施例による移動通信装置を位置決めする方法を線図的に示す流れ図である。

【図３】図３は本発明の実施例による相手の移動通信装置を位置決めする方法を線図的に示す流れ図である。

【符号の説明】

【００１９】

１００　移動通信装置
１１０　位置決め受信機
１２０　信号送受信機
１３０　制御装置
１４０　表示部
１５０　位置決め処理システム

【図１】

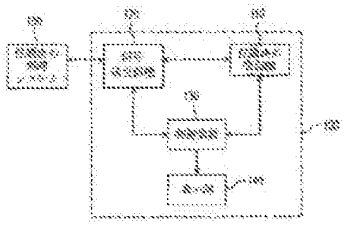


FIG. 1

【図２】

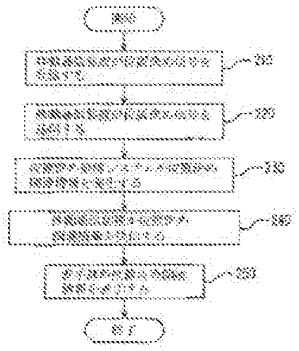


FIG. 2

【図３】

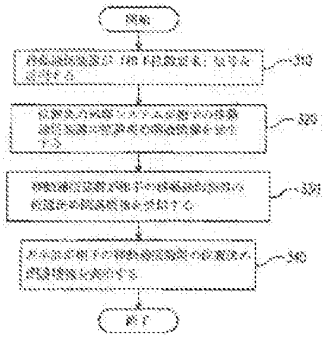


FIG. 3

Ｆターム(参考) 5J062 AA07 AA08 BB05 CC07 DD11 DD23 FF01 HH05
5K067 BB20 DD52 DD53 DD54 FF03 FF23 GG01 GG11 JJ52 JJ56

200722778

發明專利說明書

200722778

（本說明書格式、順序及粗體字，請勿任意更動，※記號部分請勿填寫）

※ 申請案號：94142748

※ 申請日期：94.12.5　　※IPC 分類：G01S 5/02 (2006.01)

一、發明名稱：（中文/英文）

行動通訊裝置定位系統與方法

System for Positioning Mobile Communication Apparatus and Method thereof

二、申請人：（共 1 人）

姓名或名稱：（中文/英文）

仁寶電腦工業股份有限公司/COMPAL ELECTRONICS, INC.

代表人：（中文/英文）許勝雄/HSU SHENG-HSIUNG

住居所或營業所地址：（中文/英文）

台北市內湖區瑞光路 581 號/NO. 581, JUI-KUANG RD., NEI-HU DIST., TAIPEI CITY, TAIWAN, R.O.C.

國　籍：（中文/英文）中華民國/TW

三、發明人：（共 2 人）

姓　名：（中文/英文）

1 龔紹祖/ SHAO-TSU KUNG

2 莊克乾/ KO-CHIEN CHUANG

國　籍：（中文/英文）1-2 中華民國/TW

四、聲明事項：

☐ 主張專利法第二十二條第二項☐第一款或☐第二款規定之事實，其事實發生日期為：　年　月　日。

☐ 申請前已向下列國家（地區）申請專利：

【格式請依：受理國家（地區）、申請日、申請案號　順序註記】

☐ 有主張專利法第二十七條第一項國際優先權：

☐ 無主張專利法第二十七條第一項國際優先權：

☐ 主張專利法第二十九條第一項國內優先權：

【格式請依：申請日、申請案號　順序註記】

☐ 主張專利法第三十條生物材料：

☐ 須寄存生物材料者：

國內生物材料　【格式請依：寄存機構、日期、號碼　順序註記】

國外生物材料　【格式請依：寄存國家、機構、日期、號碼　順序註記】

☐ 不須寄存生物材料者：

所屬技術領域中具有通常知識者易於獲得時，不須寄存。

五、中文發明摘要：

一種行動通訊裝置之定位系統，設於行動通訊裝置內。此行動通訊裝置包括控制模組、訊號收送模組、定位接收模組，以及顯示模組。定位接收模組，用以接收全球定位系統所發出之定位訊號。訊號收送模組，耦接至定位接收模組，用以將定位訊號向行動通訊裝置外傳送，並接收外界根據定位訊號判斷所得之位置相關資訊。控制模組分別耦接至訊號收送模組、定位接收模組，以及顯示模組。顯示模組則負責顯示位置相關資訊。

六、英文發明摘要：

A system for positioning a mobile communication apparatus is provided, which is established in the mobile communication apparatus. The mobile communication apparatus includes a control module, a signal transmitter/receiver module, a positioning receiver module and a display module. The positioning receiver module receives the positioning signal which is transmitted by Global Positioning System. The signal transmitter/receiver module is coupled to the positioning receiver module and transmits the positioning signal outside the mobile communication apparatus. The signal transmitter/receiver module receives the positioning relation information which responses to the positioning signal. The control module is respectively coupled to the

signal transmitter/receiver module, the positioning receiver module and the display module. The display module is responsible to display the positioning relation information.

七、指定代表圖：

(一)本案指定代表圖為：圖 1。

(二)本代表圖之元件符號簡單說明:

100：行動通訊裝置

110：定位接收模組

120：訊號收送模組

130：控制模組

140：顯示模組

150：定位處理系統

八、本案若有化學式時，請揭示最能顯示發明特徵的化學式：

無

九、發明說明：

【發明所屬之技術領域】

本發明是關於一種全球定位系統(global positioning system，簡稱 GPS)，且特別是關於一種應用於行動通訊裝置之定位系統。

【先前技術】

全球定位系統經常運用在汽車的衛星導航系統上或是內建於個人數位助理(personal digital assistant，簡稱 PDA)。由於全球定位系統需要接受定位衛星所傳送的定位訊號並比對相關的地圖資訊，所以內建全球定位系統的電子裝置通常需要配備高感度的衛星定位模組、大容量的記憶模組去預載地圖資訊，以及高速的多媒體運算能力。傳統的行動通訊裝置定位方式即是內建大量的地圖資訊，直接由行動通訊裝置負責運算比對定位訊號與地圖資訊，這樣的定位方式不僅需要消耗行動通訊裝置的運算資源，增加負載與耗電，影響行動通訊裝置的使用時間。同時也因為對其記憶體容量與運算系統的要求，大幅增加行動通訊裝置的製造成本與複雜度。另外，在操作使用上，通常也有一定的複雜度，在取得所需定位資訊的過程中，往往需要不同的操作程序。對於不熟悉電子裝置介面或是軟體使用介面者而言，都會造成增加使用上的不方便。像是很多年幼的孩童或是較為年長者，這些位址搜尋與定位的動作都有可能造成使用上的困難。

【發明內容】

本發明的目的是提供一種行動通訊裝置的定位系統。裝置本身不需負責定位訊號的比對與運算，以及儲存大量的地圖資訊。僅需發送所接收到的定位訊號即可利用定位處理系統協助運算並取得所需的位置相關資訊。不僅簡化操作方式，同時也大幅降低行動通訊裝置的製造成本與使用時的功率消耗。

為達成上述及其他目的，本發明提出一種行動通訊裝置之定位系統。此系統整合在行動通訊裝置內，此行動通訊裝置包括定位接收模組、訊號收送模組、控制模組，以及顯示模組。定位系統藉由人造衛星所發送之高頻且低功率的定位訊號去取得位置相關資訊。定位接收模組負責接收全球定位系統所發出之相對應的定位訊號。訊號收送模組耦接至定位接收模組並負責將定位訊號傳送至外界與接收外界根據所傳送的定位訊號判斷所得的位置相關資訊。

上述之外界裝置則包括定位處理系統，負責比對定位訊號，並將比對完成之位置相關資訊，包括地址，以簡訊、圖片、語音或文字等方式傳送給行動通訊裝置。控制模組則控制定位接收模組與訊號收送模組資料之接收與傳送，同時負責所接收到資料的傳送與處理。前述之控制模組更包括一按鍵，利用此一按鍵的操作，可以直接控制訊號收送模組將定位訊號發送至外界，並自外界接收此一定位訊號相對應的位置相關資訊。顯示模組則負責顯示所接收到的位置相關資訊。此單一按鍵的操作介面可大幅降低操作

復雜度，使定位系統更具人性化，符合更多人的需求。

上述之行動通訊裝置在一實施例中，其訊號收送模組可透過個別行動通訊裝置的協定，具有可發送他人位置要求訊號的功能，並自外界接收他人行動通訊裝置的位置相關資訊。此位置相關資訊即是根據他人行動通訊裝置所發送的定位訊號運算所得之位置相關資訊。此一功能對於兒童安全或是特殊人士，如失智老人、精神障礙者的行蹤掌握具有相當的助益。

從另一個觀點來看，本發明提出一種行動通訊裝置之定位方法，包括下列步驟。首先，藉由行動通訊裝置接收定位訊號，然後此行動通訊裝置發出所接收的定位訊號至外界以產生位置相關資訊，上述位置相關資訊包括地址，並以簡訊、語音、圖片等方式傳送。隨之，此行動裝置自外界接收外界所產生之位置相關資訊並藉由顯示模組將其顯示在行動通訊裝置上。

上述之行動通訊裝置之定位方法在一實施例中，更包括下列步驟。首先，行動通訊裝置發出他人位置要求訊號以要求另一個行動通訊裝置之位置相關資訊。接下來，行動通訊裝置接收他人行動通訊裝置之位置相關資訊，此位置相關資訊系對應於他人行動通訊裝置所發出之定位訊號。

本發明之行動通訊裝置因不需負責定位訊號的比對與運算，以及儲存大量的地圖資訊。僅需發送所接收到的定位訊號即可利用定位處理系統協助運算並取得所需的位

址資訊。不僅簡化操作方式，同時也大幅降低行動通訊裝置的製造成本與使用時的功率消耗。此外，搜尋他人行動通訊裝置位置資訊的功能與單一按鍵的操作方式也大幅下降其使用複雜度，使此一系統可以適用於更多特定的對象與狀況，如兒童安全或失智老人、精神障礙者行蹤搜尋等。

為讓本發明之上述和其他目的、特徵和優點能更明顯易懂，下文特舉本發明之較佳實施例，並配合所附圖式，作詳細說明如下。

【實施方式】

下文特舉本發明一實施例，並配合所附圖式，作詳細說明如下。無論在圖式中還是本文的描述裡，除非另外說明，相同或相似的元件符號即是表示作用相同或相似的元件。

以下說明請參照圖 1，圖 1 為根據於本發明一實施例的行動通訊裝置之定位系統方塊圖。行動通訊裝置 100 包括定位接收模組 110、訊號收送模組 120、控制模組 130、顯示模組 140。控制模組 130 分別耦接至訊號收送模組 120、定位接收模組 110，以及顯示模組 140。訊號收送模組 120 更耦接至定位接收模組 110。此外，我們將定位處理系統 150 裝設在基地台等可與訊號收送模組 120 溝通訊號的地方，行動通訊裝置 100 透過定位接收模組 110 接收全球定位系統所發出的定位訊號後，會經由訊號收送模組 120 將定位訊號傳送給定位處理系統 150，由於定位處理系統 150 為一構置於行動通訊裝置外之定位訊號處理系統，此定位處理系統 150 儲存相關地圖資訊與負責比對運算訊

號收送模組 120 所傳出之定位訊號，產生與定位訊號相對應的位置相關資訊，此位置相關資訊包括地址、明顯的地標建物等等，並將此一位置相關資訊以簡訊、圖片、語音或文字等方式傳送至訊號收送模組 120，在訊號接收模組 120 接收位置相關資訊後，將其位置相關資訊藉由顯示模組 140 顯示。於行動通訊裝置 100 更可增設一控制模組 130，用以控制訊號收送模組 120 傳送定位訊號與接收位置相關資訊。

上述之控制模組 130 在本實施例中可藉由一按鍵來控制，透過此一按鍵的操作，行動通訊裝置 100 可以完成定位訊號的接收與發送，且自定位系統 150 接收此行動通訊裝置 100 的位置相關資訊並顯示之。亦即，使用者僅需操作此一按鍵便可取得行動通訊裝置 100 的位置相關資訊，不需要額外的操作程序。此外，透過不同行動通訊裝置 100 間的協定。若使用者需要得知他人行動通訊裝置 100 之位置相關資訊時，訊號收送模組 120 可發出他人位置要求訊號以要求另一個行動通訊裝置 100 之位置相關資訊。定位處理系統 150 會根據此要求訊號取得他人行動通訊裝置 100 的定位訊號，並將相對應於他人行動通訊裝置 100 的位置相關資訊傳送至使用者的訊號收送模組 120。接下來，訊號收送模組 120 接收他人行動通訊裝置 100 之位置相關資訊並藉由顯示模組 140 顯示之。上述之位置相關資訊係對應於他人行動通訊裝置所發出之定位訊號。

為使此技術領域者能更清楚得知本案的技術手段，以下

實施例之說明將同時參照圖 1 所示的系統元件來進行說明。

圖 2 為根據本發明一實施例的行動通訊裝置之定位方法流程圖，包括下列步驟，步驟由 210 開始。首先，步驟 210，行動通訊裝置 100 經由定位接收模組 110 接收定位訊號。接下來，步驟 220，行動通訊裝置 100 藉由訊號收送模組 120 將所接收到的定位訊號傳送給定位處理系統 150。步驟 230，定位處理系統 150 根據行動通訊裝置 100 所傳送的定位訊號，比對運算出相對應的位置相關資訊並藉由簡訊、語音、圖片、文字等其中一種方式，傳送給行動通訊裝置 100。上述之位置相關資訊包括地址。然後，步驟 240，行動通訊裝置 100 經由訊號收送模組 120 接收步驟 230 中定位處理系統 150 所傳送的位置相關資訊。最後，步驟 250，顯示模組 140 顯示訊號收送模組 120 所接收到的位置相關資訊。

圖 3 為根據本發明一實施例的他人行動通訊裝置之定位方法，包括下列步驟，步驟由 310 開始。首先，步驟 310，行動通訊裝置 100 藉由訊號收送模組 120 發出他人位置要求訊號以要求另一行動通訊裝置 100 之位置相關資訊。接下來，步驟 320，定位處理系統 150 根據他人行動通訊裝置之定位訊號，產生他人行動裝置的位置相關訊號並以簡訊、圖片、語音等其中一種方式傳送之。然後，步驟 330，行動通訊裝置 100 藉由訊號收送模組 120 接收他人行動通訊裝置 100 之位置相關資訊，此位置相關資訊係對應於他人行動通訊裝置所發出之定位訊號。最後，步驟 340，藉由顯示模組 140 顯示所接收到的他人行動通訊裝置 100 的

位置相關資訊。

綜合上述。本發明之行動通訊裝置，不僅簡化操作方式，同時也因不需儲存大量地圖資訊與運算資源而大幅降低行動通訊裝置的製造成本與使用時的功率消耗。此外，搜尋他人行動通訊裝置位置資訊的功能與單一按鍵的操作方式也大幅下降其使用複雜度，使此一系統可以適用於更多特定的對象與狀況，如兒童安全或失智老人、精神障礙者行蹤搜尋等。

雖然本發明已以較佳實施例揭露如上，然其並非用以限定本發明，任何熟習此技藝者，在不脫離本發明之精神和範圍內，當可作些許之更動與潤飾，因此本發明之保護範圍當視後附之申請專利範圍所界定者為準。

【圖式簡單說明】

圖 1 繪示為根據本發明一實施例的行動通訊裝置之定位系統方塊圖。

圖 2 繪示為根據本發明一實施例的行動通訊裝置之定位方法流程圖。

圖 3 繪示為根據本發明一實施例的他人行動通訊裝置之定位方法流程圖。

【主要元件符號說明】

100：行動通訊裝置

110：定位接收模組

120：訊號收送模組

130：控制模組

140：顯示模組

150：定位處理系統

210~250：流程圖步驟

310~340：流程圖步驟

十、申請專利範圍：

1.一種行動通訊裝置之定位系統，該定位系統係設於該行動通訊裝置內，該行動通訊裝置包括：

一定位接收模組，用以接收一全球定位系統所發出之相應的一定位訊號；以及

一訊號收送模組，耦接至該定位接收模組，用以將該定位訊號向該行動通訊裝置外傳送，並接收外界根據該定位訊號判斷所得之一位置相關資訊。

2.如申請專利範圍第 1 項所述之行動通訊裝置之定位系統，更包括一控制模組，用以控制該訊號收送模組之接收與傳送。

3.如申請專利範圍第 1 項所述之行動通訊裝置之定位系統，其特徵在於更包括一顯示模組以顯示該位置相關資訊。

4.如申請專利範圍第 1 項所述之行動通訊裝置之定位系統，該訊號收送模組更包括發出一他人位置要求訊號，並自外界接收根據與該他人位置要求訊號相對應之行動通訊裝置之定位訊號判斷所得之位置相關資訊。

5.如申請專利範圍第 1 或 4 項所述之行動通訊裝置之定位系統，所述之位置相關資訊係為地址。

6.一種行動通訊裝置之定位方法，其係包括下列步驟：

一行動通訊裝置接收一定位訊號；

該行動通訊裝置發出該定位訊號至外界以產生一位置相關資訊；以及

該行動通訊裝置自外界接收該位置相關資訊。

7.如申請專利範圍第 6 項所述之行動通訊裝置之定位方法，其更包括下列步驟：

該行動通訊裝置發出一他人位置要求訊號以要求另一行動通訊裝置之位置相關資訊；以及

該行動通訊裝置接收根據另一行動通訊裝置之定位訊號判斷所得之位置相關資訊。

8.如申請專利範圍第 6 或 7 項所述之行動通訊裝置之定位方法，其中所述之位置相關資訊係為地址。

9.如申請專利範圍第 6 或 7 項所述之行動通訊裝置之定位方法，其中該行動通訊裝置接收所述之位置相關資訊係藉由簡訊、語音與圖片其中一者。

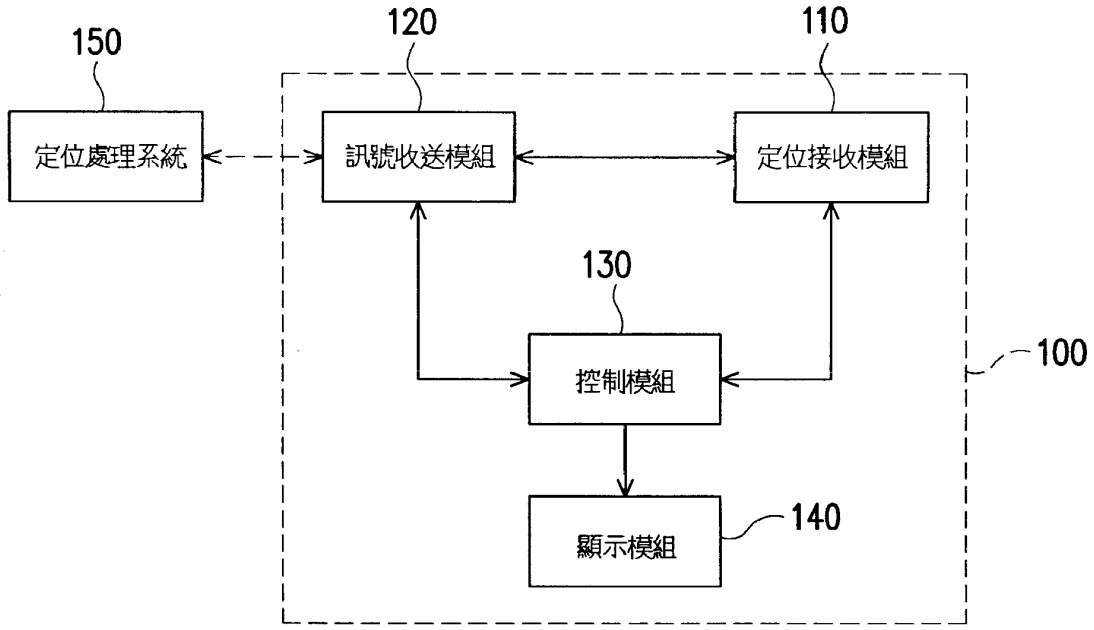


圖 1

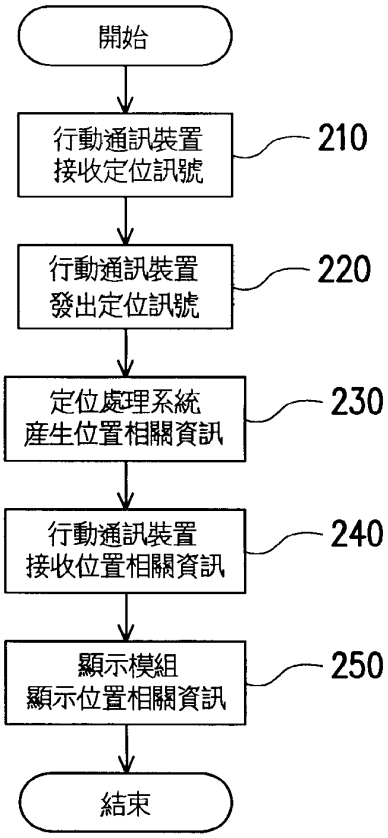

開始
行動通訊裝置
接收定位訊號
210
行動通訊裝置
發出定位訊號
220
定位處理系統
產生位置相關資訊
230
行動通訊裝置
接收位置相關資訊
240
顯示模組
顯示位置相關資訊
250
結束

圖 2

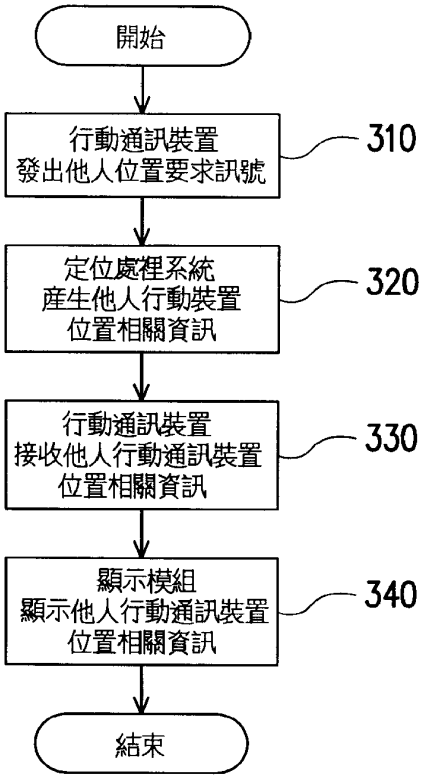

開始
行動通訊裝置
發出他人位置要求訊號
310
定位處理系統
產生他人行動裝置
位置相關資訊
320
行動通訊裝置
接收他人行動通訊裝置
位置相關資訊
330
顯示模組
顯示他人行動通訊裝置
位置相關資訊
340
結束

圖 3

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 December 2000 (14.12.2000)

PCT

(10) International Publication Number
WO 00/75682 A1

(51) International Patent Classification[7]: G01S 5/14, 1/02, G01C 21/28

(21) International Application Number: PCT/EP00/03329

(22) International Filing Date: 13 April 2000 (13.04.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
PCT/EP99/03960 8 June 1999 (08.06.1999) EP

(71) Applicant *(for all designated States except US)*: **SONY INTERNATIONAL (EUROPE) GMBH** [DE/DE]; Kemperplatz 1, D-10785 Berlin (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **KOVACS, Ernö** [US/DE]; Sony International (Europe) GmbH, Hedelfinger Strasse 61, D-70327 Stuttgart (DE). **SCHRAMM, Oliver** [DE/DE]; Sony International (Europe) GmbH, Hedelfinger Strasse 61, D-70327 Stuttgart (DE).

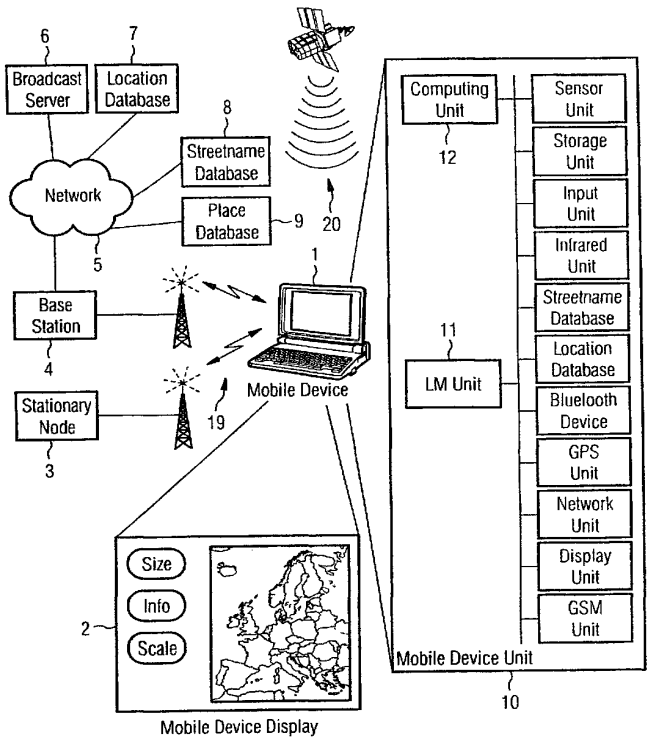
(74) Agent: **RUPP, Christian**; Mitscherlich & Partner, Sonnenstrasse 33, D-80331 München (DE).

(81) Designated States *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, 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, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU,

[Continued on next page]

(54) Title: GEOLOCATION OF MOBILE DEVICES



(57) Abstract: A technique for the determination of the current position of a mobile device based on a plurality of geolocation positioning services is proposed. Different position information sources are accessed wirelessly to acquire position information. The position information thereby comprises respectively at least information about the position of the corresponding position information source. At least one of the plurality of accessed position information sources is selected depending on the values of operation parameters, such as for example availability, cost, speed, power consumption and quality of the position information, wherein the operation parameters are associated with the different position information sources. The position of the mobile device is then determined based on the position information of the at least one selected position information source.

WO 00/75682 A1



MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

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.

Geolocation of mobile devices

The present invention relates to a method for the determination of the current position of a mobile device, to a software element, a mobile device comprising such a software element as well as to a mobile device comprising means for the determination of its current position.

The present invention generally relates to the field of mobile computing, hand-held computers, wireless communication and mobile multimedia middleware. Particularly it relates to selecting and appropriate location determination method according to a stored set of operation parameters describing the different location determination's devices available.

Future hand-held devices will include a set of different location devices helping to determine the current geo-position of the mobile device. The best known type of devices are GPS (or D-GPS) receivers. Others are infrared beacons for indoor use or GSM cell broadcast for transmitting the area code to which the mobile phone belongs. In the future additional means like the GSM location service or microsensor techniques will be available.

Most devices currently used are only including one or two of this position means. In the future there will be problems when a plurality of positioning devices will be available.

Therefore, the present invention has as an object to provide for a technique for handling a plurality of accessable geolocation positioning devices.

This object is achieved by means of the features of the independent claims. The dependent claims develop further the central idea of the present invention.

Therefore, according to the present invention a method for the determination of the current position of a mobile device is provided. The method comprises the step of accessing wirelessly a plurality of different position information sources for acquiring position information, the position information comprising respectively at least information about the position of the corresponding position information source. At least one of the plurality of accessed position information sources is selected depending

on the values of operation parameters associated with the different position information sources. The position of the mobile device is then determined based on the position information of the at least one selected position information source.

The operation parameters can comprise at least one of availability, cost, speed, power consumption and quality of the position information service.

New position information sources to be accessed can be added dynamically during operation.

A position information source can be selected manually.

The acquired position information of the at least one position information source and the corresponding operation parameters can be stored.

A set of operation parameters used for the selection step defines a selection policy, wherein different selection policies can be set.

In case more than one position information source is selected, the corresponding position information can be combined.

The invention furthermore proposes a software element executing, when loaded in a mobile device, a method as set forth above.

The invention furthermore proposes a mobile device comprising such a software element.

According to the present invention a mobile device comprising means for the determination of its current position is provided. The means for the position determination comprise means for wirelessly accessing a plurality of different position information sources for acquiring position information. The position information comprises respectively at least information about the position of the corresponding position information source. The means for the position determination comprise furthermore means for selecting at least one of the plurality of accessed position information sources depending on the values of operation parameters associated with the different position sources. Furthermore, means for determining the position of the mobile device based on the position information of the at least one selected position information source is provided.

The operation parameters can be transmitted along with the position information or can be known in advance to the mobile device. Furthermore, the operation parameters can be derived from the transmission of the position information itself (for example in the case of the periodicity of the transmission, the accuracy etc.).

Further objects, features and advantages of the present invention will come clear from the following description of preferred embodiments taken into conjunction with the figures of the enclosed drawings.

Figure 1 shows the overlook over the overall system,

Figure 2 shows a logical representation of a local manager unit,

Figure 3 shows the internal structure of a local manager unit, and

Figure 4 shows the idea of a so-called L-Broadcast mechanism.

This invention describes a LM (location manager) unit that gives transparent access to different location devices. The LM unit selects an appropriate location device and reads the related information. In addition to the position information, the LM unit provides information about the current operating parameter (e.g. the speed of the location update, the accuracy, the involved cost, etc.).

LM Unit

The LM unit consists of several subunits and some external units which are attached to the LM unit. These external units include the location devices itself. For example, if the LM unit provides access to a GPS receiver, the GPS receiver itself is attached as an external unit.

The LM unit consists of the LM Factory unit, the LM API unit, the LM Storage unit, the LMSS (Location Manager Selection Service) unit and several additional LD (Location Driver) units. There is one LD unit for each external unit attached, but there might be LD units without external attached location device units. For example, the GPS-LD unit contains the components necessary to access an external GPS unit and to retrieve the current position from that device.

LM Factory

LD units can be added dynamically during the runtime of the system, for example when new location devices are attached to the LM unit. The LD Factory unit is managing the

configuration of different units and the adding and removing of LD units. The LM Loader unit loads the additional LD units.

LM Storage unit and LM API unit

The LM Storage unit stores the latest retrieved location together with a set of operation parameter. The parameter describe the quality of the stored information, e.g. the accuracy, the time of the latest update, the accumulated cost resulting from LM operation, and more. The LM API units comprises two subunits, the LM Location API unit and the LM TupleSpace API unit. Both subunits access the LM Storage unit for retrieving the current location information and operating parameters. The LM Location API unit provides a location-specific interface with operation for each piece of location information available. The LM TupleSpace API unit provides a high-level interface using the TupleSpace model. In this model, the interface consists of operations to manipulate a set op tuple (key/value pairs). Each tuple is mapped to an appropriate parameter stored in the LM Storage unit.

Some operating parameters can be set through the LM API units and will influence the LMSS selection policy and the LD unit operation.

Method	Description
Set	Sets a parameter value
Get	Retrieves a parameter value
Mset	Sets a set of parameter values
Mget	Retrieves a set of parameter values
Mop	Execute a mixture of several set and get operations
GetAttributes	Returns a list of Attributes

Table 1: TupleSpace API

Method	Description
GetLongitude	Retrieves the current longitude
GetLatitude	Retrieves the current latitude
GetAltitude	Retrieves the current altitude
SetLongitude	Set the current longitude and switch to manual input
SetLatitude	Set the current latitude and switch too manual input
SetAltitude	Set the current Altitude and switch to manual input
SetMode	Switch between different modes by setting the LM selection policy
GetMode	Retrieves the current mode

Table 2: Location API

LD units

A LD unit consists of a LD API unit, a LD Parameter unit and a LD Interface unit. The LD API unit is used to access a LD unit. A LD unit provides a set of operating parameter that describes the service offered by the LD unit. This set is contained the LD Parameter subunit. The LMSS unit accesses the LD Parameter units of the different LD units to determine the currently used LD unit. The LD interface unit communicates with the external location device units through whatever means is required by these external units. The LD units ensure that the parameters stored in the LD Parameter unit is matched or correctly updated. The operation of the LD unit and the attached location device units can be influenced through setting LD parameters. This is done by using the LD API unit.

LD units determine the current position and offer this information through the LD API unit. This can be either a unsolicited message (an event) thrown when the user has changed its position significantly or just stored for subsequent retrieval.

LMSS unit

The LMSS unit consists of the LMSS Policy unit, the LMSS Executer unit and the LMSSS Combiner unit. The LMSS Policy unit manages different selection policy used to select one or more of the current available LD units. The LMSS Policy unit can store

a set of different selection policies. Additional policies can be loaded dynamically into the LMSS Policy unit. The LMSS Policy unit selects the current used policy based on the current operation parameter of the mobile device, the set op LM operating parameters stored in the LM Storage unit and on the user's input. For example, if the mobile device is in a sleep modus, the LMSS Policy unit selects a policy that saves power.

The LMSS Executer is an additional subunit of the LMSS unit that executes the selected policy. Whenever a new LD driver is selected, the LMSS Executer activates the LD unit through the respective LD API unit. This activation allows LD units to access external units and retrieve the required information according to the current LD parameter sets. Some selection policies might influence the LD parameters. This will be done by the LMSS Executer through setting parameters in the respective LD parameter unit.

If the current LMSS selection policy allows more than one LD unit to determine the current position, the LMSS Combiner will combine the results and determine the operating parameter of the LM unit. The resulting location information and the operating parameters are stored in the LM Storage unit.

As in figure 2 explained the Location Manager is based on the Location Manager Selection Service (LMSS). The task of this component is to offer the best location dependent information out of different sources. These are the different device driver, possible manual input - or for stationary use a configuration file can be used. So the LMSS can ask each device driver component for position information and offer the best to the above location manager. The quality of the position information can be determined based on the quality of Location description that is associated with each position information.

Example

LM with a single LD (location driver)

The simplest LM contains only a single LD. In this case, the LMSS selection policy will activate this LD unit (if required and appropriate according to the LM operating parameters) and retrieve the information from there. If we assume that the attached location device is a GPS receiver, then the LM unit will work as follows. The LMSS will select the used policy from the LMSS Policy unit. The LMSS Executer unit will activate the GPS LD unit. The GPS LD unit will activate the external GPS location

device. The GPS receiver unit will send periodically position information through the GPS LD Interface unit. The LD unit will process this information and store it together with the operating parameters in the LD Parameter. If requested by one of the LD operating parameters, it will further inform the LMSS about new positions. The LMNSS will store this information in the LMSS Storage unit. If requested by an operating parameter of the LM unit, it will inform applications about the new position through the LM API unit.

LM with more than one LD

In this case, the LMSS Policy unit has to determine an appropriate LD device based on operating parameters like availability/status of the attached external devices, and more. If the LD policy units selects more than one LD devices, the LD Combiner has to combine the results of both LD units.

Currently known LD units

The following table consists of a set of currently known LD units with respect to the presented invention:

GPS LD unit	A LD unit using an external attached GPS receiver. Depending on the kind of GPS receiver and its features, the GPS LD unit will configure the GPS receiver to deliver certain kind of output.
GSM LS LD unit	Future GSM versions will support the GSM Location Service. With this service, each GSM phone owner can determine his position by calling a Location Service center.
ConfigFile LD unit	The config file LD unit reads its location and other operating parameters from a config file.
ManualInput LD unit	The manual input LD unit let the user set his current position manually.
WellKnownPlaces LD unit	This LD unit maps well-known places to geographic positions. The user will input the name of the place. The LD unit will lookup this place an associated geographic

	information in a database. The database can be stored locally or on the network. A special kind of this LD unit is the Streetname LD unit that simply maps street names to position information.
Infrared LD unit	Small, inexpensive Infrared beacons can transmit the current position to mobile devices passing by.
Network Broadcast LM unit	Cellular networks or networks with a limited geographic range can broadcast the position of a base station or a stationary node over the network. A mobile node can safely assume that it is close to this geographic position.
Ad-hoc Network LM unit	Ad-hoc networks are built on the fly using technologies like Bluetooth or future wireless networks. For example, car-to-car communication can be established in this way. This can be used to that powerful and well-equipped nodes can offer services to other nodes. One of this service could be the location information. The accuracy of the information can be derived from the means of communication.
Tiangulation LM unit	Using network specific triangulation mechanism, the wireless network can determine the position of the user. This information can be transmitted to the mobile node directly.

Table 3: Known LD units

Explanation of Figures

Figure 1 shows the overall system. The system comprises the mobile device 1 with a display 2, the (wireless) access networks 19, the fixed network 5, base station 4 in the wireless network 19, additional stationary nodes 3 attached to the wireless network 19, a fixed network 20 (like the Internet or the GSM network), a streetname database 8, a place database 9, a broadcast server 6, a location database 7, the display 2 of the mobile device, location-based applications 11, and the set of sub-units which might be part of the mobile device. The sub-units comprised:

- the computing unit 12 - executing the applications running on the mobile device
- the sensor unit - measuring speed, acceleration and other parameters
- the storage unit - storing information like databases, maps, etc.
- input units - units that are used by the human user for inputting information (e.g. the keyboard, a pen, a touch screen, etc.)
- infrared unit - a unit to communicate using infrared
- bluetooth device unit - a unit to communicate using bluetooth
- streetbase database unit - a (local) database of streets
- location database unit - a (local) database of known locations
- a GPS unit - a unit to measure the position using GPS or D-GPS
- a network unit - a unit containing network access units like Ethernet, GPR, GSM data services, Token Ring, or else)
- display unit - a way to display information to the user

A mobile client which has direct access to a GPS receiver can use this information for his services. But when a mobile client is used in a house (indoor) then it is unwise to get location dependent information through the GPS receiver, because the deviation is to great for a conducive use.

A better solution will be to connect to a mobile gateway, which can offer the information with a higher QoL. This concept is realized through the L-Broadcast mechanism. The L-Broadcast mechanism consists of two components - The Broadcast-Server and the Broadcast-Client.

The Broadcast-Server is a separate component while the Broadcast-Client is a so-called device driver of the LMSS. The basically idea is that when a mobile client enters a house the LMSS receives position information with a very high QoL. This information can be used by a mobile client service.

The Broadcast-Server is a service in the mobile gateway. It gets position information from a Location Manager, which may be stationary and can possible use the configuration file.

There are two different ways how the Broadcast-Client and the Broadcast-Server can communicate with each other.

In this model the server broadcasts position information in a definite interval and clients listen on a multicast socket. This model is a very straightforward realization of the problem. A drawback is that the server sends information even there is a client or not.

The second model is the inverse of the previous. Here the mobile client broadcast a request when he needs information about his location. The request contains information about the client like his machine address and communication port. A server who receives that request on a multicast socket can send a location information directly to the client. This model has the advantage that the client can determine when information is send over the network.

Figure 2 shows a logical view of the LM unit 11. The LM unit 11 provides a API (Application Program Interface) 13 which might be part of a Mobile-API. The LM unit 11 executes the operation requests receives through the API 13. It used the services of a LMSS 14. The LMSS 14 selects among different LD units (GPS 15, Manual Input 16, Config Files 17, GSM Location services 18.

Figure 3 explains the LM unit 11. The LM unit 11 is attached to a set of external units. This external units provide location information. The LM unit consists of the LM API unit 13, the LMSS unit 14, the LM Storage unit 21, the LM Factory unit 22, and one or more LD units 23.

The LM API unit 13 consists of the LM TupleSpace API unit and the LM Location API unit.

The LMSS unit 14 consists of the LMSS policy unit, the LMSS Executer unit, and the LMSS Combiner unit.

Figure 4 shows the idea of the Location-Broadcast mechanism. A mobile client connects to a Broadcast-Server on a mobile gateway or another mobile client. The LMSS of the mobile client can choose the best available location information based on the QoL. When the mobile client enters a house he can broadcast via infrared and gets position information from the next, may be stationary mobile gateway, which reads the location information itself from a configuration file.

The invention proposes techniques for determining the geolocation of mobile devices using a variety of different location devices. The invention presents a technique for combining position information derived from a plurality of different position devices (position information sources) based on quality information about the position devices. The derived position information is offered through a standard API (application program interface) unit to application of the mobile device. The API comprises a high-level, TupleSpace like API unit and a low-level direct access API unit. The invention

uses further information (operation parameters) known about the position devices to select a suitable device. A special mode for manual input is provided. The unit includes a plurality of different location determination devices. Each device is described through a set of operation parameters defining the quality of the location information (e.g. the accuracy, the cost, the availability of the device and much more). This information is taken to select the most appropriate location driver. Furthermore, the set of available location devices can be enhanced dynamically.

The main advantageous differences between the invention and the state of the art is that different location devices can be used, a selection can be effected based on operation parameters like availability, cost, speed, accuracy, and the system is dynamically extensible by adding new location devices in operation. Furthermore, the invention allows to manually select the appropriate location driver and to include the newly loaded driver directly into the computation of the unit.

According to the invention new local manager devices can easily be integrated. The position information is augmented with quality information. Small mobile devices can rely on the services of better equipped nodes. Outdoor and indoor location services can be better integrated.

Claims:

1. Method for the determination of the current position of a mobile device, the method comprising the following steps:
- accessing wirelessly a plurality of different position information sources for acquiring position information, the position information comprising respectively at least information about the position of the corresponding position information source,
- selecting at least one of the plurality of accessed position information sources depending on the values of operation parameters associated with the different position information sources, and
- determining the position of the mobile device based on the position information of the at least one selected position information source.

2. Method according to claim 1, characterized in that the operation parameters comprise at least one of availability, cost, speed, power consumption, and quality of the position information.

3. Method according to claim 1 or 2, characterized in that new position information sources to be accessed are added dynamically during operation.

4. Method according to anyone of the preceding claims, characterized in that a position information source can be selected manually.

5. Method according to anyone of the preceding claims,

characterized in that
the acquired position information of the at least one position information sources and the corresponding operation parameters are stored.

6. Method according to anyone of the preceding claims,
characterized in that
a set of operation parameters used for the selection step defines a selection policy and different selection policies can be set.

7. Method according to anyone of the preceding claims,
characterized in that
in case more than one position information sources are selected, the corresponding position information is combined.

8. Software element executing, when loaded in a mobile device, a method according to anyone of the preceding claims.

9. Mobile device comprising a software element according to claim 8.

10. Mobile device comprising means for the determination of its current position,
the means the for the position determination comprising :
- means for wirelessly accessing a plurality of different position information sources for acquiring position information, the position information comprising respectively at least information about the position of the corresponding position information source,
- means for selecting at least one of the plurality of accessed position information sources depending on the values of operation parameters associated with the different position information sources, and
- means for determining the position of the mobile device based on the position information of the at least one selected position information source.

11. Mobile device according to claim 10,
characterized in that

the operation parameters comprise at least one of availability, cost, speed, power consumption, and quality of the position information.

12. Mobile device according to claim 10 or 11,
characterized by
means for dynamically adding new position information sources to be accessed during operation.

13. Mobile device according to anyone of claims 10 to 12,
characterized by
means for selecting position information sources manually.

14. Mobile device according to anyone of claims 10 to 13,
characterized by
a storage unit for storing the acquired position information of the at least one position information sources and the corresponding operation parameters.

15. Mobile device according to anyone of claims 10 to 14,
characterized by
means for setting on e of a plurality of selection policies respectively defined by a set of operation parameters used by the selection means.

16. Mobile device according to anyone of claims 10 to 15,
characterized by
processing means combining, in case more than one position information sources are selected by the selection means, the corresponding position information.

FIG 1

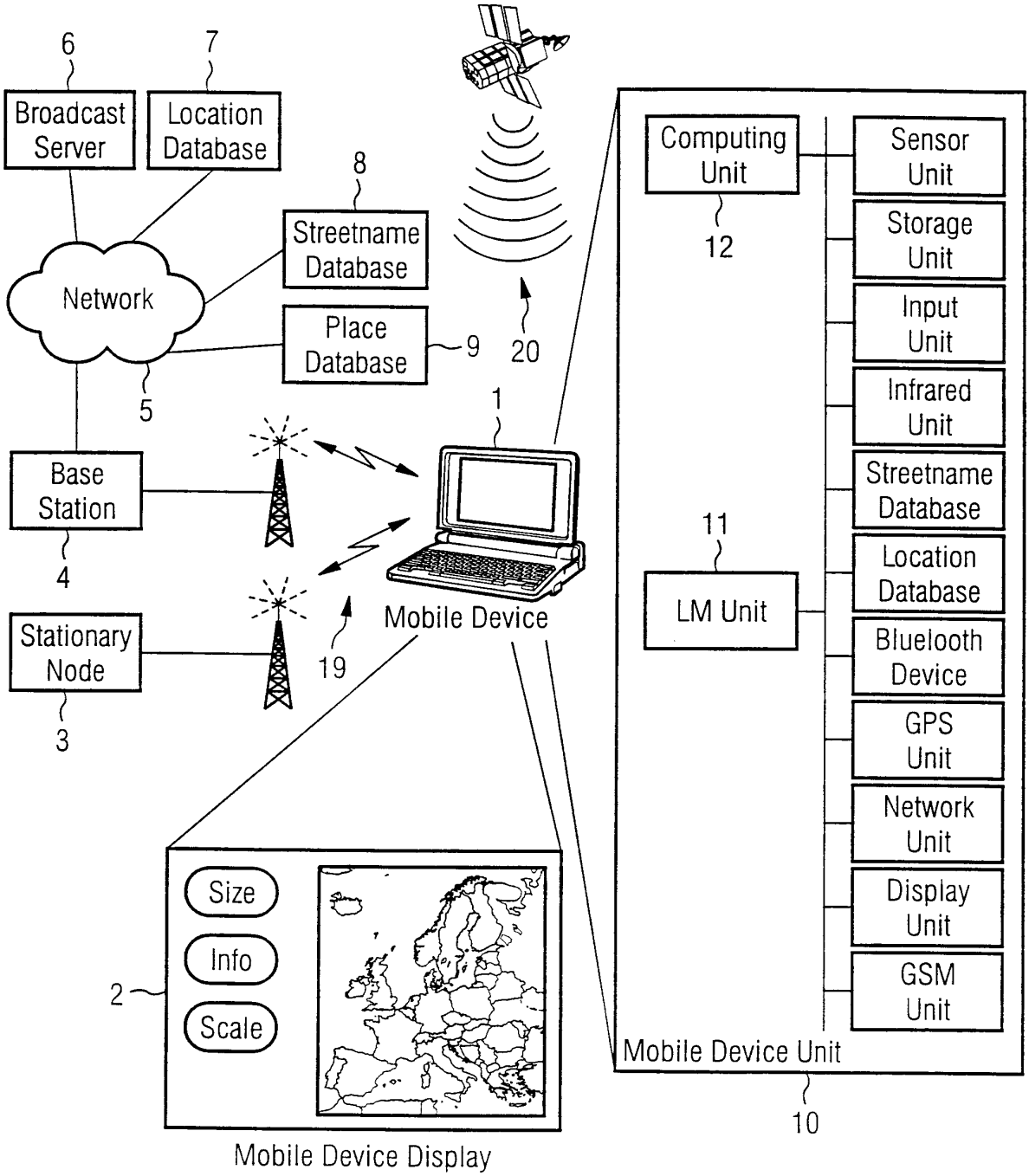

6
7
Broadcast Server
Location Database
8
Streetname Database
Network
Place Database
9
20
5
1
Base Station
4
Stationary Node
3
19
Mobile Device
Computing Unit
12
Sensor Unit
Storage Unit
Input Unit
Infrared Unit
Streetname Database
11
Location Database
LM Unit
Bluelooth Device
GPS Unit
Network Unit
Display Unit
GSM Unit
Mobile Device Unit
10
Size
Info
Scale
2
Mobile Device Display

FIG 2

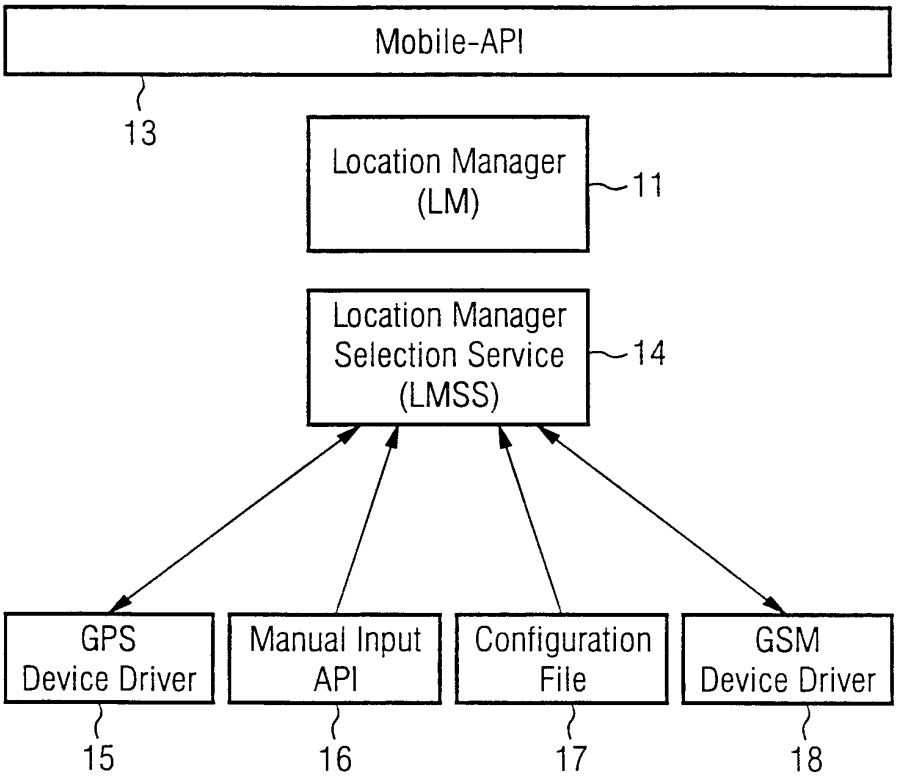

Mobile-API
13
Location Manager
(LM)
11
Location Manager
Selection Service
(LMSS)
14
GPS
Device Driver
Manual Input
API
Configuration
File
GSM
Device Driver
15
16
17
18

FIG 3

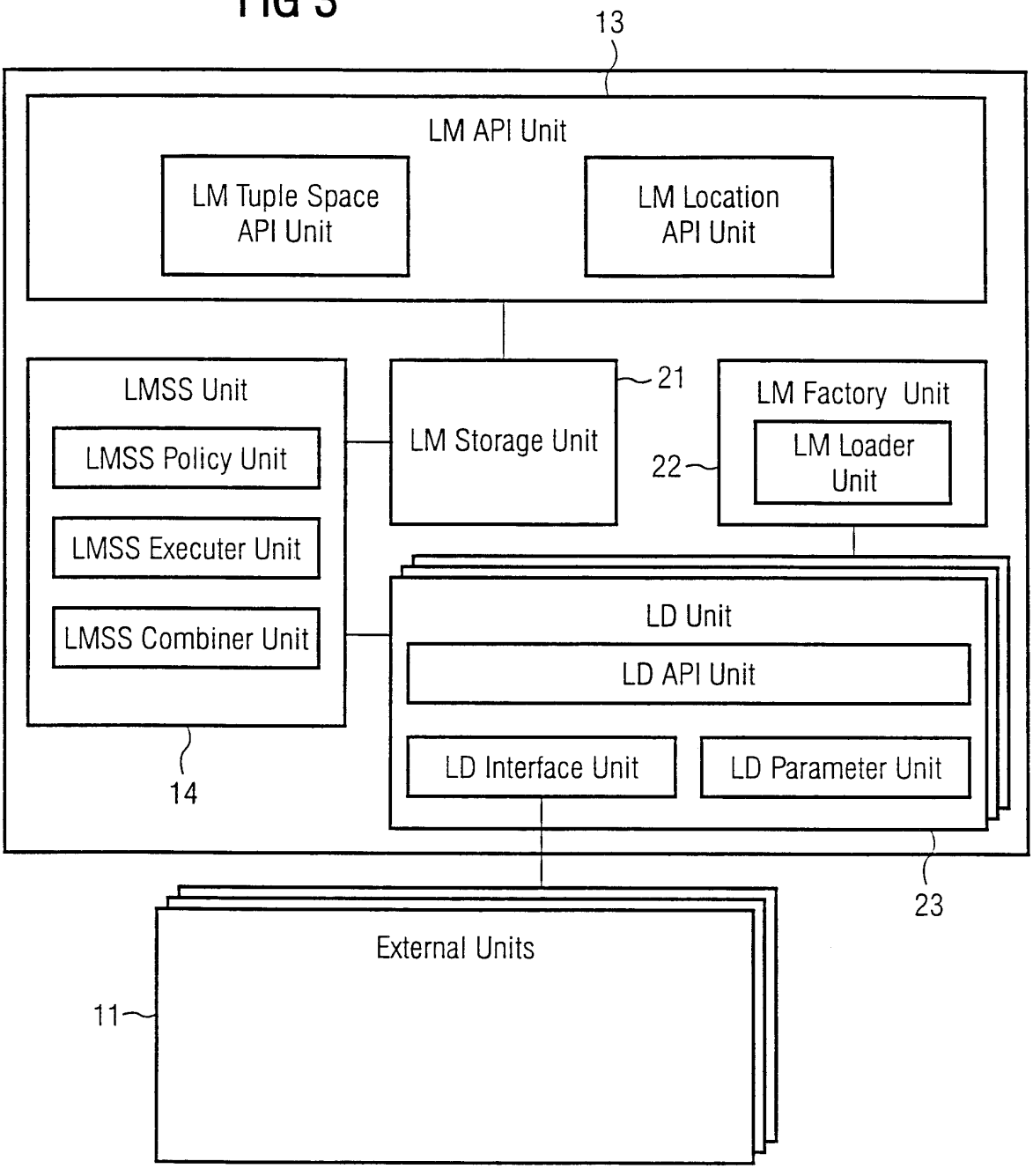
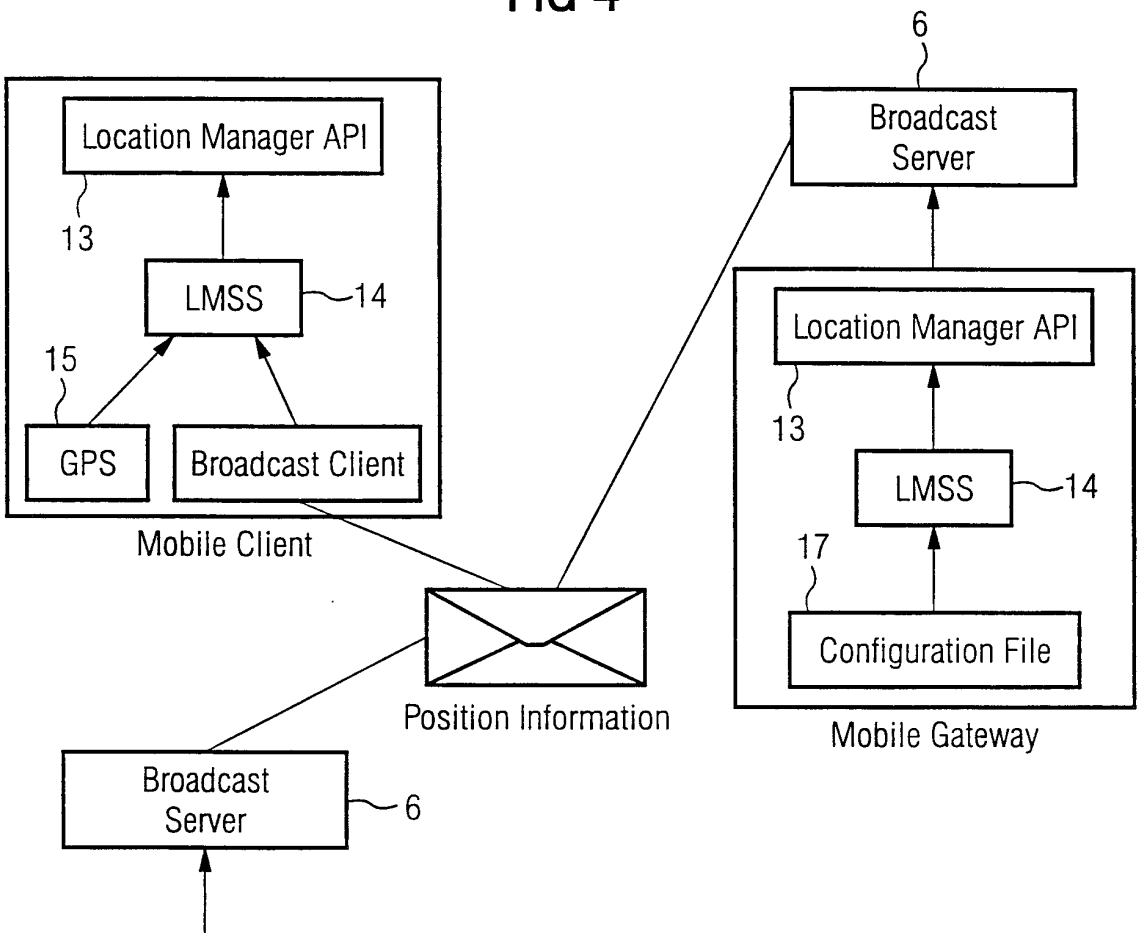

13
LM API Unit
LM Tuple Space API Unit
LM Location API Unit
LMSS Unit
LMSS Policy Unit
LMSS Executer Unit
LMSS Combiner Unit
14
LM Storage Unit
21
LM Factory Unit
22
LM Loader Unit
LD Unit
LD API Unit
LD Interface Unit
LD Parameter Unit
23
External Units
11

FIG 4


6
Broadcast Server
Location Manager API
13
LMSS
14
15
GPS
Broadcast Client
Mobile Client
Position Information
Location Manager API
13
LMSS
14
17
Configuration File
Mobile Gateway
Broadcast Server
6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 00/03329

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01S5/14 G01S1/02 G01C21/28

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 7 G01S G01C

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 practical, search terms used)
EPO-Internal, PAJ, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 906 655 A (FAN ZHEJUN) 25 May 1999 (1999-05-25) column 1, line 49 -column 2, line 3	1,10
X	DE 198 03 253 A (ANY CO) 6 August 1998 (1998-08-06) column 6, line 65 -column 7, line 11; figure 1	1,10
A	US 5 488 559 A (SEYMOUR LESLIE G) 30 January 1996 (1996-01-30) abstract	1,10

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

☒ Patent family members are listed in annex.

° 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 document 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	Date of mailing of the international search report
5 September 2000	13/09/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Haffner, R

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 00/03329

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5906655 A	25-05-1999	AU 5933698 A	15-10-1998
		GB 2323989 A	07-10-1998
		JP 10311735 A	24-11-1998
DE 19803253 A	06-08-1998	JP 10213449 A	11-08-1998
US 5488559 A	30-01-1996	DE 69423090 D	30-03-2000
		EP 0664040 A	26-07-1995
		JP 8502591 T	19-03-1996
		WO 9504325 A	09-02-1995

Form PCT/ISA/210 (patent family annex) (July 1992)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
8 December 2005 (08.12.2005)

PCT

(10) International Publication Number
WO 2005/115787 A1

(51) International Patent Classification[7]: B60K 6/04

(21) International Application Number: PCT/JP2005/010089

(22) International Filing Date: 26 May 2005 (26.05.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2004-159793 28 May 2004 (28.05.2004) JP

(71) Applicant *(for all designated States except US)*: TOYOTA JIDOSHA KABUSHIKI KAISHA [JP/JP]; 1, Toyota-cho, Toyota-shi, Aichi, 4718571 (JP).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: HARADA, Osamu [JP/JP]; c/o TOYOTA JIDOSHA KABUSHIKI KAISHA, 1, Toyota-cho, Toyota-shi, Aichi, 4718571 (JP). YAMAGUCHI, Katsuhiko [JP/JP]; c/o TOYOTA JIDOSHA KABUSHIKI KAISHA, 1, Toyota-cho, Toyota-shi, Aichi, 4718571 (JP).

(74) Agent: ITEC INTERNATIONAL PATENT FIRM; Uchisaiwaicho Dai Bldg., 3-3, Uchisaiwai-cho 1-chome, Chiyoda-ku, Tokyo 100-0011 (JP).

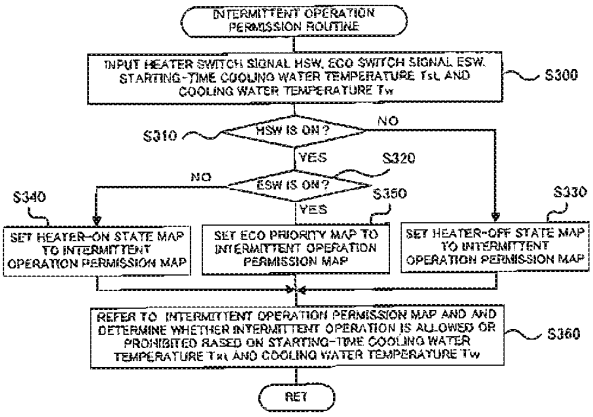
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(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), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, 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).

Published:
— *with international search report*

[Continued on next page]

(54) Title: HYBRID VEHICLE AND CONTROL METHOD THEREOF



(57) Abstract: In response to simultaneous ON settings of a heater switch signal HSW and an eco switch signal ESW, an eco priority map is set to an intermittent operation permission map (step S350). The heater switch signal HSW is output from a heater switch that is operated to warm up a passenger compartment, while the eco switch signal ESW is output from an eco switch that is operated to give preference to improvement in fuel consumption of the vehicle over the heater function. The eco priority map is designed to allow intermittent operation of an engine in a lower range of cooling water temperature Tw of the engine than that in a heater-on state map set in response to OFF setting of the eco switch signal ESW and ON setting of the heater switch signal HSW. The control procedure of the invention refers to the intermittent operation permission map and determines whether the intermittent operation of the engine is allowed or prohibited, based on the current cooling water temperature Tw and a starting-time cooling water temperature Tst, which represents a temperature of cooling water at a first start of the engine since activation of the vehicle system (step S360).

WO 2005/115787 A1

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.

DESCRIPTION

Hybrid Vehicle and Control Method Thereof

Technical Field

The present invention relates to a hybrid vehicle and a control method of a hybrid vehicle.

Background Art

One proposed hybrid vehicle is equipped with an air conditioning system to warm up a passenger compartment with an engine as a heat source and intermittently operates the engine, based on a measured internal temperature of the passenger compartment, a target temperature set in the air conditioning system, and a cooling water temperature of the engine (see, for example, Japanese Patent Laid-Open Gazette No. 9-233601). This prior art hybrid vehicle drives the engine to ensure the sufficient level of heating performance even at a stop of the vehicle or in a motor drive mode using an electric motor alone for driving, when a temperature difference ΔT between the target temperature set in the air conditioning system and the measured internal temperature of the passenger compartment is not less than a preset reference level, which depends upon the cooling water temperature of the engine.

Disclosure of the Invention

For the purpose of the environmental protection, preference may be given to the enhanced energy efficiency of the vehicle over the high-level heating performance of the passenger compartment. The permission for the intermittent operation of the engine as the heat source even in a low temperature range for the restricted heating performance sacrifices the comfortable ride of the driver and other passengers, while enhancing the energy efficiency of the vehicle. The prohibition on the intermittent operation of the engine as the heat source for the high-level heating performance, on the other hand, undesirably lowers the energy efficiency of the vehicle, while ensuring the comfortable ride of the driver and other passengers.

The present invention aims to improve the energy efficiency of the vehicle while ensuring a certain level of heating performance in a hybrid vehicle and a control method of a hybrid vehicle. The invention also aims to achieve adequate intermittent operation of an internal combustion engine in a hybrid vehicle and a control method of a hybrid vehicle.

In order to attain at least part of the above aims, a hybrid vehicle and a control method of a hybrid vehicle of the present invention is constructed as follows.

The present invention is directed to a first hybrid vehicle that is equipped with an internal combustion engine and a motor and is driven with power output from at least the motor

to a drive shaft, the hybrid vehicle including: a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment; a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to an operator's request; a cooling water temperature measurement module that measures a cooling water temperature in the internal combustion engine; a power demand setting module that sets a power demand required for the drive shaft. The first hybrid vehicle further includes an intermittent operation permission module that, in response to no reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, gives permission for intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured by the cooling water temperature measurement module is not lower than a preset first temperature, while otherwise placing a prohibition on the intermittent operation of the internal combustion engine. In response to reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, on the other hand, the intermittent operation permission module gives permission for the intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured by

the cooling water temperature measurement module is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine. The first hybrid vehicle further includes a control module that, in response to the permission for the intermittent operation of the internal combustion engine given by the intermittent operation permission module, controls the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine. In response to the prohibition on the intermittent operation of the internal combustion engine placed by the intermittent operation permission module, on the other hand, the control module controls the internal combustion engine and the motor to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine.

In the first hybrid vehicle of the invention, in response to no reception of the fuel consumption priority instruction during heating of the passenger compartment, permission for intermittent operation of the internal combustion engine is given upon condition that the cooling water temperature of the internal combustion engine is not lower than the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In

response to reception of the fuel consumption priority instruction during heating of the passenger compartment, on the other hand, permission for the intermittent operation of the internal combustion engine is given upon condition that the cooling water temperature of the internal combustion engine is not lower than the preset second temperature, which is below the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In response to the permission for the intermittent operation of the internal combustion engine, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine. In response to the prohibition on the intermittent operation of the internal combustion engine, on the contrary, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine. The first hybrid vehicle of the invention thus ensures the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine even in a lower temperature range of the cooling water of the internal combustion engine in response to reception of the fuel consumption priority instruction during heating of the passenger compartment, compared with the case with no reception

of the fuel consumption priority instruction. This arrangement effectively improves the energy efficiency of the vehicle, while ensuring a certain level of heating performance.

In one preferable embodiment of the hybrid vehicle of the invention, the intermittent operation permission module gives permission for the intermittent operation of the internal combustion engine, based on a starting-time cooling water temperature measured by the cooling water temperature measurement module at a first start of the internal combustion engine since activation of the hybrid vehicle. This is ascribed to the fact that the cooling water temperature at a start of the internal combustion engine depends upon the outside air temperature and the time period elapsed since a stop of the operation of the vehicle. This arrangement thus assures adequate intermittent operation of the internal combustion engine. The intermittent operation permission module may give permission for the intermittent operation of the internal combustion engine, based on the preset second temperature, which decreases with an increase in starting-time cooling water temperature.

In another preferable embodiment, the hybrid vehicle of the invention further includes an engine operation stop instruction module that gives an engine operation stop instruction for stopping the operation of the internal combustion engine, based on the power demand. In this embodiment, the control module may control the internal

combustion engine to be idled, in response to the engine operation stop instruction of the internal combustion engine given by the engine operation stop instruction module under the prohibition on the intermittent operation of the internal combustion engine placed by the intermittent operation permission module.

In one preferable embodiment, the hybrid vehicle of the invention includes an electric power-mechanical power input-output module that is linked to an output shaft of the internal combustion engine and to the drive shaft connecting with a predetermined axle of the hybrid vehicle and outputs at least part of power from the internal combustion engine to the drive shaft through input and output of electric powers and mechanical powers, where the motor is linked to either of the predetermined axle connecting with the drive shaft and another axle of the hybrid vehicle that is different from the predetermined axle. In this embodiment, the control module may control the electric power-mechanic power input-output module. Here, as one structure, the electric power-mechanical power input-output module may include a three shaft-type power input-output unit that is linked to three shafts, the output shaft of the internal combustion engine, the drive shaft, and a rotating shaft, and determines a power input from and output to residual one shaft based on powers input from and output to any two shafts among the three shafts, and a motor that is capable of inputting and outputting power from and to the rotating shaft.

As another structure, the electric power-mechanical power input-output module may include a pair-rotor motor that has a first rotor connected to the output shaft of the internal combustion engine and a second rotor connected to the drive shaft, where the first rotor and the second rotor rotate relative to each other to drive the pair-rotor motor.

The present invention is also directed to a second hybrid vehicle that is equipped with an internal combustion engine and a motor and is driven with power output from at least the motor to a drive shaft, the hybrid vehicle including: a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment; a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to an operator's request; a temperature measurement module that measures either of temperature of the internal combustion engine and temperature of a medium, which depends on the temperature of the internal combustion engine, and sets the measured temperature to a control temperature; and a power demand setting module that sets a power demand required for the drive shaft. The second hybrid vehicle also includes an intermittent operation permission module that, in response to no reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, gives permission for intermittent operation of the internal

combustion engine upon condition that the control temperature measured by the temperature measurement module is not lower than a preset first temperature, while otherwise placing a prohibition on the intermittent operation of the internal combustion engine. In response to reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, on the other hand, the intermittent operation permission module giving permission for the intermittent operation of the internal combustion engine upon condition that the control temperature measured by the temperature measurement module is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine. The second hybrid vehicle further includes a control module that, in response to the permission for the intermittent operation of the internal combustion engine given by the intermittent operation permission module, controls the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine. In response to the prohibition on the intermittent operation of the internal combustion engine placed by the intermittent operation permission module, on the other hand, the control module controlling the internal combustion engine and the motor to

ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine.

In the second hybrid vehicle of the invention, in response to no reception of the fuel consumption priority instruction during heating of the passenger compartment, permission for intermittent operation of the internal combustion engine is given upon condition that either the temperature of the internal combustion engine or the temperature of a medium, which depends on the temperature of the internal combustion engine, is not lower than the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In response to reception of the fuel consumption priority instruction during heating of the passenger compartment, on the other hand, permission for the intermittent operation of the internal combustion engine is given upon condition that the control temperature is not lower than the preset second temperature, which is below the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In response to the permission for the intermittent operation of the internal combustion engine, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine. In response to the prohibition on the intermittent operation of

the internal combustion engine, on the contrary, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine. The second hybrid vehicle of the invention thus ensures the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine even in a lower temperature range of the cooling water of the internal combustion engine in response to reception of the fuel consumption priority instruction during heating of the passenger compartment, compared with the case with no reception of the fuel consumption priority instruction. This arrangement effectively improves the energy efficiency of the vehicle, while ensuring a certain level of heating performance.

The present invention is further directed to a control method of a hybrid vehicle, which is equipped with an internal combustion engine, a motor, a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment, and a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to a operator's request, the hybrid vehicle being driven with power output from at least the motor to a drive shaft. The control method includes the steps of (a) setting a power demand required for the drive shaft and (b) measuring a cooling

water temperature in the internal combustion engine. The control method further includes the step (c) that, in response to no reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, gives permission for intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured in the step (b) is not lower than a preset first temperature, while otherwise placing a prohibition on the intermittent operation of the internal combustion engine, and in response to reception of the fuel consumption priority instruction given by the fuel consumption priority instruction module during heating of the passenger compartment by the heating module, gives permission for the intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured in the step (b) is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine. The control method further includes the step (d) that, in response to the permission for the intermittent operation of the internal combustion engine given in the step (c), controls the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine, and in response to the

prohibition on the intermittent operation of the internal combustion engine placed in the step (c), controls the internal combustion engine and the motor to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine.

In the control method of the invention, in response to no reception of the fuel consumption priority instruction during heating of the passenger compartment, permission for intermittent operation of the internal combustion engine is given upon condition that the cooling water temperature of the internal combustion engine is not lower than the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In response to reception of the fuel consumption priority instruction during heating of the passenger compartment, on the other hand, permission for the intermittent operation of the internal combustion engine is given upon condition that the cooling water temperature of the internal combustion engine is not lower than the preset second temperature, which is below the preset first temperature. Otherwise the prohibition is placed on the intermittent operation of the internal combustion engine. In response to the permission for the intermittent operation of the internal combustion engine, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal

combustion engine. In response to the prohibition on the intermittent operation of the internal combustion engine, on the contrary, the internal combustion engine and the motor are controlled to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine. The control method of the invention thus ensures the output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine even in a lower temperature range of the cooling water of the internal combustion engine in response to reception of the fuel consumption priority instruction during heating of the passenger compartment, compared with the case with no reception of the fuel consumption priority instruction. This arrangement effectively improves the energy efficiency of the vehicle, while ensuring a certain level of heating performance.

In one preferable embodiment of the control method of the invention, the step (c) gives permission for the intermittent operation of the internal combustion engine, based on a starting-time cooling water temperature measured by the step (b) at a first start of the internal combustion engine since activation of the hybrid vehicle. In this case, the step (c) may give permission for the intermittent operation of the internal combustion engine, based on the preset second temperature, which decreases with an increase in starting-time cooling water temperature.

In another preferable embodiment, the control method of the invention further includes the step of: (e) giving an engine operation stop instruction for stopping the operation of the internal combustion engine based on the power demand, preceding step (d). In this embodiment, the (d) controls the internal combustion engine to be idled, in response to the engine operation stop instruction of the internal combustion engine given in the step (e) under the prohibition on the intermittent operation of the internal combustion engine placed in the step (c).

Brief Description of the Drawings

Fig. 1 schematically illustrates the construction of a hybrid vehicle 20 with a power output apparatus mounted thereon in one embodiment of the invention; Fig. 2 is a flowchart showing a drive control routine executed by a hybrid electronic control unit 70; Fig. 3 is an example of a torque demand setting map; Fig. 4 shows an efficient operation line of an engine 22 to set target rotation speed Ne* and target torque Te*; Fig. 5 is an alignment chart showing dynamics of the respective rotation elements included in a power distribution integration mechanism 30; Fig. 6 is a flowchart showing an intermittent operation permission routine executed by the hybrid electronic control unit 70; Fig. 7 is an example of a heater-off state map; Fig. 8 is an example of a heater-on state map, Fig. 9 is an example of an eco priority map; Fig. 10 schematically illustrates the

construction of a hybrid vehicle 120 with a power output apparatus mounted thereon in one modified example; and Fig. 11 schematically illustrates the construction of a hybrid vehicle 220 with a power output apparatus mounted thereon in another modified example.

Best Modes of Carrying Out the Invention

One mode of carrying out the invention is discussed below as a preferred embodiment. Fig. 1 schematically illustrates the construction of a hybrid vehicle 20 with a power output apparatus mounted thereon in one embodiment of the invention. As illustrated, the hybrid vehicle 20 of the embodiment includes an engine 22, a three shaft-type power distribution integration mechanism 30 that is linked with a crankshaft 26 functioning as an output shaft of the engine 22 via a damper 28, a motor MG1 that is linked with the power distribution integration mechanism 30 and is capable of generating electric power, a reduction gear 35 that is attached to a ring gear shaft 32a functioning as a drive shaft connected with the power distribution integration mechanism 30, another motor MG2 that is linked with the reduction gear 35, an air conditioning system 90 that adjusts temperature in a passenger compartment, and a hybrid electronic control unit 70 that controls the whole power output apparatus.

The engine 22 is an internal combustion engine that consumes a hydrocarbon fuel, such as gasoline or light oil, to

output power and is under control of an engine electronic control unit (hereafter referred to as engine ECU) 24. The engine ECU 24 receives input signals from various sensors detecting the driving conditions of the engine 22, such as a cooling water temperature sensor 23 that measures cooling water temperature Tw, and carries out operation control including fuel injection control, ignition control, and intake air flow regulation. The engine ECU 24 communicates with the hybrid electronic control unit 70 and receives control signals from the hybrid electronic control unit 70 to control the operations of the engine 22, while outputting data regarding the driving conditions of the engine 22 to the hybrid electronic control unit 70 according to the requirements.

The power distribution and integration mechanism 30 has a sun gear 31 that is an external gear, a ring gear 32 that is an internal gear and is arranged concentrically with the sun gear 31, multiple pinion gears 33 that engage with the sun gear 31 and with the ring gear 32, and a carrier 34 that holds the multiple pinion gears 33 in such a manner as to allow free revolution thereof and free rotation thereof on the respective axes. Namely the power distribution and integration mechanism 30 is constructed as a planetary gear mechanism that allows for differential motions of the sun gear 31, the ring gear 32, and the carrier 34 as rotational elements. The carrier 34, the sun gear 31, and the ring gear 32 in the power distribution and integration mechanism 30 are respectively coupled with the

crankshaft 26 of the engine 22, the motor MG1, and the reduction gear 35 via the ring gear shaft 32a. While the motor MG1 functions as a generator, the power output from the engine 22 and input through the carrier 34 is distributed into the sun gear 31 and the ring gear 32 according to the gear ratio. While the motor MG1 functions as a motor, on the other hand, the power output from the engine 22 and input through the carrier 34 is combined with the power output from the motor MG1 and input through the sun gear 31 and the composite power is output to the ring gear 32. The power output to the ring gear 32 is finally transmitted to the driving wheels 63a, 63b via the gear mechanism 60 and differential gear 62 from ring gear shaft 32a.

Both of the motors MG1 and MG2 are constructed as known synchronous generator motors, which are driven as an electric generator as well as an electric motor. The motors MG1 and MG2 transmit electric power from and to a battery 50 via inverters 41 and 42. A power line 54 connecting the inverters 41 and 42 with the battery 50 includes a positive terminal bus line and a negative terminal bus line shared by the two inverters 41 and 42. This arrangement enables the electric power generated by one of the motors MG1 and MG2 to be consumed by the other motor. The motors MG1 and MG2 are both driven and controlled by a motor electronic control unit (hereinafter referred to as motor ECU) 40. The motor ECU 40 receives signals required for driving and controlling the motors MG1 and MG2, for example, signals from rotational position detection sensors 43 and 44 that detect the

rotational positions of rotors in the motors MG1 and MG2 and values of phase electric currents supplied to the motors MG1 and MG2 and detected by non-illustrated electric current sensors. The motor ECU 40 outputs switching control signals to the inverters 41 and 42. The motor ECU 40 communicates with the hybrid electronic control unit 70 and drives and controls the motors MG1 and MG2 in response to control signals from the hybrid electronic control unit 70 while outputting data regarding the driving conditions of the motors MG1 and MG2 to the hybrid electronic control unit 70 according to the requirements.

The battery 50 is controlled by a battery electronic control unit (hereinafter referred to as battery ECU) 52. The battery ECU 52 receives signals required for controlling the battery 50, for example, a value of inter-terminal voltage measured by a non-illustrated voltage sensor disposed between terminals of the battery 50, a value of charge discharge electric current measured by a non-illustrated electric current sensor attached to the power line 54 connecting with an output terminal of the battery 50, and a battery temperature Tb measured by a temperature sensor 51 attached to the battery 50. The battery ECU 52 outputs data regarding the conditions of the battery 50 to the hybrid electronic control unit 70 via communication according to the requirements. The battery ECU 52 computes a state of charge (SOC) from an accumulated value of the charge discharge electric current measured by the

electric current sensor, and an input limit Win and an output limit Wout of the battery 50 from the state of charge (SOC) and battery temperature Tb, for controlling the battery 50.

The air conditioning system 90 includes a heat exchanger 91 that is located in the cooling system of the engine 22 for heat exchange with cooling water, a blower 93 that takes the outside air or the inside air of the passenger compartment 21 into the heat exchanger 91 and sends the hot air heated through the heat exchange by the heat exchanger 91 into the passenger compartment 21, a switchover mechanism 92 that switches over the air intake source of the blower 93 between the outside air and the inside air of the passenger compartment 21, an operation panel 94 that is placed in the passenger compartment 21, and an air conditioning electronic control unit (air conditioning ECU) 98 that controls the operations of the whole air conditioning system 90. The air conditioning ECU 98 receives, via its input port (not shown), a heater switch signal HSW from a heater switch 95 that is mounted on the operation panel 94 and is operated to control on and off the heater function, an eco-switch signal ESW from an eco-switch 96 that is mounted on the operation panel 94 and is operated to give preference to improvement in fuel consumption of the vehicle over the heater function, and a passenger compartment temperature Tin from a temperature sensor 97 that is attached to the operation panel 94 to measure the internal temperature of the passenger compartment 21. The air conditioning ECU 98 drives and controls

the blower 93 in response to these input signals to adjust the passenger compartment temperature Tin to a preset level. The air conditioning ECU 98 establishes communication with the hybrid electronic control unit 70 to output data representing the present conditions of the air conditioning system 90 to the hybrid electronic control unit 70 according to the requirements.

The hybrid electronic control unit 70 is constructed as a microprocessor including a CPU 72, a ROM 74 that stores processing programs, a RAM 76 that temporarily stores data, and a non-illustrated input-output port, and a non-illustrated communication port. The hybrid electronic control unit 70 receives various inputs via the input port: an ignition signal from an ignition switch 80, a gearshift position SP from a gearshift position sensor 82 that detects the current position of a gearshift lever 81, an accelerator opening Acc from an accelerator pedal position sensor 84 that measures a step-on amount of an accelerator pedal 83, a brake pedal position BP from a brake pedal position sensor 86 that measures a step-on amount of a brake pedal 85, and a vehicle speed V from a vehicle speed sensor 88. The hybrid electronic control unit 70 communicates with the engine ECU 24, the motor ECU 40, and the battery ECU 52 via the communication port to transmit diverse control signals and data to and from the engine ECU 24, the motor ECU 40, and the battery ECU 52, as mentioned previously.

The hybrid vehicle 20 of the embodiment thus constructed

calculates a required torque, which is to be output to the ring gear shaft 32a or the drive shaft, based on the accelerator opening Acc corresponding to the driver's step-on amount of the accelerator pedal 83 and the vehicle speed V. The engine 22 and the motors MG1 and MG2 are under operation control to enable power corresponding to the calculated required torque to be actually output to the ring gear shaft 32a. The operation control of the engine 22 and the motors MG1 and MG2 has multiple modes, a torque conversion drive mode, a charge-discharge drive mode, and a motor drive mode. In the torque conversion drive mode, the engine 22 is under operation control to output a power equivalent to the required power. The motors MG1 and MG2 are driven and controlled to cause the total power output from the engine 22 to be subjected to the torque conversion by means of the power distribution and integration mechanism 30 and the motors MG1 and MG2 and to be output to the ring gear shaft 32a. In the charge-discharge drive mode, the engine 22 is under operation control to output a power equivalent to the sum of the required power and an electric power used for charging and discharging the battery 50. The motors MG1 and MG2 are driven and controlled to cause all or part of the power output from the engine 22 with a charge or a discharge of the battery 50 to be subjected to the torque conversion by means of the power distribution and integration mechanism 30 and the motors MG1 and MG2 and to be output as the required power to the ring gear shaft 32a. In the motor drive mode, the operation of the engine

22 is at a stop, while the motor MG2 is driven and controlled to output a power equivalent to the required power to the ring gear shaft 32a.

The description now regards the operations of the hybrid vehicle 20 of the embodiment constructed as discussed above, especially a series of control in response to simultaneous ON settings of the heater switch 95 and the eco-switch 96. Fig. 2 is a flowchart showing a drive control routine executed by the hybrid electronic control unit 70 in the hybrid vehicle 20 of the embodiment. This routine is carried out repeatedly at preset time intervals (for example, at every 8 msec).

In the drive control routine, the CPU 72 of the hybrid electronic control unit 70 first inputs various data required for control, that is, the accelerator opening Acc from the accelerator pedal position sensor 84, the brake pedal position BP from the brake pedal position sensor 86, the vehicle speed V from the vehicle speed sensor 88, a rotation speed Ne of the engine 22, rotation speeds Nm1 and Nm2 of the motors MG1 and MG2, and a charge-discharge power demand Pb*, the input limit Win, and the output limit Wout of the battery 50 (step S100). The rotation speed Ne of the engine 22 is computed from a crank position signal detected by a crank position sensor 23a attached to the crankshaft 26 and is received from the engine ECU 24 by communication. The rotation speeds Nm1 and Nm2 of the motors MG1 and MG2 are computed from the rotational positions of the respective rotors in the motors MG1 and MG2 detected by the

rotational position detection sensors 43 and 44 and are received from the motor ECU 40 by communication. The charge-discharge power demand Pb* of the battery 50 is set corresponding to the current state of charge (SOC) of the battery 50 and is received from the battery ECU 52 by communication. The input limit Win and the output limit Wout of the battery 50 are computed by and received from the battery ECU 52 by communication.

After the data input, the CPU 72 sets a torque demand Tr* to be output to the ring gear shaft 32a or the drive shaft linked to the drive wheels 63a and 63b as the torque required for the vehicle and a power demand P* required to drive the hybrid vehicle 20, based on the input accelerator opening Acc and the input vehicle speed V (step S110). A concrete procedure of setting the torque demand Tr* in this embodiment stores in advance variations in torque demand Tr* against the accelerator opening Acc and the vehicle speed V as a torque demand setting map in the ROM 74 and reads the torque demand Tr* corresponding to the given accelerator opening Acc and the given vehicle speed V from the map. One example of the torque demand setting map is shown in Fig. 3. This map includes braking torque variations, although this part is not directly related to the control procedure of this embodiment. The power demand P* is calculated as the sum of the product of the torque demand Tr* and a rotation speed Nr of the ring gear shaft 32a or the drive shaft, the charge-discharge power demand Pb* of the battery 50, and a potential loss. The rotation speed Nr of the ring gear shaft

32a is obtained by multiplying the vehicle speed V by a conversion coefficient k or by dividing the rotation speed Nm2 of the motor MG2 by a gear ratio Gr of the reduction gear 35.

The set power demand P* is compared with a predetermined threshold value Pref (step S120). The threshold value Pref is used as a criterion for determining whether the operation of the engine 22 is to be stopped, and is set to or around a lower limit of efficient power output from the engine 22. When the power demand P* is not less than the predetermined threshold value Pref, the CPU 72 sets a target rotation speed Ne* and a target torque Te* of the engine 22 corresponding to the power demand P* (step S130). The target rotation speed Ne* and the target torque Te* of the engine 22 are determined according to an efficient operation line of ensuring efficient operations of the engine 22 and the power demand P*. Fig. 4 shows an efficient operation line of the engine 22 to set the target rotation speed Ne* and the target torque Te*. The target rotation speed Ne* and the target torque Te* are given at an intersection of the efficient operation line and a line of constant power demand P* (= Ne* × Te*).

The CPU 72 calculates a target rotation speed Nm1* of the motor MG1 from the target rotation speed Ne* of the engine 22, the rotation speed Nr (= Nm2/Gr) of the ring gear shaft 32a, and a gear ratio ρ of the power distribution integration mechanism 30 according to Equation (1) given below, while calculating a torque command Tm1* of the motor MG1 from the

calculated target rotation speed Nm1* and the current rotation speed Nm1 of the motor MG1 according to Equation (2) given below (step S140):

$$Nm1^* = Ne^* \cdot (1+\rho)/\rho - Nm2/(Gr \cdot \rho) \quad (1)$$

$$Tm1^* = \text{Previous } Tm1^* + k1(Nm1^*-Nm1) + k2\int(Nm1^*-Nm1)dt \quad (2)$$

Equation (1) is a dynamic relational expression of the rotation elements included in the power distribution integration mechanism 30. Fig. 5 is an alignment chart showing torque-rotation speed dynamics of the respective rotation elements included in the power distribution integration mechanism 30. The left axis 'S' represents the rotation speed of the sun gear 31 that is equivalent to the rotation speed Nm1 of the motor MG1. The middle axis 'C' represents the rotation speed of the carrier 34 that is equivalent to the rotation speed Ne of the engine 22. The right axis 'R' represents the rotation speed Nr of the ring gear 32 (ring gear shaft 32a), which is obtained by multiplying the rotation speed Nm2 of the motor MG2 by the gear ratio Gr of the reduction gear 35. Equation (1) is readily introduced from this alignment chart of Fig. 5. Two thick arrows on the axis 'R' respectively show a torque that is transmitted to the ring gear shaft 32a when the torque Te* is output from the engine 22 in steady operation at a specific drive point of the target rotation speed Ne* and the target

torque Te*, and a torque that is applied to the ring gear shaft 32a via the reduction gear 35 when a torque Tm2* is output from the motor MG2. Equation (2) is a relational expression of feedback control to drive and rotate the motor MG1 at the target rotation speed Nm1*. In Equation (2) given above, 'k1' in the second term and 'k2' in the third term on the right side respectively denote a gain of the proportional and a gain of the integral term.

After calculation of the target rotation speed Nm1* and the torque command Tm1* of the motor MG1, the CPU 72 calculates a lower torque restriction Tmin and an upper torque restriction Tmax as minimum and maximum torques output from the motor MG2 according to Equations (3) and (4) given below (step S200):

$$Tmin = (Win - Tm1^{*} \cdot Nm1) / Nm2 \quad (3)$$

$$Tmax = (Wout - Tm1^{*} \cdot Nm1) / Nm2 \quad (4)$$

The lower torque restriction Tmin and the upper torque restriction Tmax are respectively given by dividing a difference between the input limit Win of the battery 50 and power consumption (power generation) of the motor MG1, which is the product of the torque command Tm1* and the input current rotation speed Nm1 of the motor MG1, and a difference between the output limit Wout of the battery 50 and the power consumption (power generation) of the motor MG1 by the input current rotation speed Nm2 of the motor MG2. The CPU 72 then calculates

a tentative motor torque Tm2tmp to be output from the motor MG2 from the torque demand Tr*, the torque command Tm1* of the motor MG1, the gear ratio ρ of the power distribution integration mechanism 30, and the gear ratio Gr of the reduction gear 35 according to Equation (5) given below (step S210):

$$Tm2tmp = (Tr^* + Tm1^* / \rho) / Gr \qquad (5)$$

The CPU 72 limits the calculated tentative motor torque Tm2tmp to the range between the lower torque restriction Tmin and the upper torque restriction Tmax to set a torque command Tm2* of the motor MG2 (step S220). Setting the torque command Tm2* of the motor MG2 in this manner restricts the torque demand Tr* to be output to the ring gear shaft 32a or the drive shaft within the range between the input limit Win and the output limit Wout of the battery 50. Equation (5) is readily introduced from the alignment chart of Fig. 5.

The CPU 72 sends the target rotation speed Ne* and the target torque Te* of the engine 22 to the engine ECU 24, while sending the torque commands Tm1* and Tm2* of the motors MG1 and MG2 to the motor ECU 40 (step S230), before exiting from the drive control routine. The engine ECU 24 receives the target rotation speed Ne* and the target torque Te* and executes fuel injection control and ignition control of the engine 22 to drive the engine 22 at the specified drive point of the target rotation speed Ne* and the target torque Te*. The motor ECU 40 receives

the torque commands Tm1* and Tm2* and executes switching control of the switching elements included in the respective inverters 41 and 42 to drive the motor MG1 with the torque command Tm1* and the motor MG2 with the torque command Tm2*.

When the power demand P* is less than the predetermined threshold value Pref at step S120, the CPU 72 determines whether the intermittent operation of the engine 22 is allowed or prohibited (step S150). The determination of step S150 follows an intermittent operation permission routine shown in the flowchart of Fig. 6 as discussed below.

In the intermittent operation permission routine, the CPU 72 first inputs data required for the determination of whether the intermitted operation of the engine 22 is allowed or prohibited, that is, the heater switch signal HSW, the eco switch signal ESW, a temperature Tst of cooling water at a first start of the engine 22 since activation of the vehicle system (hereafter referred to as starting-time cooling water temperature Tst), and a current cooling water temperature Tw (step S300). The heater switch signal HSW and the eco switch signal ESW are output by the operations of the heater switch 95 and the eco switch 96 and are received from the air conditioning ECU 98 by communication. The cooling water temperature Tw measured by the cooling water temperature sensor 23 at a first start of the engine 22 since activation of the vehicle system is set to the starting-time cooling water temperature Tst and is stored in the engine ECU 24. The

starting-time cooling water temperature Tst is accordingly received from the engine ECU 24 by communication. The current cooling water temperature Tw is measured by the cooling water temperature sensor 23 and is received from the engine ECU 24 by communication.

After the data input, the CPU 72 checks the ON-OFF settings of the heater switch signal HSW and the eco switch signal ESW (steps S310 and S320). In response to the OFF setting of the heater switch signal HSW, a heater-off state map is set to an intermittent operation permission map (step S330). In response to the ON setting of the heater switch signal HSW and the OFF setting of the eco switch signal ESW, a heater-on state map is set to the intermittent operation permission map (step S340). In response to the simultaneous ON settings of the heater switch signal HSW and the eco switch signal ESW, an eco priority map is set to the intermittent operation permission map (step S350). Respective examples of the heater-off state map, the heater-on state map, and the eco priority map are shown in Figs. 7, 8, and 9. In the heater-off state map of Fig. 7, permission for the intermittent operation of the engine 22 does not depend upon the starting-time cooling water temperature Tst. The intermittent operation of the engine 22 is allowed at the cooling water temperature Tw of not lower than a preset reference temperature T1, but is prohibited at the cooling water temperature Tw of lower than the preset reference temperature T1. This is because, in the heater-off state, there is no

necessity of controlling the intermittent operation of the engine 22 for heating the passenger compartment 21. The reference temperature T1 may be set to any arbitrary value, for example, 0°C or 10°C. In the heater-on state map of Fig. 8, when the starting-time cooling water temperature Tst is not lower than a preset reference temperature T4, permission for the intermittent operation of the engine 22 does not depend upon the starting-time cooling water temperature Tst, like the heater-off state map. The intermittent operation of the engine 22 is allowed at the cooling water temperature Tw of not lower than the preset reference temperature T1, but is prohibited at the cooling water temperature Tw of lower than the preset reference temperature T1. When the starting-time cooling water temperature Tst is lower than the preset reference temperature T4, on the other hand, the lower starting-time cooling water temperature Tst gives the higher cooling water temperature Tw as the permission temperature for the intermittent operation of the engine 22. The starting-time cooling water temperature Tst is the measured temperature of cooling water at a first start of the engine 22 since activation of the vehicle system and accordingly depends upon the outside air temperature and the time elapsed between a previous system activation and a current system activation. Especially when a sufficient time period has elapsed between the previous system activation and the current system activation, the starting-time cooling water temperature Tst well reflects the outside air

temperature. The lower outside air temperature thus heightens the permission temperature for the intermittent operation of the engine 22. The heightened permission temperature enhances the heating effects in the passenger compartment 21 in the condition of the lower outside air temperature. The reference temperature T4 may be set to any arbitrary value, for example, 10°C or 20°C. In the eco priority map of Fig. 9, when the starting-time cooling water temperature Tst is not lower than the preset reference temperature T4, permission for the intermittent operation of the engine 22 does not depend upon the starting-time cooling water temperature Tst, like the heater-off state map. The intermittent operation of the engine 22 is allowed at the cooling water temperature Tw of not lower than the preset reference temperature T1, but is prohibited at the cooling water temperature Tw of lower than the preset reference temperature T1. When the starting-time cooling water temperature Tst is lower than the preset reference temperature T4, on the other hand, the lower starting-time cooling water temperature Tst gives the higher cooling water temperature Tw as the permission temperature for the intermittent operation of the engine 22. The gradient of the permission temperature variation in the eco priority map shown by the solid line in Fig. 9 is, however, gentler than the gradient in the heater-on state map shown in Fig. 8 or by the broken line of Fig. 9. Namely the eco priority map sets the lower cooling water temperature Tw to the permission temperature for the

intermittent operation of the engine 22 than the heater-on state map. This increases the potential for permission of the intermittent operation of the engine 22 and accordingly prevents the fuel consumption from being worsened by the unnecessary continuation of the operation of the engine 22 for heating the passenger compartment 21. This control thus ensures the high fuel consumption of the vehicle.

After setting the intermittent operation permission map in response to the ON-OFF settings of the heater switch signal HSW and the eco switch signal ESW, the CPU 72 refers to the intermittent operation permission map and determines whether the intermittent operation of the engine 22 is allowed or prohibited based on the starting-time cooling water temperature Tst and the current cooling water temperature Tw input at step S300 (step S360). The intermittent operation permission routine is then terminated. In response to the simultaneous ON settings of the heater switch signal HSW and the eco switch signal ESW, the eco priority map of Fig. 9 is set to the intermittent operation permission map. Permission for or prohibition on the intermittent operation of the engine 22 accordingly depends upon whether the coordinates of the starting-time cooling water temperature Tst and the current cooling water temperature Tw input at step S300 are located in an intermittent operation permission area or in an intermittent operation prohibition area in the eco priority map.

On termination of the intermittent operation permission

routine, the control flow returns to the drive control routine of Fig. 2. When the intermittent operation of the engine 22 is allowed in the intermittent operation permission routine (step S160), the CPU 72 sets both the target rotation speed Ne* and the target torque Te* of the engine 22 to 0 in order to stop the operation of the engine 22 (step S170), and sets the torque command Tm1* of the motor MG1 to 0 (step S190). The drive control routine then sets the torque command Tm2* of the motor MG2 (steps S200 to S220) and sends the target rotation speed Ne* and the target torque Ne* of the engine 22 to the engine ECU 24 and the torque commands Tm1* and Tm2* of the motors MG1 and MG2 to the motor ECU 40 (step S230). In response to reception of the target rotation speed Ne* and the target torque Te* both set to 0, the engine ECU 24 stops the operation of the engine 22.

When the intermittent operation of the engine 22 is prohibited in the intermittent operation permission routine (step S160), on the other hand, the CPU 72 sets an idle rotation speed Nidl specified for idle operation of the engine 22 and the value 0 respectively to the target rotation speed Ne* and the target torque Te* of the engine (step S180), and sets the torque command Tm1* of the motor MG1 to 0 (step S190). The drive control routine then sets the torque command Tm2* of the motor MG2 (steps S200 to S220) and sends the target rotation speed Ne* and the target torque Ne* of the engine 22 to the engine ECU 24 and the torque commands Tm1* and Tm2* of the motors MG1

and MG2 to the motor ECU 40 (step S230). In response to reception of the target rotation speed Ne* set to the idle rotation speed Nidl and the target torque Te* set to 0, the engine ECU 24 controls the engine 22 to be idled at the idle rotation speed Nidl.

In the hybrid vehicle 20 of the embodiment described above, under the ON setting of the heater switch signal HSW, the cooling water temperature Tw of the engine 22 set to the permission temperature for the intermittent operation of the engine 22 in the ON setting of the eco switch signal ESW is lower than that in the OFF setting of the eco switch signal ESW. Such setting increases the potential for permission of the intermittent operation of the engine 22 in the ON setting of the eco switch signal ESW. This control improves the fuel consumption of the vehicle, while slightly lowering the heating performance. The higher cooling water temperature Tw is set to the permission temperature for the intermittent operation of the engine 22 with a decrease in starting-time cooling water temperature Tst, which represents the temperature of cooling water at a first start of the engine 22 since activation of the vehicle system, in the range of lower than the preset reference temperature T4. The permission temperature for the intermittent operation of the engine 22 thus well reflects the outside air temperature and the time elapsed between a previous system activation and a current system activation.

In the hybrid vehicle 20 of the embodiment, the eco

priority map and the heater-on state map are designed to set the higher cooling water temperature Tw to the permission temperature for the intermittent operation of the engine 22 with a decrease in starting-time cooling water temperature Tst in the range of lower than the preset reference temperature T4. Each of the eco priority map and the heater-on state map may be modified to set the boundary between permission for and prohibition on the intermittent operation of the engine 22 at a predetermined reference level of the cooling water temperature Tw, regardless of the starting-time cooling water temperature Tst. In such modification, the reference level in the eco priority map should be set lower than the reference level in the heater-on state map.

In the hybrid vehicle 20 of the embodiment, the eco priority map and the heater-on state map are designed to set the higher cooling water temperature Tw to the permission temperature for the intermittent operation of the engine 22 with a decrease in starting-time cooling water temperature Tst in the range of lower than the preset reference temperature T4. In another possible modification, the eco priority map may be designed to set the higher cooling water temperature Tw to the permission temperature for the intermittent operation of the engine 22 with a decrease in starting-time cooling water temperature Tst in the range of lower than another specified level, which is lower than the preset reference temperature T4.

The hybrid vehicle 20 of the embodiment refers to the

heater-on state map in the ON setting of the heater switch signal HSW and the OFF setting of the eco switch signal ESW, and determines whether the intermittent operation of the engine 22 is allowed or prohibited, based on the starting-time cooling water temperature Tst and the current cooling water temperature Tw. One modified control may unconditionally prohibit the intermittent operation of the engine 22, regardless of the starting-time cooling water temperature Tst and the current cooling water temperature Tw, in the ON setting of the heater switch signal HSW and the OFF setting of the eco switch signal ESW.

In the hybrid vehicle 20 of the embodiment, the power of the motor MG2 is output to the ring gear shaft 32a after torque conversion by the reduction gear 35. The technique of the invention may be adopted in a hybrid vehicle 120 of a modified configuration shown in Fig. 10, where the power of the motor MG2 is transmitted to a different axle (an axle linked to wheels 64a and 64b) from the axle connecting with the ring gear shaft 32a (the axle linked to the drive wheels 63a and 63b). In the hybrid vehicle 20 of the embodiment, the power of the engine 22 is output via the power distribution integration mechanism 30 to the ring gear shaft 32a or the drive shaft linked to the drive wheels 63a and 63b. The technique of the invention is also applicable to a hybrid vehicle 220 of another modified configuration that has a pair-rotor motor 230 as shown in Fig. 11. The pair-rotor motor 230 includes an inner rotor 232

connected to the crankshaft 26 of the engine 22 and an outer rotor 234 connected to the drive shaft of outputting power to the drive wheels 63a and 63b. Part of the output power of the engine 22 is transmitted to the drive shaft, while the residual part of the engine output power is converted into electric power. The technique of the invention may be applied to any hybrid vehicle that is structured to allow the intermittent operation of an engine and uses the engine as a heat source to warm up a passenger compartment.

The above embodiment is to be considered in all aspects as illustrative and not restrictive. There may be many modifications, changes, and alterations without departing from the scope or spirit of the main characteristics of the present invention. All changes within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Industrial Applicability

The technique of the invention is applicable to vehicle manufacturing industry.

CLAIMS

1. A hybrid vehicle that is equipped with an internal combustion engine and a motor and is driven with power output from at least the motor to a drive shaft, said hybrid vehicle comprising:

a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment;

a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to an operator's request;

a cooling water temperature measurement module that measures a cooling water temperature in the internal combustion engine;

a power demand setting module that sets a power demand required for the drive shaft;

an intermittent operation permission module that, in response to no reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, gives permission for intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured by said cooling water temperature measurement module is not lower than a preset first temperature, while otherwise placing a prohibition on the intermittent operation of the internal combustion engine,

in response to reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, said intermittent operation permission module giving permission for the intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured by said cooling water temperature measurement module is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine; and

a control module that, in response to the permission for the intermittent operation of the internal combustion engine given by said intermittent operation permission module, controls the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine,

in response to the prohibition on the intermittent operation of the internal combustion engine placed by said intermittent operation permission module, said control module controlling the internal combustion engine and the motor to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine.

2. A hybrid vehicle in accordance with claim 1, wherein

said intermittent operation permission module gives permission for the intermittent operation of the internal combustion engine, based on a starting-time cooling water temperature measured by said cooling water temperature measurement module at a first start of the internal combustion engine since activation of said hybrid vehicle.

3. A hybrid vehicle in accordance with claim 2, wherein said intermittent operation permission module gives permission for the intermittent operation of the internal combustion engine, based on the preset second temperature, which decreases with an increase in starting-time cooling water temperature.

4. A hybrid vehicle in accordance with claim 1, said hybrid vehicle further comprising:

an engine operation stop instruction module that gives an engine operation stop instruction for stopping the operation of the internal combustion engine, based on the power demand,

wherein said control module controls the internal combustion engine to be idled, in response to the engine operation stop instruction of the internal combustion engine given by said engine operation stop instruction module under the prohibition on the intermittent operation of the internal combustion engine placed by said intermittent operation permission module.

5. A hybrid vehicle in accordance with claim 1, said hybrid vehicle further comprising:

an electric power-mechanical power input-output module

that is linked to an output shaft of the internal combustion engine and to the drive shaft connecting with a predetermined axle of said hybrid vehicle and outputs at least part of power from the internal combustion engine to the drive shaft through input and output of electric powers and mechanical powers,

wherein the motor is linked to either of the predetermined axle connecting with the drive shaft and another axle of said hybrid vehicle that is different from the predetermined axle, and

said control module controls said electric power-mechanic power input-output module.

6. A hybrid vehicle in accordance with claim 5,

wherein said electric power-mechanical power input-output module comprises a three shaft-type power input-output unit that is linked to three shafts, the output shaft of the internal combustion engine, the drive shaft, and a rotating shaft, and determines a power input from and output to residual one shaft based on powers input from and output to any two shafts among the three shafts, and a motor that is capable of inputting and outputting power from and to the rotating shaft.

7. A hybrid vehicle in accordance with claim 5,

wherein said electric power-mechanical power input-output module comprises a pair-rotor motor that has a first rotor connected to the output shaft of the internal combustion engine and a second rotor connected to the drive

shaft, where the first rotor and the second rotor rotate relative to each other to drive the pair-rotor motor.

8. A hybrid vehicle that is equipped with an internal combustion engine and a motor and is driven with power output from at least the motor to a drive shaft, said hybrid vehicle comprising:

a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment;

a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to an operator's request;

a temperature measurement module that measures either of temperature of the internal combustion engine and temperature of a medium, which depends on the temperature of the internal combustion engine, and sets the measured temperature to a control temperature;

a power demand setting module that sets a power demand required for the drive shaft;

an intermittent operation permission module that, in response to no reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, gives permission for intermittent operation of the internal combustion engine upon condition that the control temperature measured by said temperature measurement module is not lower than a preset first temperature, while otherwise

placing a prohibition on the intermittent operation of the internal combustion engine,

in response to reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, said intermittent operation permission module giving permission for the intermittent operation of the internal combustion engine upon condition that the control temperature measured by said temperature measurement module is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine; and

a control module that, in response to the permission for the intermittent operation of the internal combustion engine given by said intermittent operation permission module, controls the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine,

in response to the prohibition on the intermittent operation of the internal combustion engine placed by said intermittent operation permission module, said control module controlling the internal combustion engine and the motor to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal

combustion engine.

9. A control method of a hybrid vehicle, which is equipped with an internal combustion engine, a motor, a heating module that uses the internal combustion engine as a heat source to warm up a passenger compartment, and a fuel consumption priority instruction module that gives a fuel consumption priority instruction for giving preference to fuel consumption, in response to a operator's request, said hybrid vehicle being driven with power output from at least the motor to a drive shaft,

said control method comprising the steps of:

(a) setting a power demand required for the drive shaft;

(b) measuring a cooling water temperature in the internal combustion engine;

(c) in response to no reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, giving permission for intermittent operation of the internal combustion engine upon condition that the cooling water temperature measured in said step (b) is not lower than a preset first temperature, while otherwise placing a prohibition on the intermittent operation of the internal combustion engine,

in response to reception of the fuel consumption priority instruction given by said fuel consumption priority instruction module during heating of the passenger compartment by said heating module, giving permission for the intermittent

operation of the internal combustion engine upon condition that the cooling water temperature measured in said step (b) is not lower than a preset second temperature, which is below the preset first temperature, while otherwise placing the prohibition on the intermittent operation of the internal combustion engine; and

(d) in response to the permission for the intermittent operation of the internal combustion engine given in said step (c), controlling the internal combustion engine and the motor to ensure an output power level corresponding to the power demand to the drive shaft with the intermittent operation of the internal combustion engine,

in response to the prohibition on the intermittent operation of the internal combustion engine placed in said step (c), controlling the internal combustion engine and the motor to ensure the output power level corresponding to the power demand to the drive shaft with continuous operation of the internal combustion engine.

10. A control method in accordance with claim 9, wherein said step (c) gives permission for the intermittent operation of the internal combustion engine, based on a starting-time cooling water temperature measured by said step (b) at a first start of the internal combustion engine since activation of said hybrid vehicle.

11. A control method in accordance with claim 10, wherein said step (c) gives permission for the intermittent operation

of the internal combustion engine, based on the preset second temperature, which decreases with an increase in starting-time cooling water temperature.

12. A control method in accordance with claim 9, said control method further comprising the step of:

(e) giving an engine operation stop instruction for stopping the operation of the internal combustion engine based on the power demand, preceding step (d),

wherein said (d) controls the internal combustion engine to be idled, in response to the engine operation stop instruction of the internal combustion engine given in said step (e) under the prohibition on the intermittent operation of the internal combustion engine placed in said step (c).

Fig. 1

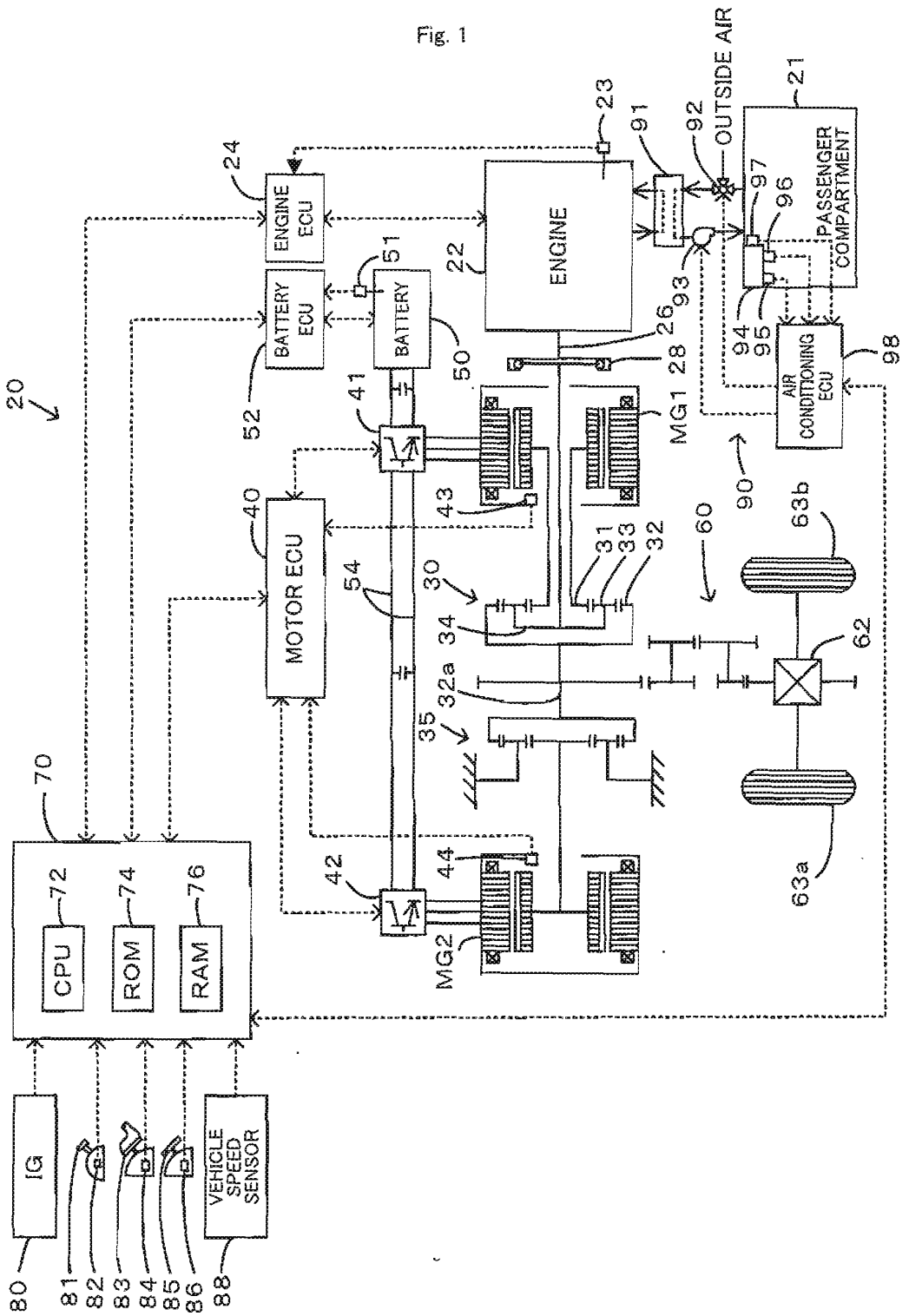

20
70
CPU
72
ROM
74
RAM
76
IG
80
81
82
83
84
85
86
VEHICLE SPEED SENSOR
88
ENGINE ECU
24
BATTERY ECU
52
BATTERY
51
50
MOTOR ECU
40
41
42
43
44
54
MG1
MG2
ENGINE
22
23
26
28
30
31
32
33
34
35
32a
60
62
63a
63b
91
92
OUTSIDE AIR
93
94
95
96
97
PASSENGER COMPARTMENT
21
AIR CONDITIONING ECU
98
90

Fig. 2

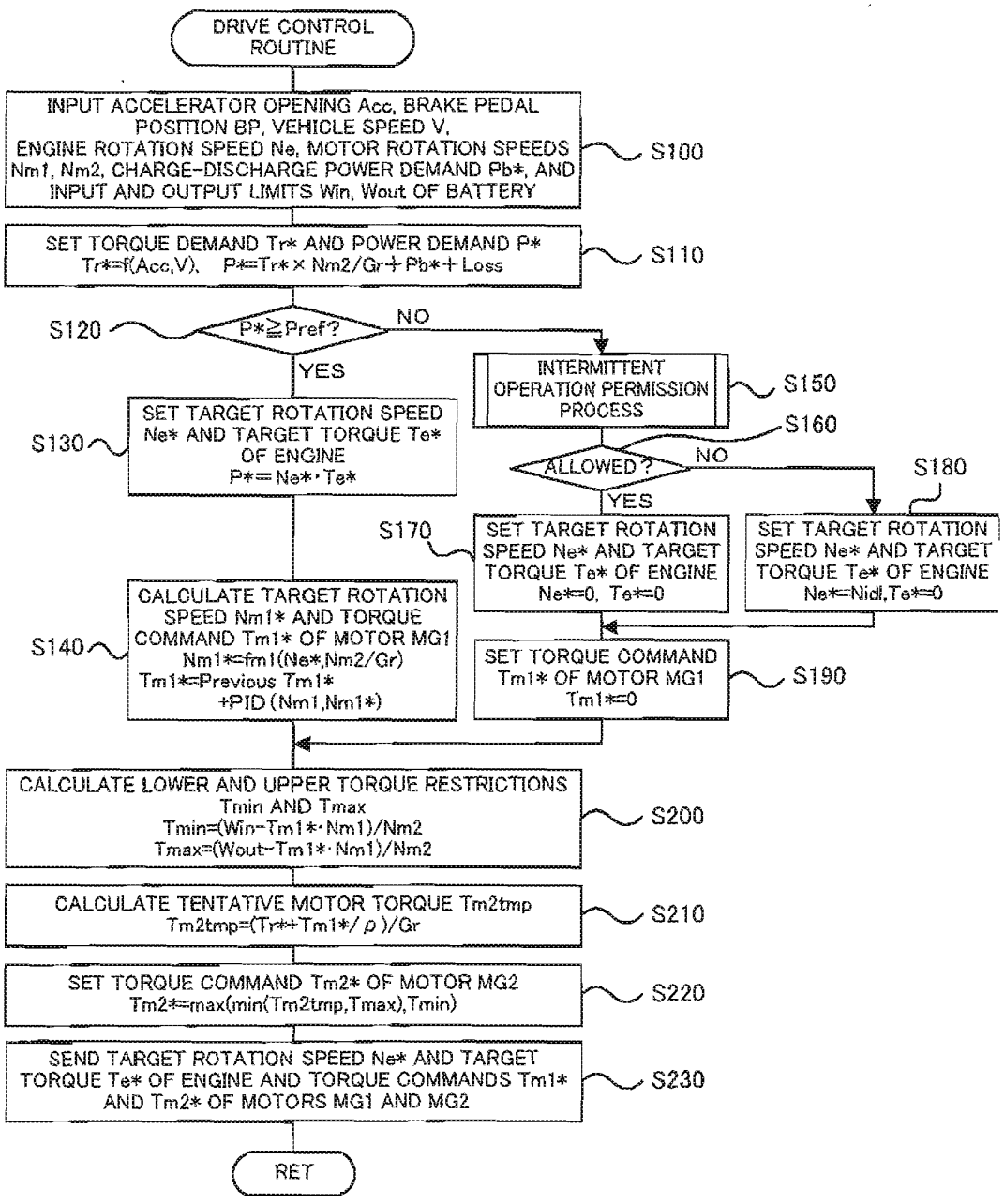

DRIVE CONTROL ROUTINE
INPUT ACCELERATOR OPENING Acc, BRAKE PEDAL POSITION BP, VEHICLE SPEED V, ENGINE ROTATION SPEED Ne, MOTOR ROTATION SPEEDS Nm1, Nm2, CHARGE-DISCHARGE POWER DEMAND Pb*, AND INPUT AND OUTPUT LIMITS Win, Wout OF BATTERY
S100
SET TORQUE DEMAND Tr* AND POWER DEMAND P*
Tr*=f(Acc,V), P*=Tr*×Nm2/Gr+Pb*+Loss
S110
S120
P*≧Pref?
NO
YES
INTERMITTENT OPERATION PERMISSION PROCESS
S150
S160
ALLOWED?
NO
YES
S180
S130
SET TARGET ROTATION SPEED Ne* AND TARGET TORQUE Te* OF ENGINE
P*=Ne*·Te*
S170
SET TARGET ROTATION SPEED Ne* AND TARGET TORQUE Te* OF ENGINE
Ne*=0, Te*=0
SET TARGET ROTATION SPEED Ne* AND TARGET TORQUE Te* OF ENGINE
Ne*=Nidl,Te*=0
S140
CALCULATE TARGET ROTATION SPEED Nm1* AND TORQUE COMMAND Tm1* OF MOTOR MG1
Nm1*=fm1(Ne*,Nm2/Gr)
Tm1*=Previous Tm1*+PID(Nm1,Nm1*)
SET TORQUE COMMAND Tm1* OF MOTOR MG1
Tm1*=0
S190
CALCULATE LOWER AND UPPER TORQUE RESTRICTIONS Tmin AND Tmax
Tmin=(Win-Tm1*·Nm1)/Nm2
Tmax=(Wout-Tm1*·Nm1)/Nm2
S200
CALCULATE TENTATIVE MOTOR TORQUE Tm2tmp
Tm2tmp=(Tr*+Tm1*/ρ)/Gr
S210
SET TORQUE COMMAND Tm2* OF MOTOR MG2
Tm2*=max(min(Tm2tmp,Tmax),Tmin)
S220
SEND TARGET ROTATION SPEED Ne* AND TARGET TORQUE Te* OF ENGINE AND TORQUE COMMANDS Tm1* AND Tm2* OF MOTORS MG1 AND MG2
S230
RET

Fig. 3

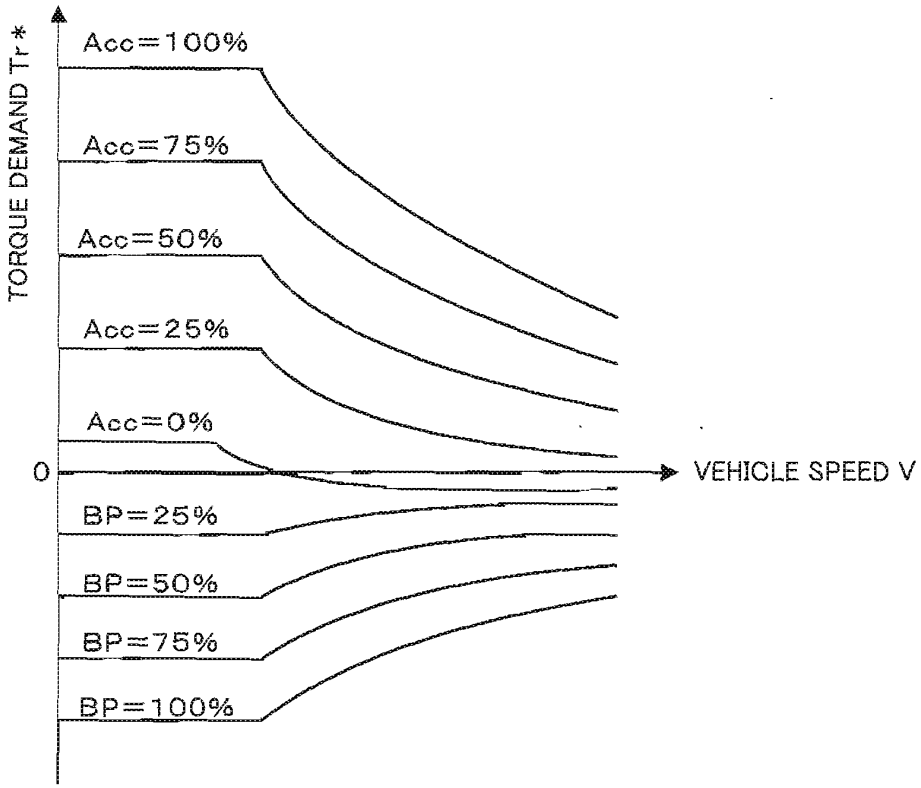

TORQUE DEMAND Tr*
Acc=100%
Acc=75%
Acc=50%
Acc=25%
Acc=0%
0
VEHICLE SPEED V
BP=25%
BP=50%
BP=75%
BP=100%

Fig. 4

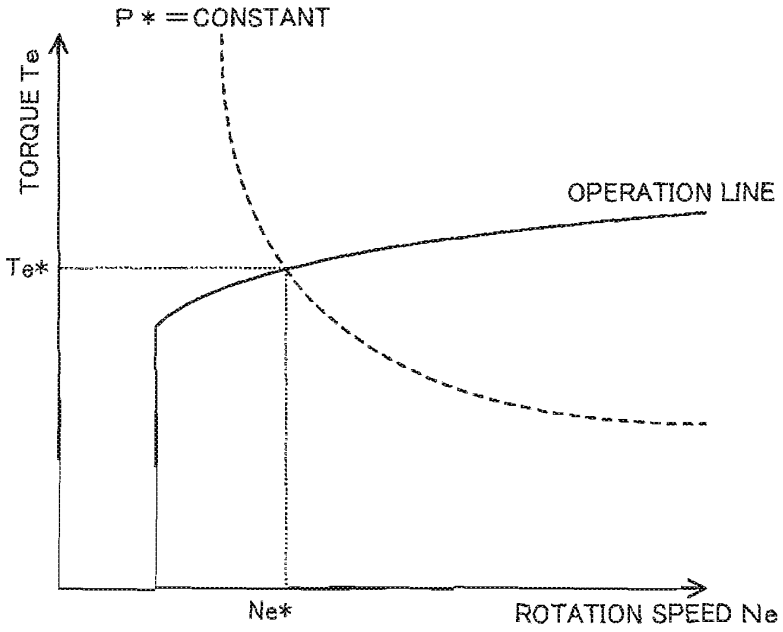

P*=CONSTANT
TORQUE Te
OPERATION LINE
Te*
Ne*
ROTATION SPEED Ne

Fig. 5

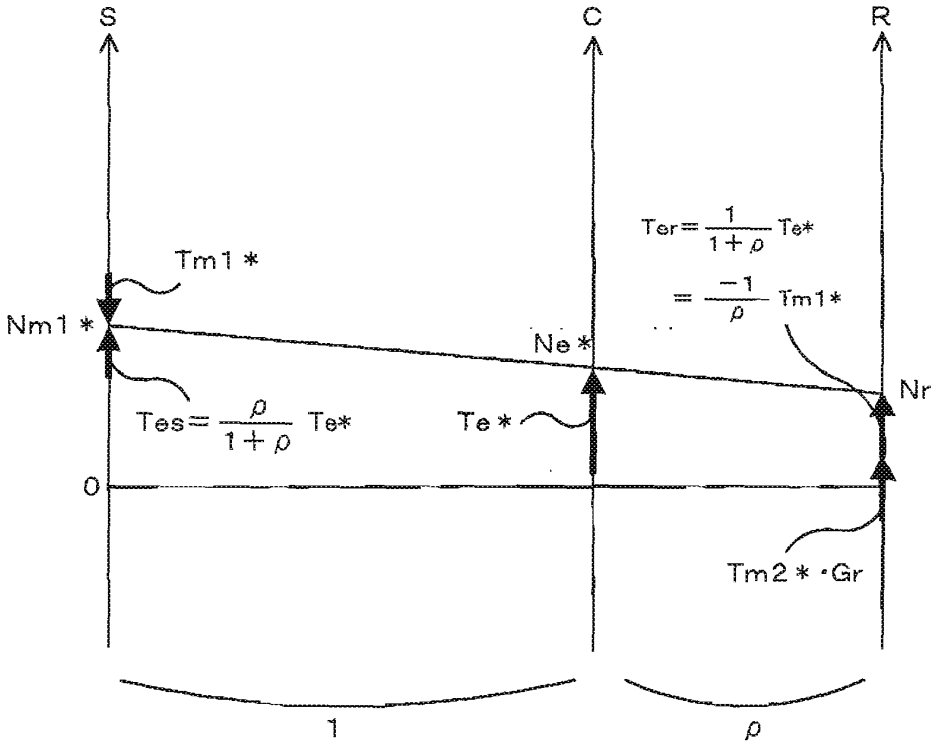


Fig. 6

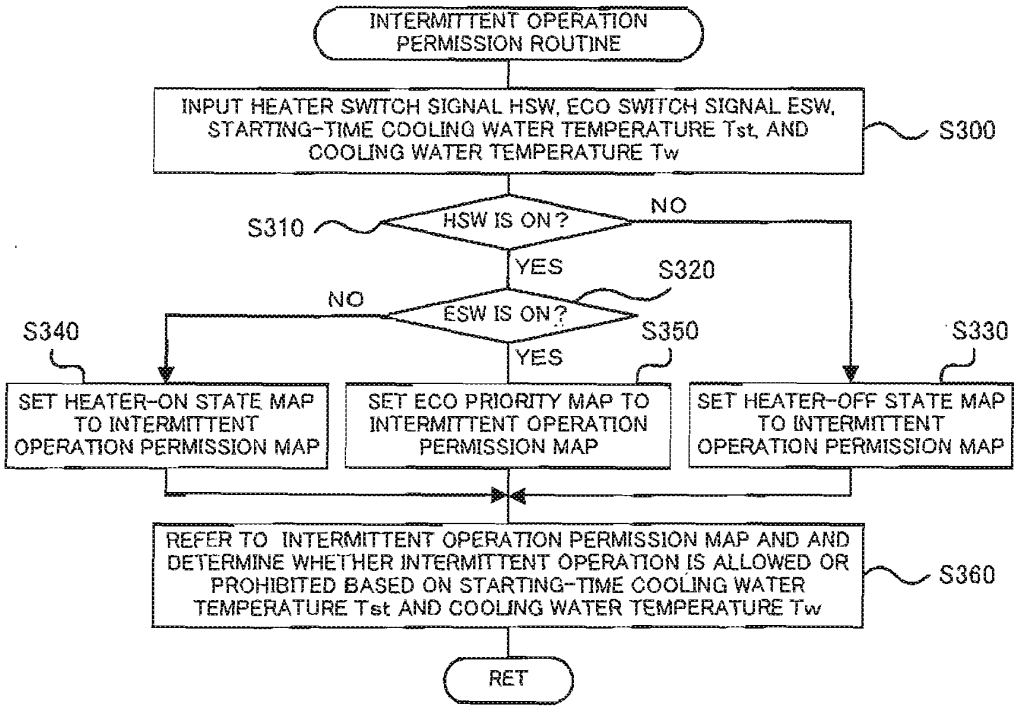

INTERMITTENT OPERATION PERMISSION ROUTINE
INPUT HEATER SWITCH SIGNAL HSW, ECO SWITCH SIGNAL ESW, STARTING-TIME COOLING WATER TEMPERATURE Tst, AND COOLING WATER TEMPERATURE Tw
S300
S310
HSW IS ON?
NO
YES
S320
ESW IS ON?
NO
YES
S340
S350
S330
SET HEATER-ON STATE MAP TO INTERMITTENT OPERATION PERMISSION MAP
SET ECO PRIORITY MAP TO INTERMITTENT OPERATION PERMISSION MAP
SET HEATER-OFF STATE MAP TO INTERMITTENT OPERATION PERMISSION MAP
REFER TO INTERMITTENT OPERATION PERMISSION MAP AND AND DETERMINE WHETHER INTERMITTENT OPERATION IS ALLOWED OR PROHIBITED BASED ON STARTING-TIME COOLING WATER TEMPERATURE Tst AND COOLING WATER TEMPERATURE Tw
S360
RET

Fig. 7

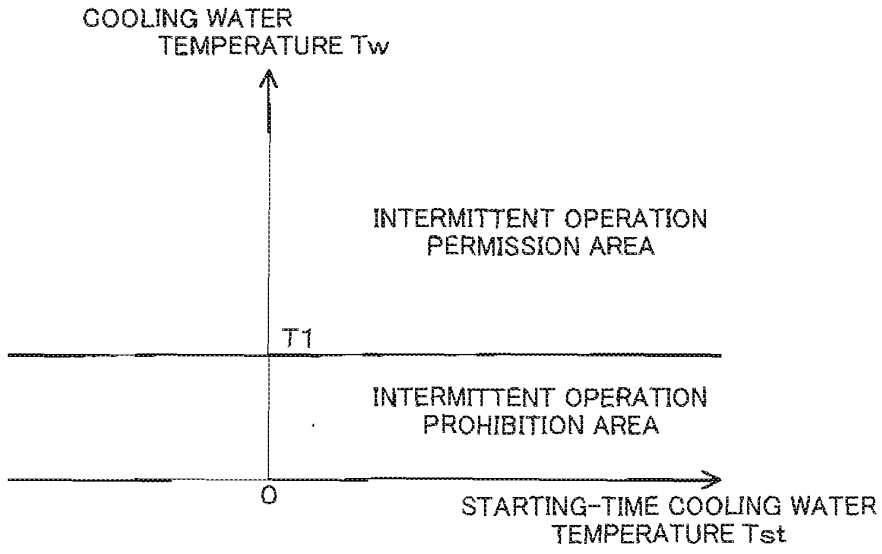

COOLING WATER TEMPERATURE Tw
INTERMITTENT OPERATION PERMISSION AREA
T1
INTERMITTENT OPERATION PROHIBITION AREA
0
STARTING-TIME COOLING WATER TEMPERATURE Tst

Fig. 8

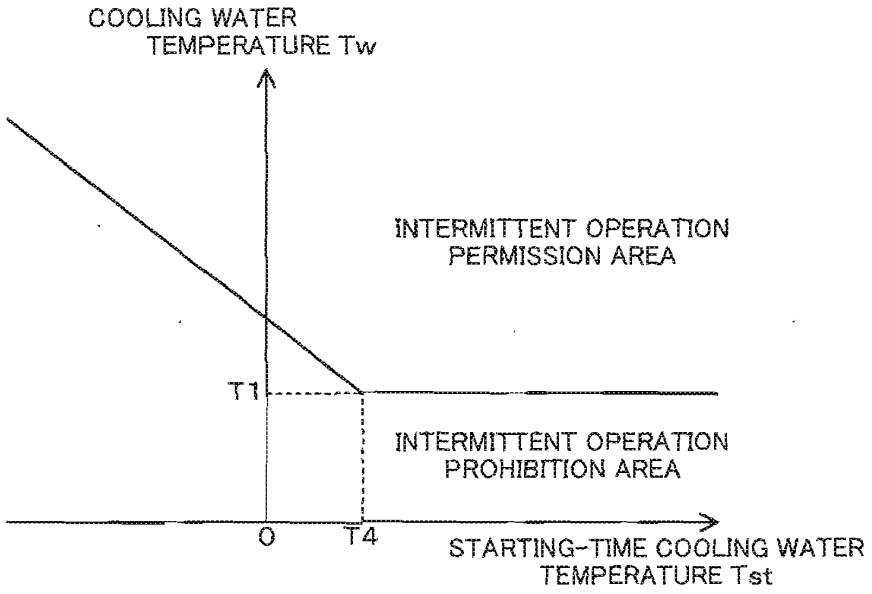

COOLING WATER
TEMPERATURE Tw
INTERMITTENT OPERATION
PERMISSION AREA
T1
INTERMITTENT OPERATION
PROHIBITION AREA
0
T4
STARTING-TIME COOLING WATER
TEMPERATURE Tst

Fig. 9

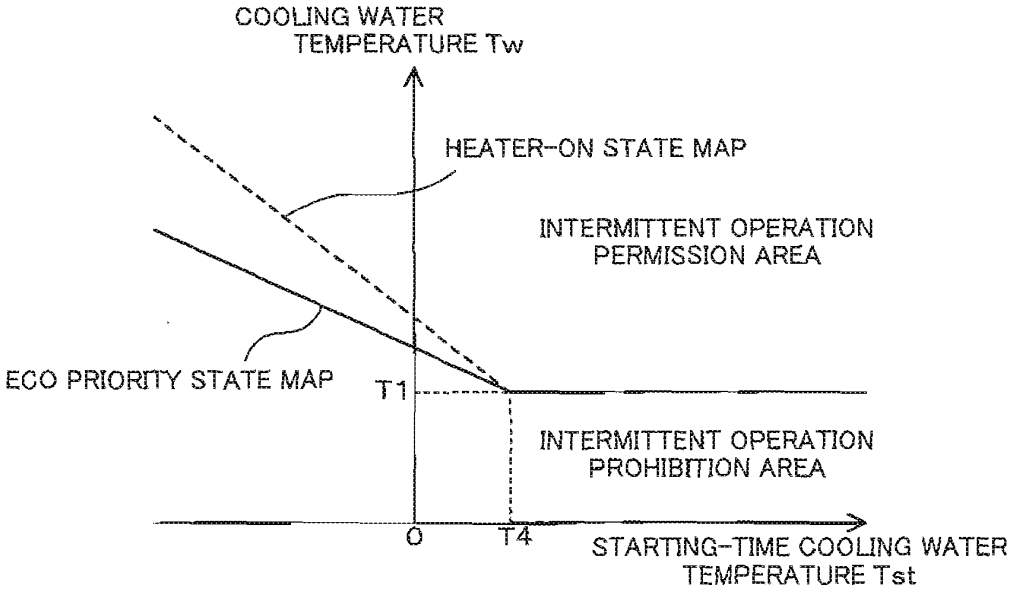

COOLING WATER
TEMPERATURE Tw
HEATER-ON STATE MAP
INTERMITTENT OPERATION
PERMISSION AREA
ECO PRIORITY STATE MAP
T1
INTERMITTENT OPERATION
PROHIBITION AREA
0
T4
STARTING-TIME COOLING WATER
TEMPERATURE Tst

Fig. 10

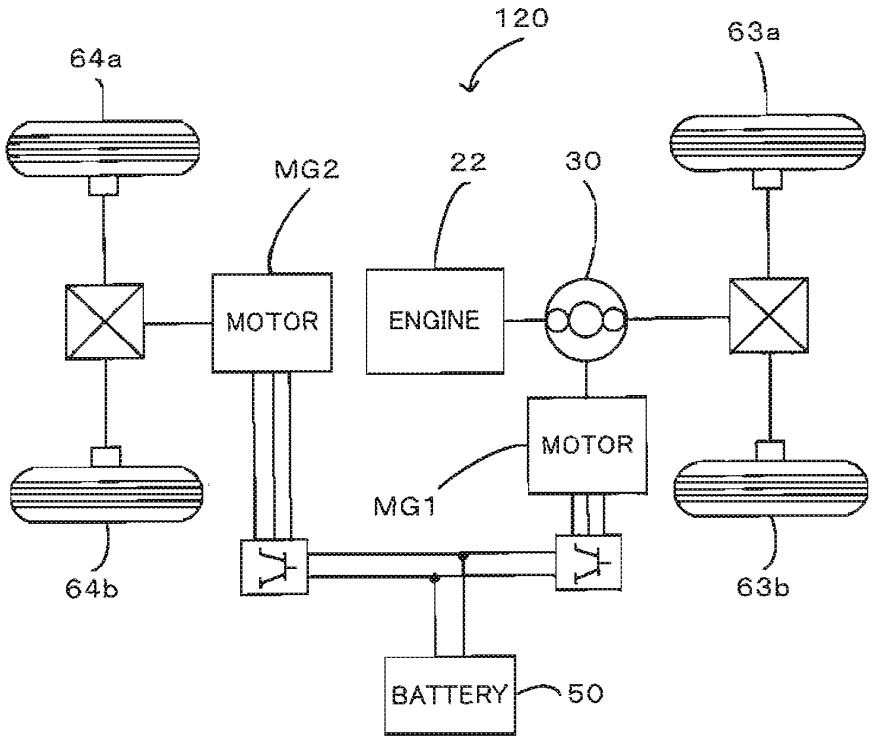
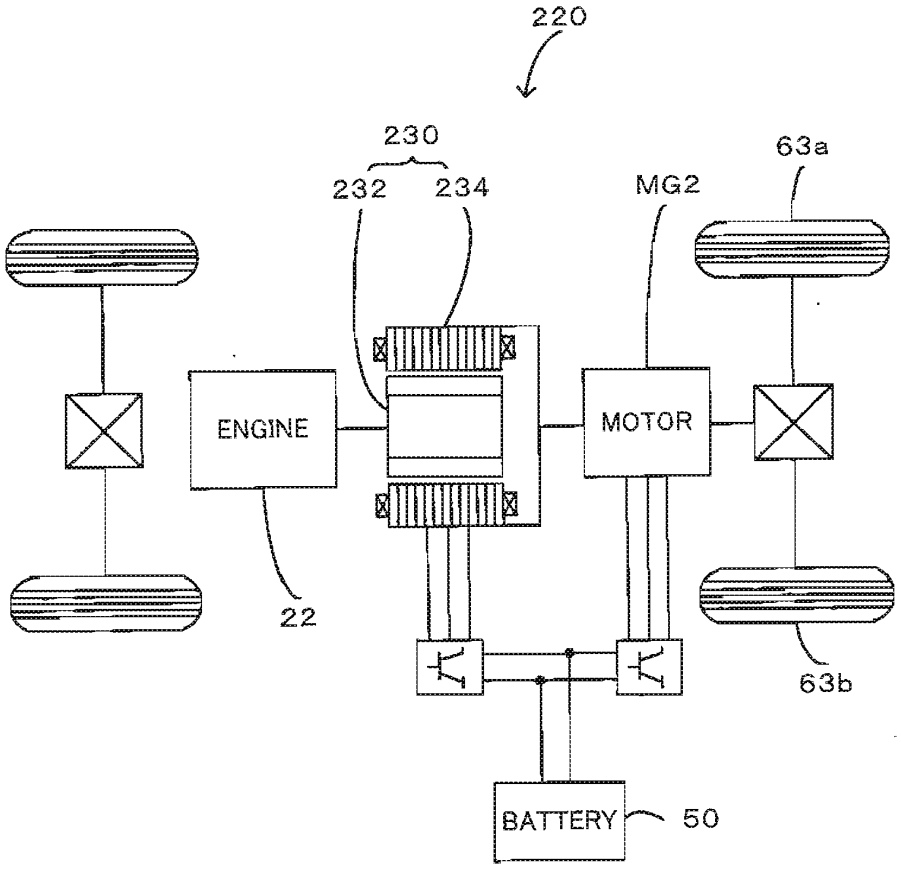

120
64a
63a
MG2
22
30
MOTOR
ENGINE
MOTOR
MG1
64b
63b
BATTERY
50

Fig. 11



INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP2005/010089

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60K6/04

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 7 B60K B60H

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 100 38 280 A1 (HONDA GIKEN KOGYO K.K., TOKIO/TOKYO) 1 March 2001 (2001-03-01) abstract; figures	1,8,9
A	EP 1 391 338 A (HONDA GIKEN KOGYO KABUSHIKI KAISHA) 25 February 2004 (2004-02-25) abstract; figures paragraph '0039!	1,8,9
A	DE 198 01 167 C1 (DAIMLERCHRYSLER AG, 70567 STUTTGART, DE) 29 April 1999 (1999-04-29) abstract; figures	1,8,9

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

☒ Patent family members are listed in annex.

° 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 document 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	Date of mailing of the international search report
19 August 2005	25/08/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Wagner, H

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP2005/010089

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10038280 A1	01-03-2001	JP 2001050074 A	23-02-2001
		US 6532926 B1	18-03-2003
EP 1391338 A	25-02-2004	JP 2004084479 A	18-03-2004
		DE 60300708 D1	30-06-2005
		EP 1391338 A1	25-02-2004
		US 2004055305 A1	25-03-2004
DE 19801167 C1	29-04-1999	NONE	

Form PCT/ISA/210 (patent family annex) (January 2004)

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

PCT

(43) International Publication Date
8 May 2008 (08.05.2008)

(10) International Publication Number
WO 2008/053789 A1

(51) International Patent Classification:
G06F 15/78 (2006.01) *H01L 29/786* (2006.01)
H01L 27/08 (2006.01)

(21) International Application Number:
PCT/JP2007/070868

(22) International Filing Date: 19 October 2007 (19.10.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2006-296650 31 October 2006 (31.10.2006) JP

(71) Applicant *(for all designated States except US)*: SEMICONDUCTOR ENERGY LABORATORY CO., LTD. [JP/JP]; 398, Hase, Atsugi-shi, Kanagawa, 2430036 (JP).

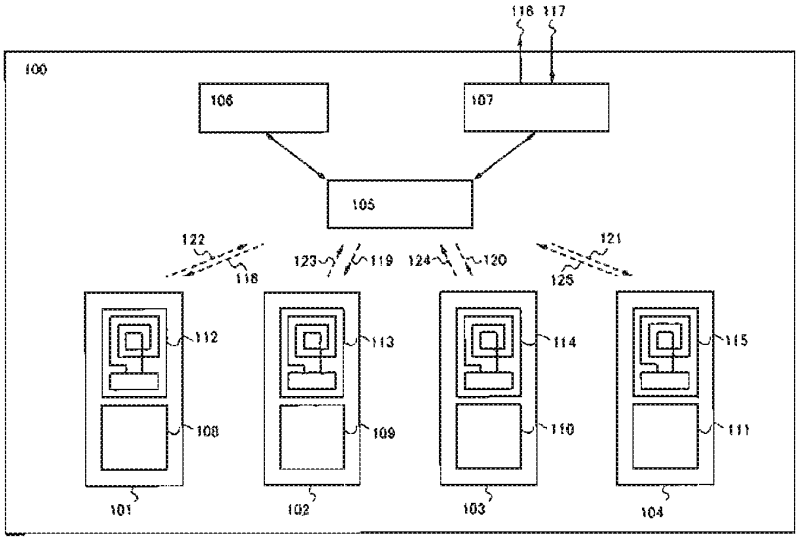
(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: KUROKAWA, Yoshiyuki [JP/JP]; c/o SEMICONDUCTOR ENERGY LABORATORY CO., LTD., 398, Hase, Atsugi-shi, Kanagawa, 2430036 (JP).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(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), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, 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).

Published:
— *with international search report*

(54) Title: SEMICONDUCTOR DEVICE



(57) Abstract: In a multi-core semiconductor device, a data bus between CPUs or the like consumes a larger amount of power. By provision of a plurality of CPUs which transmit data by a backscattering method of a wireless signal, a router circuit which mediates data transmission and reception between the CPUs or the like, and a thread control circuit which has a thread scheduling function, a semiconductor device which consumes less power and has high arithmetic performance can be provided at low cost.

WO 2008/053789 A1

DESCRIPTION

SEMICONDUCTOR DEVICE

TECHNICAL FIELD

[0001]

The present invention relates to a semiconductor device having a plurality of CPUs, which is called a multi-core semiconductor device.

BACKGROUND ART

[0002]

Currently, almost all central processing units (CPUs) included in semiconductor devices adopt an architecture called a stored-program system. In this stored-program system, instructions to be processed by a CPU and data necessary for the processing are stored in a memory, and the CPU performs processing by sequentially reading data from the memory. Therefore, for the semiconductor device having a CPU, techniques for increasing an operating frequency of CPU and increasing a memory access rate are employed in order to improve performance.

[0003]

The semiconductor device can have higher arithmetic processing performance by increasing the operating frequency of the CPU. However, the amount of electric power consumed by the semiconductor device is increased in proportion to the operating frequency. In addition, an increase in operating frequency generally requires an increase in circuit size of the CPU. Thus, the CPU consumes more power as the operating frequency is increased. Therefore, there has been proposed a system for improving overall processing performance of a semiconductor device by providing a plurality of CPUs which consume less power due to suppressed circuit size and operating frequency and by distributing processes to all of the CPUs (for example, Reference 1: Japanese Published Patent Application No. 2006-268070). Such a system may be referred to as a multi-core system.

[0004]

As the multi-core system, various structures and data processing methods have been proposed, such as a symmetric multiprocessing (SMP) system where CPUs are treated equally, an asymmetric multiprocessing (AMP) system where CPUs are treated unequally, a single instruction multiple data (SIMD) method in which plural pieces of data are processed with a single instruction, and a multiple instruction multiple data (MIMD) method in which plural pieces of data are processed with plural instructions. The multi-core system can reduce power consumption of each CPU.

DISCLOSURE OF INVENTION

[0005]

However, even if the multi-core system is employed, since data transmission and reception between CPUs or the like become necessary, an increase in the amount of power consumed by a data bus for them becomes a problem.

[0006]

In view of the above problem, it is an object of the present invention to provide a semiconductor device which is prevented from consuming more power even if it has a plurality of CPUs.

[0007]

A semiconductor device of the present invention includes a plurality of CPUs, a router circuit, and a thread control circuit. Each CPU functions to transmit and receive data to and from the router circuit with a wireless signal. The router circuit functions to transmit and receive data to and from each CPU with a wireless signal. The thread control circuit has a function to allocate an instruction to be executed by each CPU, i.e., a scheduling function.

[0008]

Data transmission from each CPU to the router circuit is carried out through modulation of a wireless signal. Modulation such as phase modulation or amplitude modulation is achieved by turning on or off a switch of a wireless circuit included in each CPU. With the use of such a modulation method, i.e., a backscattering method, the

amount of power needed for data transmission from each CPU can be reduced.

[0009]

A feature of the semiconductor device of the present invention disclosed in this specification is to include a plurality of CPUs, a router circuit, a thread control circuit connected to the router circuit through a first bus, and an external device controller connected to the router circuit through a second bus. Each of the plurality of CPUs includes a first wireless circuit which includes a first antenna circuit, a first demodulation circuit, and a first modulation circuit and a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register. The router circuit includes a data processing circuit and a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit. The first wireless circuit and the second wireless circuit each function to transmit and receive data between the CPU and the router circuit with a wireless signal. The first wireless circuit functions to transmit data to the second wireless circuit by a backscattering method. The data processing circuit functions to process and store first data to be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller. The thread control circuit functions to appropriately allocate an instruction to be executed by the CPU core to the CPU core. The external device controller functions to transmit and receive data to and from an external device which is connected through an external data input line and an external data output line.

[0010]

Another feature of the semiconductor device of the present invention disclosed in this specification is to include a plurality of CPUs, a router circuit, a thread control circuit connected to the router circuit through a first bus, and an external device controller connected to the router circuit through a second bus. Each of the plurality of CPUs includes a first wireless circuit which includes a first antenna circuit, a first demodulation circuit, a first modulation circuit, and a power supply circuit and a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register. The power supply circuit functions to generate a power supply voltage to be

supplied to the CPU from a wireless signal received by the first antenna circuit. The router circuit includes a data processing circuit and a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit. The first wireless circuit and the second wireless circuit function to transmit and receive data between the CPU and the router circuit with a wireless signal. The first wireless circuit functions to transmit data to the second wireless circuit by a backscattering method. The data processing circuit functions to process and store first data to be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller. The thread control circuit functions to appropriately allocate an instruction to be executed by the CPU core to the CPU core. The external device controller functions to transmit and receive data to and from an external device which is connected through an external data input line and an external data output line.

[0011]

Another feature of the semiconductor device of the present invention disclosed in this specification is to include a plurality of CPUs, a router circuit, a thread control circuit connected to the router circuit through a first bus, and an external device controller connected to the router circuit through a second bus. Each of the plurality of CPUs includes a first wireless circuit which includes a first antenna circuit, a third antenna circuit, a first demodulation circuit, a first modulation circuit, a first power supply circuit, and a second power supply circuit and a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register. The first power supply circuit functions to generate a power supply voltage to be supplied to the CPU from a first wireless signal received by the first antenna circuit. The second power supply circuit includes a step-up circuit and functions to generate a power supply voltage to be supplied to the CPU from a second wireless signal received by the third antenna circuit. The router circuit includes a data processing circuit and a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit. The first wireless circuit and the second wireless circuit function to

transmit and receive data between the CPU and the router circuit with a wireless signal. The first wireless circuit functions to transmit data to the second wireless circuit by a backscattering method. The data processing circuit functions to process and store first data to be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller. The thread control circuit functions to appropriately allocate an instruction to be executed by the CPU core to the CPU core. The external device controller functions to transmit and receive data to and from an external device which is connected through an external data input line and an external data output line.

[0012]

In the semiconductor device of the present invention having the above structure, the external device controller can be a DRAM controller, a PCI bus controller, or a USB controller.

[0013]

Each CPU may be formed using a thin film transistor which includes as an active layer a semiconductor thin film formed over a substrate having an insulating surface. Note that the substrate having an insulating surface is preferably one of a glass substrate, a plastic substrate, and a silicon-on-insulator (SOI) substrate.

[0014]

The present invention can provide a multi-core semiconductor device which consumes less power and has high arithmetic performance, at low cost. By providing a plurality of CPUs, a router circuit, and a thread control circuit and employing a backscattering method for data transmission from each CPU to the router circuit, the present invention can also provide a semiconductor device which can transmit data from each CPU to the router circuit while consuming a very small amount of power. The present invention can further provide a semiconductor device having a lot of flexibility in physical form because the CPU does not need to be electrically connected to another CPU, the router circuit, the thread control circuit, and an external terminal.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a block diagram of a semiconductor device of the present invention.

FIG. 2 is a block diagram of a CPU included in a semiconductor device of the present invention.

FIG. 3 is a block diagram of a router circuit included in a semiconductor device of the present invention.

FIG. 4 shows a structure of a wireless circuit of a CPU included in a semiconductor device of the present invention.

FIG. 5 shows a structure of a wireless circuit of a CPU included in a semiconductor device of the present invention.

FIGS. 6A to 6D show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 7A to 7C show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 8A and 8B show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 9A and 9B show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 10A and 10B show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 11A to 11C show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 12A to 12C show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 13A and 13B show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 14A to 14C show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 15A to 15C show an example of a method for manufacturing a

semiconductor device of the present invention.

FIGS. 16A to 16C show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 17A and 17B show an example of a method for manufacturing a semiconductor device of the present invention.

FIGS. 18A to 18H show examples of applications of a semiconductor device of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0016]

Embodiment modes of the present invention will be hereinafter described with reference to the accompanying drawings. However, the present invention can be carried out in many different modes, and it is easily understood by those skilled in the art that the mode and detail of the present invention can be modified in various ways without departing from its spirit and scope. Therefore, the present invention is not interpreted as being limited to the description in the embodiment modes. Note that in the drawings illustrating the embodiment modes, the same portions or portions having a similar function are denoted by the same reference numerals, and repetitive explanation thereof is omitted.

[0017]

(Embodiment Mode 1)

Embodiment Mode 1 describes an example of a structure of a semiconductor device of the present invention with reference to FIGS. 1 to 3. FIGS. 1 to 3 are block diagrams of a semiconductor device, a CPU, and a router circuit of this embodiment mode, respectively.

[0018]

In FIG. 1, a semiconductor device 100 has first to fourth CPUs 101 to 104, a router circuit 105, a thread control circuit 106, and an external device controller 107. The first to fourth CPUs 101 to 104 have first to fourth CPU cores 108 to 111 and first to fourth wireless circuits 112 to 115, respectively. Note that in FIG. 1, the router circuit

105 transmits first to fourth wireless transmission signals 118 to 121 to the first to fourth CPUs 101 to 104, and the first to fourth CPUs 101 to 104 transmit fifth to eighth wireless transmission signals 122 to 125 to the router circuit 105, respectively. The semiconductor device 100 transmits and receives a data signal or a control signal to and from an external device connected to the semiconductor device 100 with the use of an external data output line 116 and an external data input line 117.

[0019]

Next, a specific structure of CPU is described with reference to FIG. 2. Note that in FIG. 2, a CPU 200 corresponds to each of the first to fourth CPUs 101 to 104 of FIG. 1; a CPU core 201 corresponds to each of the first to fourth CPU cores 108 to 111 of FIG. 1; and a wireless circuit 202 corresponds to each of the first to fourth wireless circuits 112 to 115 of FIG. 1.

[0020]

The CPU core 201 has a control circuit 203, an arithmetic circuit 204, a cache memory 205, and a general purpose register 206. The control circuit 203 controls the processing in the CPU 200. The arithmetic circuit 204 performs numerical operation and logical operation. The cache memory 205 is a storage device which stores programs processed by the CPU 200 and data necessary for the processing. The general purpose register 206 is used as a storage source of data which are used for numerical operation and logical operation and as a storage destination of operation results. Note that the CPU core 201 can employ an architecture such as a reduced instruction set computer (RISC) or a complex instruction set computer (CISC).

[0021]

The wireless circuit 202 has an antenna circuit 207, a demodulation circuit 208, a modulation circuit 209, and a power supply circuit 210. The antenna circuit 207 functions to transmit and receive a communication signal. For example, the antenna circuit 207 may be provided with a coil in the case of employing an electromagnetic induction method, or may be provided with a dipole antenna in the case of employing an electric field method. The demodulation circuit 208 functions to extract reception data from a communication signal. For example, the demodulation circuit 208 may be a

low-pass filter (LPF). The modulation circuit 209 functions to superimpose transmission data on a communication signal. The power supply circuit 210 functions to generate a power supply voltage for the CPU 200 from a communication signal. For example, the power supply circuit 210 can be formed using a rectifier circuit and a storage capacitor. Although this embodiment mode describes a so-called passive CPU which generates a power supply voltage from a wireless signal received, a so-called active CPU which supplies a power supply voltage from an incorporated battery can also be used. Alternatively, a structure in which a power supply voltage is supplied from a commercial power supply can also be used.

[0022]

Note that the data transmission from the first to fourth CPUs 101 to 104 to the router circuit 105 is conducted using a modulation method by turning on or off a switch of the modulation circuit, i.e., a backscattering method. As the backscattering method, a phase modulation method or an amplitude modulation method can be used. As a data encoding method, a technique such as a quadrature phase shift keying (QPSK) method, a binary phase shift keying (BPSK) method, or an 8 phase shift keying (8PSK) method can be used. These modulation methods do not require CPUs themselves to transmit a transmission signal; therefore, these methods can reduce power necessary for the data transmission from the CPUs. Thus, employment of a backscattering method for data transmission from a CPU to reduce power consumption is a feature of the semiconductor device of the present invention.

[0023]

Here, each of the QPSK method, the BPSK method, and the 8PSK method is a modulation method for converting digital values into analog signals and is a phase shift keying method for expressing information using a combination of a plurality of waves with phase shifts. With the QPSK method, four-value (2-bit) information can be transmitted or received at a time by using a total of four waves, a reference sine wave and waves with phase shifts of 90°, 180°, and 270°, and by allocating different values to each of them. With the BPSK method, two-value (1-bit) information can be transmitted or received at a time by using a reference sine wave and a wave with an inverted phase and

by relating one of them to 0 and the other to 1. With the 8PSK method, eight-value (3-bit) information can be transmitted or received at a time by using a total of eight waves, a reference sine wave and waves with phase shifts of 45° each and by allocating different values to each of them.

[0024]

Next, a specific structure of the router circuit is described with reference to FIG. 3. In FIG. 3, a router circuit 300 corresponding to the router circuit 105 of FIG. 1 has an antenna circuit 301, a demodulation circuit 302, a modulation circuit 303, a first bus controller circuit 304, a second bus controller circuit 305, and a data processing circuit 306. The antenna circuit 301, the demodulation circuit 302, and the modulation circuit 303 are collectively referred to as a wireless circuit 309. The antenna circuit 301 functions to transmit and receive a communication signal to and from the CPUs. For example, the antenna circuit 301 may be provided with a coil in the case of employing an electromagnetic induction method, or may be provided with a dipole antenna in the case of employing an electric field method. The demodulation circuit 302 functions to extract reception data from a communication signal. For example, the demodulation circuit 302 may be an LPF. The modulation circuit 303 functions to superimpose transmission data on a communication signal. The first bus controller circuit 304 is connected to the thread control circuit 106 of FIG. 1 through a first bus 307 and functions to control data transmission and reception to and from the thread control circuit 106. The second bus controller circuit 305 is connected to the external device controller 107 of FIG. 1 through a second bus 308 and functions to control data transmission and reception to and from the external device controller 107.

[0025]

The data processing circuit 306 functions to process and store reception data from the CPUs, transmission data to the CPUs, data input and output through the first bus 307, and data input and output through the second bus 308, and functions to manage and conduct data transmission and reception between the CPUs, between the CPUs and the thread control circuit, and between the CPUs and the external device controller.

[0026]

As described above, the router circuit 105 can function to mediate data transmission and reception between the first to fourth CPUs 101 to 104 and the thread control circuit 106 or the external device controller 107. For example, when the router circuit 105 receives, from the first CPU 101, transmission data to which the external device controller 107 is designated as a data transmission destination, the router circuit 105 transmits the data to the transmission destination, i.e., the external device controller 107. By employing such a method as described above by which data transmission and reception are mediated by the router circuit 105, there is an advantage that competition in data transmission and reception between the CPUs, between the CPUs and the thread controller circuit, and between the CPUs and the external device controller hardly occurs even if a plurality of CPUs are provided. In addition, data transmission and reception can be efficiently allocated to the CPU, the thread control circuit, or the external device controller which requires data transmission and reception.

[0027]

Note that a wireless signal is used for data transmission from the router circuit 105 to the first to fourth CPUs 101 to 104, and a technique such as a time division multiple access (TDMA) method or a code division multiple access (CDMA) method can be employed. Data transmission and reception between the router circuit 105 and the thread control circuit 106 or the external device controller 107 can be conducted using a wireless signal or a wired signal.

[0028]

Here, the TDMA method is a method in which a single frequency is shared by a plurality of transmitters in turn at short intervals. The CMDA method is a method by which transmission data of a plurality of transmitters are each multiplied by different codes and all transmission data are synthesized and transmitted using a single frequency. A receiver can extract only transmission data of a relevant transmitter by multiplying the synthesized signal with the code of the relevant transmitter.

[0029]

The thread control circuit 106 functions to allocate processing (a thread) to be

executed by a CPU to the CPU. Specifically, the thread control circuit 106 functions to schedule threads with the use of information showing an operation state such as being running or idle, information showing running and idle threads, and information about the order of thread priorities, with respect to the first to fourth CPUs 101 to 104 in the semiconductor device 100. In addition, the thread control circuit 106 functions to allocate information about a CPU assigned to handle processing and data necessary for the processing to a thread to produce thread information and functions to transmit the thread information to the router circuit 105. Note that the thread information is transmitted to the relevant CPU of the first to fourth CPUs 101 to 104 through the router circuit 105 and executed appropriately.

[0030]

Note that a thread is a unit of processing of a CPU. A normal CPU employs a processing method called multitasking. In this method, a plurality of processes are pseudo-simultaneously executed by temporally changing processes. However, changing processes may require a changing operation with heavy load such as data storing or reading of an internal register of a CPU. A thread is a process which is divided so that a changing process is not needed. In other words, the division of processing into threads enables efficient multitasking.

[0031]

The external device controller 107 functions to transmit and receive a data signal or a control signal between the semiconductor device 100 and an external device connected to the semiconductor device 100, with the use of the external data output line 116 and the external data input line 117. For example, when the semiconductor device 100 is connected to an external dynamic random access memory (DRAM), the external device controller 107 functions as a DRAM controller. When the semiconductor device 100 is connected to an external peripheral device having a PCI bus, the external device controller 107 functions as a PCI bus controller. When the semiconductor device 100 is connected to an external universal serial bus (USB), the external device controller 107 functions as a USB controller. In addition, the external device controller 107 functions to transmit and receive data to and from the router circuit 105.

[0032]

In the operation of the semiconductor device 100, for example, if the first CPU 101 executes an instruction to generate a new thread, the first CPU 101 transmits an instruction requiring generation of a thread to the thread control circuit 106 through the router circuit 105. The thread control circuit 106 determines a CPU, to which the thread is to be allocated, from idle CPUs or CPUs executing threads with low priority, and transmits thread information including an address of an instruction to be executed to the CPU through the router circuit. Thus, the thread control circuit 106 has a function to allocate a thread to a relevant CPU, i.e., a scheduling function.

[0033]

In a semiconductor device with a normal multiprocessor structure, allocation of a thread to a relevant CPU is carried out by software with the use of a thread scheduling function of an operating system (OS) corresponding to a multiprocessor. However, the scheduling function itself is achieved by a thread; therefore, a CPU is used. Thus, operation performance of the semiconductor device as a whole is lowered.

[0034]

On the other hand, the semiconductor device of the present invention can realize thread scheduling without lowering the arithmetic processing performance of a CPU by provision of a thread control circuit having a thread scheduling function. Thus, the semiconductor device of the present invention can realize thread scheduling without lowering the operation performance of a CPU.

[0035]

As described above, by provision of a plurality of CPUs which use a backscattering method of a wireless signal for data transmission, a router circuit which mediates data transmission and reception between CPUs or the like, and a thread control circuit which has a thread scheduling function, a semiconductor device which consumes less power and has high arithmetic performance can be provided at low cost.

[0036]

(Embodiment Mode 2)

Embodiment Mode 2 describes the structure of the wireless circuit of the CPU in

the above embodiment mode with reference to FIG. 4. FIG. 4 shows a case where the wireless circuit has the antenna circuit 207, the demodulation circuit 208, the modulation circuit 209, and the power supply circuit 210.

[0037]

In FIG. 4, the modulation circuit 209 has a transistor 406 and can superimpose transmission data on a communication signal by changing the potential of a modulation signal line 402.

[0038]

The demodulation circuit 208 has a first coupling capacitor 407, a first diode 408, a second diode 409, an LPF resistor 410, and an LPF capacitor 411. A first AC voltage obtained from a communication signal by the antenna circuit 207 is supplied through a wiring 401 and converted into a second AC voltage by the first coupling capacitor 407, and the second AC voltage is supplied to a wiring 412. The second AC voltage is converted into a DC voltage by a rectifier circuit which has the first diode 408 and the second diode 409, and the DC voltage is supplied to a wiring 413. The DC voltage is converted into a demodulated signal by an LPF which has the LPF resistor 410 and the LPF capacitor 411, and the demodulated signal is supplied to a demodulation signal line 403.

[0039]

The power supply circuit 210 has a second coupling capacitor 414, a third diode 415, a fourth diode 416, and a storage capacitor 417. The first AC voltage obtained from a communication signal by the antenna circuit 207 is supplied through the wiring 401 and converted into a third AC voltage by the second coupling capacitor 414, and the third AC voltage is supplied to a wiring 418. The third AC voltage is converted into a power supply signal by a rectifier circuit which has the third diode 415 and the fourth diode 416, and the power supply signal is supplied to a power supply wiring 404. The power supply signal is smoothed by the storage capacitor 417. Note that a ground signal is supplied through a ground wiring 405.

[0040]

As described above, by provision of a wireless circuit which enables wireless

data transmission and reception in a CPU and by performing data transmission and reception between CPUs or the like with the use of a backscattering method of a wireless signal through a router, a semiconductor device which consumes less power and has high arithmetic performance can be provided at low cost.

[0041]

Note that this embodiment mode can be combined with any of structures of semiconductor devices described in the other embodiment modes of this specification.

[0042]

(Embodiment Mode 3)

Embodiment Mode 3 describes a structure of a wireless circuit of a CPU, which is different from that of Embodiment Mode 2, with reference to FIG. 5.

[0043]

In FIG. 5, the antenna circuit 207 has a first antenna 534 and a second antenna 535. The first antenna 534 is used for data transmission and reception with a first communication signal and for generation of a first power supply voltage from the first communication signal. The second antenna 535 is used for generation of a second power supply voltage from a second communication signal.

[0044]

The modulation circuit 209 has a transistor 506 and can superimpose transmission data on the first communication signal by changing the potential of a modulation signal line 502.

[0045]

The demodulation circuit 208 has a first coupling capacitor 507, a first diode 508, a second diode 509, an LPF resistor 510, and an LPF capacitor 511. A first AC voltage obtained from the first communication signal by the first antenna 534 is supplied through a wiring 501 and converted into a second AC voltage by the first coupling capacitor 507, and the second AC voltage is supplied to a wiring 512. The second AC voltage is converted into a first DC voltage by a rectifier circuit which has the first diode 508 and the second diode 509, and the first DC voltage is supplied to a wiring 513. The first DC voltage is converted into a demodulated signal by an LPF which has the LPF resistor 510

and the LPF capacitor 511, and the modulated signal is supplied to a demodulation signal line 503.

[0046]

The power supply circuit 210 has a first power supply circuit 536 and a second power supply circuit 537. The first power supply circuit 536 has a second coupling capacitor 514, a third diode 515, a fourth diode 516, and a first storage capacitor 517. The first AC voltage obtained from the first communication signal by the first antenna 534 is supplied through the wiring 501 and converted into a third AC voltage by the second coupling capacitor 514, and the third AC voltage is supplied to a wiring 518. The third AC voltage is converted into a first power supply signal by a rectifier circuit which has the third diode 515 and the fourth diode 516, and the first power supply signal is supplied to a first power supply wiring 539. The first power supply signal is smoothed by the first storage capacitor 517.

[0047]

The second power supply circuit 537 has a third coupling capacitor 519, a fourth coupling capacitor 520, fifth to eighth diodes 521 to 524, a second storage capacitor 525, and a third storage capacitor 526. A fourth AC voltage obtained from the second communication signal by the second antenna 535 is supplied through a wiring 538 and converted into a fifth AC voltage by the third coupling capacitor 519, and the fifth AC voltage is supplied to a wiring 527. The fifth AC voltage is converted into a second DC voltage by a rectifier circuit which has the fifth diode 521 and the sixth diode 522, and the second DC voltage is supplied to a wiring 528. The second DC voltage is smoothed by the second storage capacitor 525.

[0048]

In addition, the fifth AC voltage is converted into a sixth AC voltage by the fourth coupling capacitor 520, and the sixth AC voltage is supplied to a wiring 529. The sixth AC voltage is converted into a third DC voltage by a rectifier circuit which has the seventh diode 523 and the eighth diode 524, and the third DC voltage is supplied to a second power supply wiring 530 as a second power supply signal. The second power signal is smoothed by the third storage capacitor 526. Note that the second power supply

signal is increased to a high potential when added to a potential accumulated in the second storage capacitor 525.

[0049]

With a ninth diode 531 and a tenth diode 532, a power supply signal with a higher potential of the first power supply signal and the second power supply signal is supplied to a power supply wiring 504 as a power supply voltage. Note that the power supply voltage is smoothed by a fourth storage capacitor 533. Note also that a ground signal is supplied through a ground wiring 505. The fourth storage capacitor 533 can be a capacitor such as an electric double layer capacitor. Instead of a capacitor, the fourth storage capacitor 533 may be a secondary battery such as a lithium battery, preferably a lithium polymer battery using a gel electrolyte, or a lithium-ion battery.

[0050]

Here, the second power supply circuit 537 is a step-up circuit. Thus, it is possible to supply a power supply voltage sufficient for operating a CPU even when the second communication signal is weak. In other words, continuous supply of weak second communication signal enables a CPU to continue its operation even if the first communication signal is supplied only when the CPU conducts wireless communication and the first communication signal is stopped from being supplied when the CPU does not conduct wireless communication. Accordingly, wireless communication with a CPU can be achieved with less power consumption.

[0051]

As described above, by provision, in a CPU, of a wireless circuit enabling wireless data transmission and reception and a step-up circuit generating a certain power even if it receives a weak signal and by performing data transmission and reception between CPUs or the like with the use of a backscattering method of a wireless signal through a router, a semiconductor device which consumes less power and has high arithmetic performance can be provided at low cost.

[0052]

Note that this embodiment mode can be combined with any of structures of the semiconductor devices described in the other embodiment modes of this specification.

[0053]

(Embodiment Mode 4)

Embodiment Mode 4 describes an example of a method for manufacturing the semiconductor device described in the above embodiment modes with reference to drawings. This embodiment mode describes a structure in which an antenna circuit and a power supply circuit in a CPU of the semiconductor device are formed using thin film transistors over the same substrate. It is to be noted that when an antenna circuit and a power supply circuit are formed at a time over the same substrate, reduction in size of the semiconductor device can be achieved, which is advantageous. In addition, this embodiment mode describes an example in which a thin-film secondary battery is used as a storage capacitor in the power supply circuit. Needless to say, instead of the secondary battery, a capacitor such as an electric double layer capacitor may be used.

[0054]

First, a peeling layer 1303 is formed over one surface of a substrate 1301 with an insulating film 1302 interposed therebetween, and then an insulating film 1304 functioning as a base film and a semiconductor film (e.g., a film containing amorphous silicon) 1305 are stacked thereover (see FIG. 6A). It is to be noted that the insulating film 1302, the peeling layer 1303, the insulating film 1304, and the semiconductor film 1305 can be formed consecutively.

[0055]

The substrate 1301 is selected from a glass substrate, a quartz substrate, a metal substrate (e.g., a ceramic substrate or a stainless steel substrate), a semiconductor substrate such as a Si substrate, and the like. Alternatively, a plastic substrate made of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polyether sulfone (PES), acrylic, or the like can be used. In this process, although the peeling layer 1303 is provided over the entire surface of the substrate 1301 with the insulating film 1302 interposed therebetween, the peeling layer 1303 can also be selectively formed by photolithography after being provided over the entire surface of the substrate 1301.

[0056]

The insulating films 1302 and 1304 are formed using insulating materials such

as silicon oxide, silicon nitride, silicon oxynitride (SiO_xN_y, where $x > y > 0$), or silicon nitride oxide (SiN_xO_y, where $x > y > 0$) by a CVD method, a sputtering method, or the like. For example, when each of the insulating films 1302 and 1304 is formed to have a two-layer structure, a silicon nitride oxide film may be formed as a first insulating film and a silicon oxynitride film may be formed as a second insulating film. In addition, a silicon nitride film may be formed as a first insulating film and a silicon oxide film may be formed as a second insulating film. The insulating film 1302 functions as a blocking layer which prevents an impurity element contained in the substrate 1301 from getting mixed into the peeling layer 1303 or elements formed thereover. The insulating film 1304 functions as a blocking layer which prevents an impurity element contained in the substrate 1301 or the peeling layer 1303 from getting mixed into elements formed over the insulating film 1304. In this manner, providing the insulating films 1302 and 1304 which function as the blocking layers can prevent adverse effects on the elements formed over the peeling layer 1303 or the insulating film 1304, which would otherwise be caused by an alkali metal such as Na or an alkaline earth metal contained in the substrate 1301 or by the impurity element contained in the peeling layer 1303. It is to be noted that when quartz is used for the substrate 1301, for example, the insulating film 1302 may be omitted.

[0057]

The peeling layer 1303 may be formed using a metal film, a stacked structure of a metal film and a metal oxide film, or the like. As a metal film, either a single layer or stacked layers is/are formed using an element selected from tungsten (W), molybdenum (Mo), titanium (Ti), tantalum (Ta), niobium (Nb), nickel (Ni), cobalt (Co), zirconium (Zr), zinc (Zn), ruthenium (Ru), rhodium (Rh), palladium (Pd), osmium (Os), and iridium (Ir), or an alloy material or a compound material containing such an element as its main component. In addition, such materials can be formed by a sputtering method, various CVD methods such as a plasma CVD method, or the like. A stacked structure of a metal film and a metal oxide film can be obtained by the steps of forming the above-described metal film, applying plasma treatment thereto under an oxygen atmosphere or an N_2O atmosphere or applying heat treatment thereto under an oxygen atmosphere or an N_2O

atmosphere, and thereby forming oxide or oxynitride of the metal film on the surface of the metal film. For example, when a tungsten film is provided as a metal film by a sputtering method, a CVD method, or the like, a metal oxide film of tungsten oxide can be formed on the surface of the tungsten film by application of plasma treatment to the tungsten film. When tungsten oxide is formed, there is no particular limitation on the amount of oxygen, and thus, which of the above oxides is to be formed may be determined based on the etching rate or the like. In addition, after a metal film (e.g., tungsten) is formed, an insulating film formed of silicon oxide (SiO_2) or the like may be formed over the metal film by a sputtering method, and also metal oxide (e.g., tungsten oxide on tungsten) may be formed on the metal film. Moreover, high-density-plasma treatment as described above may be applied as the plasma treatment, for example. Besides, metal nitride or metal oxynitride may also be formed. In that case, plasma treatment or heat treatment may be applied to the metal film under a nitrogen atmosphere or an atmosphere containing nitrogen and oxygen.

[0058]

The amorphous semiconductor film 1305 is formed with a thickness of 25 to 200 nm (preferably, 30 to 150 nm) by a sputtering method, an LPCVD method, a plasma CVD method, or the like.

[0059]

Next, the amorphous semiconductor film 1305 is crystallized by laser irradiation. Alternatively, the crystallization of the amorphous semiconductor film 1305 may be performed by a method combining the laser crystallization with a thermal crystallization method using RTA or an annealing furnace or with a thermal crystallization method using a metal element that promotes the crystallization. After that, the crystallized semiconductor film is etched into a desired shape, whereby crystalline semiconductor films 1305a to 1305f are formed. Then, a gate insulating film 1306 is formed so as to cover the semiconductor films 1305a to 1305f (see FIG. 6B).

[0060]

The gate insulating film 1306 is formed using an insulating material such as silicon oxide, silicon nitride, silicon oxynitride (SiO_xN_y, where $x > y > 0$), or silicon

nitride oxide (SiN_xO_y, where x > y> 0) by a CVD method, a sputtering method, or the like. For example, when the gate insulating film 1306 is formed to have a two-layer structure, it is preferable to form a silicon oxynitride film as a first insulating film and form a silicon nitride oxide film as a second insulating film. Alternatively, it is also preferable to form a silicon oxide film as a first insulating film and form a silicon nitride film as a second insulating film.

[0061]

An example of a formation process of the crystalline semiconductor films 1305a to 1305f is briefly explained below. First, an amorphous semiconductor film with a thickness of 50 to 60 nm is formed by a plasma CVD method. Then, a solution containing nickel which is a metal element that promotes crystallization is retained on the amorphous semiconductor film, which is followed by dehydrogenation treatment (500°C for one hour) and thermal crystallization treatment (550°C for four hours). Thus, a crystalline semiconductor film is formed. Then, the crystalline semiconductor film is subjected to laser irradiation and then a photolithography process to form the crystalline semiconductor films 1305a to 1305f. It is to be noted that crystallization of the amorphous semiconductor film may be performed only by laser irradiation, not by thermal crystallization which uses a metal element that promotes crystallization.

[0062]

As a laser oscillator used for crystallization, either a continuous wave laser oscillator (a CW laser oscillator) or a pulsed laser oscillator can be used. As a laser that can be used here, there are a gas laser such as an Ar laser, a Kr laser, or an excimer laser; a laser whose medium is single-crystalline YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$ or polycrystalline (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$ doped with one or more of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as a dopant; a glass laser; a ruby laser; an alexandrite laser; a Ti:sapphire laser; a copper vapor laser; and a gold vapor laser. When irradiation is performed with the fundamental wave of such a laser beam or the second to fourth harmonics of such a laser beam, crystals with a large grain size can be obtained. For example, the second harmonic (532 nm) or the third harmonic (355 nm) of an Nd:YVO_4 laser (the fundamental wave of 1064 nm) can be used. In this case, a laser

power density of approximately 0.01 to 100 MW/cm^2 (preferably, 0.1 to 10 MW/cm^2) is needed, and irradiation is performed with a scanning rate of approximately 10 to 2000 cm/sec. It is to be noted that the laser whose medium is single crystalline YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$ or polycrystalline (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$ doped with one or more of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as a dopant; an Ar ion laser, or a Ti:sapphire laser can be used as a CW laser, whereas it can also be used as a pulsed laser with a repetition rate of 10 MHz or more by a Q-switch operation, mode locking, or the like. When a laser beam with a repetition rate of 10 MHz or more is used, a semiconductor film is irradiated with the next pulse during the period in which the semiconductor film has been melted by the laser beam and is solidified. Therefore, unlike the case of using a pulsed laser with a low repetition rate, a solid-liquid interface in the semiconductor film can be continuously moved. Thus, crystal grains which have grown continuously in the scanning direction can be obtained.

[0063]

The gate insulating film 1306 may be formed by oxidization or nitridation of the surfaces of the semiconductor films 1305a to 1305f by the above-described high-density plasma treatment. For example, plasma treatment with a mixed gas of a rare gas such as He, Ar, Kr, or Xe, and oxygen, nitrogen oxide (NO_2), ammonia, nitrogen, or hydrogen is conducted. When plasma is excited by the introduction of microwaves, plasma with a low electron temperature and high density can be generated. With oxygen radicals (which may include OH radicals) or nitrogen radicals (which may include NH radicals) which are generated by the high-density plasma, a surface of a semiconductor film can be oxidized or nitrided.

[0064]

By such high-density plasma treatment, an insulating film with a thickness of 1 to 20 nm, typically 5 to 10 nm, is formed on a semiconductor film. Since the reaction in this case is a solid-phase reaction, the interface state density between the insulating film and the semiconductor film can be quite low. Since such high-density plasma treatment directly oxidizes (or nitrides) a semiconductor film (crystalline silicon or polycrystalline silicon), desirably, an insulating film can be formed with extremely little unevenness. In

addition, since crystal grain boundaries of crystalline silicon are not strongly oxidized, an excellent state is obtained. That is, by the solid-phase oxidation of a surface of a semiconductor film by high-density plasma treatment which is described in this embodiment mode, an insulating film with a uniform thickness and low interface state density can be formed without excessive oxidation reaction at the crystal grain boundaries.

[0065]

As the gate insulating film, only an insulating film formed by high-density plasma treatment may be used, or a stacked layer may be employed, which is obtained by deposition of an insulating film such as silicon oxide, silicon oxynitride, or silicon nitride on the insulating film, by a CVD method using plasma or thermal reaction. In either case, a transistor which includes such an insulating film formed by high-density plasma treatment in a part or the whole of its gate insulating film can have reduced characteristic variations.

[0066]

In addition, the semiconductor films 1305a to 1305f, which are obtained by irradiation of a semiconductor film with a continuous wave laser beam or a laser beam oscillated with a repetition rate of 10 MHz or more and scanning the semiconductor film with the laser beam in one direction to crystallize the semiconductor film, have a characteristic in that their crystals grow in the beam scanning direction. Transistors are each arranged so that its channel length direction (direction in which carriers move when a channel formation region is formed) is aligned with the scanning direction, and the above-described gate insulating film is combined with the semiconductor film, whereby thin film transistors (TFTs) with high electron field effect mobility and reduced variations in characteristics can be obtained.

[0067]

Next, a first conductive film and a second conductive film are stacked over the gate insulating film 1306. Here, the first conductive film is formed to a thickness of 20 to 100 nm by a CVD method, a sputtering method, or the like. The second conductive film is formed to a thickness of 100 to 400 nm. The first conductive film and the second

conductive film are formed of an element selected from tantalum (Ta), tungsten (W), titanium (Ti), molybdenum (Mo), aluminum (Al), copper (Cu), chromium (Cr), niobium (Nb), and the like, or an alloy material or a compound material containing such an element as its main component. Alternatively, a semiconductor material typified by polycrystalline silicon doped with an impurity element such as phosphorus can also be used. As combination examples of the first conductive film and the second conductive film, a tantalum nitride film and a tungsten film; a tungsten nitride film and a tungsten film; a molybdenum nitride film and a molybdenum film; and the like can be given. Tungsten and tantalum nitride have high heat resistance. Therefore, after forming the first conductive film and the second conductive film, heat treatment for the purpose of thermal activation can be applied thereto. In addition, in the case where a two-layer structure is not employed, but a three-layer structure is employed, it is preferable to use a stacked structure of a molybdenum film, an aluminum film, and a molybdenum film.

[0068]

Next, a resist mask is formed by photolithography, and etching treatment is conducted to form gate electrodes and gate lines. Thus, gate electrodes 1307 are formed above the semiconductor films 1305a to 1305f. Here, a stacked structure of a first conductive film 1307a and a second conductive film 1307b is shown as an example of the gate electrode 1307.

[0069]

Next, the semiconductor films 1305a to 1305f are doped with an n-type impurity element at low concentration, using the gate electrodes 1307 as masks by an ion doping method or an ion implantation method. Then, a resist mask is selectively formed by photolithography, and the semiconductor films 1305c and 1305e are doped with a p-type impurity element at high concentration. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used. As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used. Here, phosphorus (P) is used as an n-type impurity element and is selectively introduced into the semiconductor films 1305a to 1305f so as to be contained at concentrations of 1×10^{15} to $1 \times 10^{19}/cm^3$. Thus, n-type impurity regions 1308 are formed. In addition, boron (B) is used as a p-type impurity

element, and is selectively introduced into the semiconductor films 1305c and 1305e so as to be contained at concentrations of 1×10^{19} to $1 \times 10^{20}/cm^3$. Thus, p-type impurity regions 1309 are formed (see FIG. 6C).

[0070]

Subsequently, an insulating film is formed so as to cover the gate insulating film 1306 and the gate electrodes 1307. The insulating film is formed using either a single layer or a stacked layer of a film containing an inorganic material such as silicon, silicon oxide, or silicon nitride, or a film containing an organic material such as an organic resin by a plasma CVD method, a sputtering method, or the like. Next, the insulating film is selectively etched by anisotropic etching mainly in the perpendicular direction, so that insulating films 1310 (also referred to as sidewalls) which are in contact with the side surfaces of the gate electrodes 1307 are formed. The insulating films 1310 are used as masks in doping for forming LDD (Lightly Doped Drain) regions.

[0071]

Next, the semiconductor films 1305a, 1305b, 1305d, and 1305f are doped with an n-type impurity element at high concentration, using resist masks formed by photolithography, the gate electrodes 1307, and the insulating films 1310 as masks. Thus, n-type impurity regions 1311 are formed. Here, phosphorus (P) is used as an n-type impurity element, and is selectively introduced into the semiconductor films 1305a, 1305b, 1305d, and 1305f so as to be contained at concentrations of 1×10^{19} to $1 \times 10^{20}/cm^3$. Thus, the n-type impurity regions 1311 with higher concentration of impurity than that of the impurity regions 1308 are formed.

[0072]

Through the above steps, n-channel thin film transistors 1300a, 1300b, 1300d, and 1300f, and p-channel thin film transistors 1300c and 1300e are formed (see FIG. 6D).

[0073]

In the n-channel thin film transistor 1300a, a channel formation region is formed in a region of the semiconductor film 1305a which overlaps with the gate electrode 1307; the impurity regions 1311 serving as source and drain regions are formed in regions of the semiconductor film 1305a which do not overlap with the gate electrode 1307 and the

insulating film 1310; and low concentration impurity regions (LDD regions) are formed in regions of the semiconductor film 1305a which overlap with the insulating film 1310, between the channel formation region and the impurity regions 1311. Similarly, channel formation regions, low concentration impurity regions, and the impurity regions 1311 are formed in the n-channel thin film transistors 1300b, 1300d, and 1300f.

[0074]

In the p-channel thin film transistor 1300c, a channel formation region is formed in a region of the semiconductor film 1305c which overlaps with the gate electrode 1307, and the impurity regions 1309 serving as source and drain regions are formed in regions of the semiconductor film 1305c which do not overlap with the gate electrode 1307. Similarly, a channel formation region and the impurity regions 1309 are formed in the p-channel thin film transistor 1300e. Here, although LDD regions are not formed in the p-channel thin film transistors 1300c and 1300e, LDD regions may be provided in the p-channel thin film transistors or a structure without LDD regions may be applied to the n-channel thin film transistors.

[0075]

Next, an insulating film with a single layer structure or a stacked layer structure is formed so as to cover the semiconductor films 1305a to 1305f, the gate electrodes 1307, and the like. Then, conductive films 1313 electrically connected to the impurity regions 1309 and 1311 which serve as the source and drain regions of the thin film transistors 1300a to 1300f are formed over the insulating film (see FIG. 7A). The insulating film is formed with a single layer or a stacked layer, using an inorganic material such as silicon oxide or silicon nitride, an organic material such as polyimide, polyamide, benzocyclobutene, acrylic, or epoxy, a siloxane material, or the like by a CVD method, a sputtering method, an SOG method, a droplet discharging method, a screen printing method, or the like. In this embodiment mode, the insulating film is formed to have a two-layer structure, and a silicon nitride oxide film is formed as a first insulating film 1312a and a silicon oxynitride film is formed as a second insulating film 1312b. In addition, the conductive films 1313 can form the source and drain electrodes of the thin film transistors 1300a to 1300f.

[0076]

Before the insulating films 1312a and 1312b are formed or after one or both of the insulating films 1312a and 1312b is/are formed, heat treatment is preferably conducted for recovery of the crystallinity of the semiconductor films, activation of the impurity element which has been added into the semiconductor films, or hydrogenation of the semiconductor films. As the heat treatment, thermal annealing, laser annealing, RTA, or the like may be applied.

[0077]

The conductive films 1313 are formed with a single layer or a stacked layer of an element selected from aluminum (Al), tungsten (W), titanium (Ti), tantalum (Ta), molybdenum (Mo), nickel (Ni), platinum (Pt), copper (Cu), gold (Au), silver (Ag), manganese (Mn), neodymium (Nd), carbon (C), and silicon (Si), or an alloy material or a compound material containing the element as its main component by a CVD method, a sputtering method, or the like. An alloy material containing aluminum as its main component corresponds to, for example, a material which contains aluminum as its main component and also contains nickel, or a material which contains aluminum as its main component and also contains nickel and one or both of carbon and silicon. The conductive films 1313 are preferably formed to have a stacked structure of a barrier film, an aluminum silicon (Al-Si) film, and a barrier film or a stacked structure of a barrier film, an aluminum silicon (Al-Si) film, a titanium nitride film, and a barrier film. Note that the "barrier film" corresponds to a thin film formed of titanium, titanium nitride, molybdenum, or molybdenum nitride. Aluminum and aluminum silicon are suitable materials for forming the conductive films 1313 because they have low resistance value and are inexpensive. When barrier layers are provided as the top layer and the bottom layer, generation of hillocks of aluminum or aluminum silicon can be prevented. In addition, when a barrier film is formed of titanium which is an element having a high reducing property, even if a thin natural oxide film is formed on the crystalline semiconductor film, the natural oxide film can be reduced, and a favorable contact between the conductive film 1313 and the crystalline semiconductor film can be obtained.

[0078]

Next, an insulating film 1314 is formed so as to cover the conductive films 1313, and conductive films 1315a and 1315b electrically connected to the conductive films 1313 which form the source electrodes or the drain electrodes of the thin film transistors 1300a and 1300f are formed over the insulating film 1314. In addition, a conductive film 1316 electrically connected to the conductive film 1313 which forms the source electrode or drain electrode of the thin film transistor 1300b is formed. It is to be noted that the conductive films 1315a and 1315b and the conductive film 1316 may be formed using the same material at the same time. The conductive films 1315a and 1315b and the conductive film 1316 can be formed using any of the above-described materials for the conductive film 1313.

[0079]

Next, a conductive film 1317 functioning as an antenna is formed so as to be electrically connected to the conductive film 1316 (see FIG. 7B).

[0080]

The insulating film 1314 can be formed with a single layer or a stacked layer of an insulating film containing oxygen and/or nitrogen such as silicon oxide (SiO_x), silicon nitride (SiN_x), silicon oxynitride (SiO_xN_y where $x > y > 0$), or silicon nitride oxide (SiN_xO_y where $x > y > 0$); a film containing carbon such as DLC (Diamond-Like Carbon); an organic material such as epoxy, polyimide, polyamide, polyvinyl phenol, benzocyclobutene, or acrylic; or a siloxane material such as a siloxane resin by a CVD method, a sputtering method, or the like. It is to be noted that a siloxane material corresponds to a material having a bond of Si-O-Si. Siloxane has a skeleton structure with the bond of silicon (Si) and oxygen (O). As a substituent of siloxane, an organic group containing at least hydrogen (e.g., an alkyl group or aromatic hydrocarbon) is used. In addition, a fluoro group may be used as the substituent. Further, both a fluoro group and an organic group containing at least hydrogen may be used as the substituent.

[0081]

The conductive film 1317 is formed of a conductive material by a CVD method, a sputtering method, a printing method such as screen printing or gravure printing, a

droplet discharging method, a dispenser method, a plating method, or the like. The conductive film 1317 is formed with a single layer or a stacked layer of an element selected from aluminum (Al), titanium (Ti), silver (Ag), copper (Cu), gold (Au), platinum (Pt), nickel (Ni), palladium (Pd), tantalum (Ta), and molybdenum (Mo), or an alloy material or a compound material containing such an element as its main component.

[0082]

For example, when the conductive film 1317 functioning as an antenna is formed by a screen printing method, the conductive film 1317 can be provided by selective printing of a conductive paste in which conductive particles with a grain diameter of several nanometers to several tens of micrometers are dissolved or dispersed in an organic resin. The conductive particles can be at least one or more of metal particles selected from silver (Ag), gold (Au), copper (Cu), nickel (Ni), platinum (Pt), palladium (Pd), tantalum (Ta), molybdenum (Mo), titanium (Ti), and the like; fine particles of silver halide; and dispersive nanoparticles thereof. In addition, the organic resin included in the conductive paste can be one or more of organic resins which function as a binder, a solvent, a dispersing agent, and a coating material of the metal particles. Typically, organic resins such as an epoxy resin and a silicone resin can be given as examples. Preferably, a conductive paste is extruded and then baked to form the conductive film. For example, in the case of using fine particles (e.g., a grain diameter of 1 to 100 nm) containing silver as its main component as a material of the conductive paste, the conductive paste is baked and hardened at temperatures of 150 to 300°C, so that the conductive film can be obtained. Alternatively, it is also possible to use fine particles containing solder or lead-free solder as its main component. In that case, fine particles with a grain diameter of 20 μm or less are preferably used. Solder and lead-free solder have the advantage of low cost.

[0083]

The conductive films 1315a and 1315b can function as wirings which are electrically connected to a secondary battery included in the semiconductor device of the present invention in a later step. In addition, in forming the conductive film 1317 which functions as an antenna, other conductive films may be separately formed so as to be

electrically connected to the conductive films 1315a and 1315b, so that the conductive films can be utilized as the wirings for connecting the conductive films 1315a and 1315b to the secondary battery.

[0084]

Next, after forming an insulating film 1318 so as to cover the conductive film 1317, a layer including the thin film transistors 1300a to 1300f, the conductive film 1317, and the like (hereinafter referred to as an "element formation layer 1319") is peeled off the substrate 1301. Here, after forming opening portions in the element formation layer 1319 excluding the region of the thin film transistors 1300a to 1300f by laser irradiation (e.g., with UV light) (see FIG. 7C), the element formation layer 1319 can be peeled off the substrate 1301 with a physical force. The peeling layer 1303 may be selectively removed by introduction of an etchant into the opening portions before peeling the element formation layer 1319 off the substrate 1301. As the etchant, a gas or a liquid containing halogen fluoride or an interhalogen compound is used. For example, when chlorine trifluoride (ClF_3) is used as the gas containing halogen fluoride, the element formation layer 1319 is peeled off the substrate 1301. The whole peeling layer 1303 does not necessarily be removed but part thereof may be left. Accordingly, the consumption of the etchant can be suppressed and process time needed for removing the peeling layer can be shortened. In addition, even after removing the peeling layer 1303, the element formation layer 1319 can be held above the substrate 1301. In addition, by reuse of the substrate 1301 from which the element formation layer 1319 has been peeled, cost reduction can be achieved.

[0085]

The insulating film 1318 can be formed with a single layer or a stacked layer of an insulating film containing oxygen and/or nitrogen such as silicon oxide (SiO_x), silicon nitride (SiN_x), silicon oxynitride (SiO_xN_y where $x > y > 0$), or silicon nitride oxide (SiN_xO_y where $x > y > 0$); a film containing carbon such as DLC (Diamond-Like Carbon); an organic material such as epoxy, polyimide, polyamide, polyvinyl phenol, benzocyclobutene, or acrylic; or a siloxane material such as a siloxane resin by a CVD method, a sputtering method, or the like.

[0086]

In this embodiment mode, after forming the opening portions in the element formation layer 1319 by laser irradiation, a first sheet material 1320 is attached to one surface of the element formation layer 1319 (the surface where the insulating film 1318 is exposed), and then the element formation layer 1319 is peeled off the substrate 1301 (see FIG. 8A).

[0087]

Next, a second sheet material 1321 is provided for the other surface of the element formation layer 1319 (the surface exposed by peeling), followed by one or both of heat treatment and pressurization treatment for attachment of the second sheet material 1321 (see FIG. 8B). The first sheet material 1320 and the second sheet material 1321 functions as substrates, and a plastic film such as a hot-melt film can be used. In addition, without being limited to such plastic films, a substrate having an insulating surface, such as a glass substrate, can be used.

[0088]

As the first sheet material 1320 and the second sheet material 1321, a film on which antistatic treatment for preventing static electricity or the like has been applied (hereinafter referred to as an antistatic film) can also be used. As examples of the antistatic film, a film in which an antistatic material is dispersed in a resin, a film to which an antistatic material is attached, and the like can be given. The film provided with an antistatic material can be a film with an antistatic material provided on one of its surfaces, or a film with an antistatic material provided on each of its surfaces. The film with an antistatic material provided on one of its surfaces may be attached to the layer so that the antistatic material is placed on the inner side of the film or the outer side of the film. The antistatic material may be provided over the entire surface of the film, or over a part of the film. As an antistatic material, a metal, indium tin oxide (ITO), or a surfactant such as an amphoteric surfactant, a cationic surfactant, or a nonionic surfactant can be used. Further, as an antistatic material, a resin material which contains a cross-linked copolymer having a carboxyl group and a quaternary ammonium base on its side chain, or the like can be used. Such a material is attached, mixed, or applied to a film, so that an

antistatic film can be formed. The element formation layer is sealed using the antistatic film, so that the semiconductor elements can be protected from adverse effects such as external static electricity when dealt with as a commercial product.

[0089]

It is to be noted that a thin-film secondary battery is connected to the conductive films 1315a and 1315b, so that the storage capacitor of the power supply circuit is formed. The connection with the secondary battery may be conducted before the element formation layer 1319 is peeled off the substrate 1301 (at the stage shown in FIG. 7B or FIG. 7C), after the element formation layer 1319 is peeled off the substrate 1301 (at the stage shown in FIG. 8A), or after the element formation layer 1319 is sealed with the first sheet material 1320 and the second sheet material 1321 (at the stage shown in FIG. 8B). An example where the element formation layer 1319 and the secondary battery are formed to be connected is explained below with reference to FIGS. 9A and 9B and FIGS. 10A and 10B.

[0090]

At the stage shown in FIG. 7B, conductive films 1331a and 1331b which are electrically connected to the conductive films 1315a and 1315b, respectively are formed at the same time as the conductive film 1317 which functions as an antenna. Then, the insulating film 1318 is formed so as to cover the conductive films 1317, 1331a, and 1331b, followed by formation of opening portions so that the surfaces of the conductive films 1331a and 1331b are exposed. After that, the opening portions are formed in the element formation layer 1319 by laser irradiation, and then the first sheet material 1320 is attached to one surface of the element formation layer 1319 (the surface where the insulating film 1318 is exposed), so that the element formation layer 1319 is peeled off the substrate 1301 (see FIG. 9A).

[0091]

Next, the second sheet material 1321 is attached to the other surface of the element formation layer 1319 (the surface exposed by peeling), and the element formation layer 1319 is peeled off the first sheet material 1320. Therefore, a material with low viscosity is used as the first sheet material 1320. Then, conductive films 1334a

and 1334b which are electrically connected to the conductive films 1331a and 1331b respectively through the opening portions are selectively formed (see FIG. 9B).

[0092]

The conductive films 1334a and 1334b are formed of a conductive material by a CVD method, a sputtering method, a printing method such as screen printing or gravure printing, a droplet discharging method, a dispenser method, a plating method, or the like. The conductive films 1334a and 1334b are formed with a single layer or a stacked layer of an element selected from aluminum (Al), titanium (Ti), silver (Ag), copper (Cu), gold (Au), platinum (Pt), nickel (Ni), palladium (Pd), tantalum (Ta), and molybdenum (Mo), or an alloy material or a compound material containing the element as its main component.

[0093]

Although the example shown in this embodiment mode is the case where the conductive films 1334a and 1334b are formed after peeling the element formation layer 1319 off the substrate 1301, the element formation layer 1319 may be peeled off the substrate 1301 after the formation of the conductive films 1334a and 1334b.

[0094]

Next, in the case where a plurality of elements are formed over the substrate, the element formation layer 1319 is cut into elements (see FIG. 10A). A laser irradiation apparatus, a dicing apparatus, a scribing apparatus, or the like can be used for the cutting. At this time, the plurality of elements formed over one substrate are separated from one another by laser irradiation.

[0095]

Next, the separated elements are electrically connected to the secondary battery (see FIG. 10B). In this embodiment mode, a thin-film secondary battery is used as the storage capacitor of the power supply circuit, in which a current-collecting thin film, a negative electrode active material layer, a solid electrolyte layer, a positive electrode active material layer, and a current-collecting thin film are sequentially stacked.

[0096]

Conductive films 1336a and 1336b are formed of a conductive material by a

CVD method, a sputtering method, a printing method such as screen printing or gravure printing, a droplet discharging method, a dispenser method, a plating method, or the like. The conductive films 1336a and 1336b are formed with a single layer or a stacked layer of an element selected from aluminum (Al), titanium (Ti), silver (Ag), copper (Cu), gold (Au), platinum (Pt), nickel (Ni), palladium (Pd), tantalum (Ta), and molybdenum (Mo), or an alloy material or a compound material containing such an element as its main component. The conductive material should have high adhesion to a negative electrode active material layer and also low resistance. In particular, aluminum, copper, nickel, vanadium, or the like is preferably used.

[0097]

The structure of a thin-film secondary battery 1389 is described next. A negative electrode active material layer 1381 is formed over the conductive film 1336a. In general, vanadium oxide (V_2O_5) or the like is used. Next, a solid electrolyte layer 1382 is formed over the negative electrode active material layer 1381. In general, lithium phosphate (Li_3PO_4) or the like is used. Next, a positive electrode active material layer 1383 is formed over the solid electrolyte layer 1382. In general, lithium manganate ($LiMn_2O_4$) or the like is used. Lithium cobaltate ($LiCoO_2$) or lithium nickel oxide ($LiNiO_2$) may also be used. Next, a current-collecting thin film 1384 to serve as an electrode is formed over the positive electrode active material layer 1383. The current-collecting thin film 1384 should have high adhesion to the positive electrode active material layer 1383 and also low resistance. For example, aluminum, copper, nickel, vanadium, or the like can be used.

[0098]

Each of the above thin layers of the negative electrode active material layer 1381, the solid electrolyte layer 1382, the positive electrode active material layer 1383, and the current-collecting thin film 1384 may be formed by a sputtering technique or an evaporation technique. In addition, the thickness of each layer is preferably 0.1 to 3 μm.

[0099]

Next, an interlayer film 1385 is formed by application of a resin. The interlayer film 1385 is etched to form a contact hole. The interlayer film 1385 is not limited to a

resin, and other films such as an oxide film formed by CVD method or the like may be used as well; however, a resin is preferably used in terms of flatness. Alternatively, the contact hole may be formed without using etching, but using a photosensitive resin. Next, a wiring layer 1386 is formed over the interlayer film 1385 and connected to the conductive film 1336b. Thus, an electrical connection of the thin-film secondary battery is secured.

[0100]

Here, the conductive films 1334a and 1334b which are provided in the element formation layer 1319 are connected to the conductive films 1336a and 1336b respectively in advance, which serve as the connection terminals of the thin-film secondary battery 1389. Here, an example is shown in which an electrical connection between the conductive films 1334a and 1336a or an electrical connection between the conductive films 1334b and 1336b is performed by pressure bonding with an adhesive material such as an anisotropic conductive film (ACF) or an anisotropic conductive paste (ACP) interposed therebetween. In this embodiment mode, the example is shown, in which the connection is performed using conductive particles 1338 included in an adhesive resin 1337. Alternatively, a conductive adhesive such as a silver paste, a copper paste, or a carbon paste; solder joint; or the like can be used.

[0101]

The structures of such transistors can be various without being limited to the specific structures shown in this embodiment mode. For example, a multi-gate structure having two or more gate electrodes may be employed. When a multi-gate structure is employed, a structure in which channel regions are connected in series is provided; therefore, a structure in which a plurality of transistors are connected in series is provided. When a multi-gate structure is employed, various advantages can be obtained in that off-current can be reduced; withstand voltage of the transistor can be increased, so that the reliability is increased; and even if drain-source voltage changes when the transistor operates in the saturation region, a drain-source current does not change very much, and thus flat characteristics can be obtained. In addition, a structure in which gate electrodes are formed above and below a channel may also be employed. When a structure in

which gate electrodes are formed above and below a channel is employed, the channel region is enlarged and the amount of current flowing therethrough can be increased. Thus, a depletion layer can be easily formed and the subthreshold swing (S value) can be decreased. When gate electrodes are formed above and below a channel, a structure in which a plurality of transistors are connected in parallel is provided.

[0102]

In addition, the transistors may have any of the following structures: a structure in which a gate electrode is formed above a channel; a structure in which a gate electrode is formed below a channel; a staggered structure; an inverted staggered structure. In addition, the transistors may have a structure in which a channel region is divided into a plurality of regions and the divided regions are connected in parallel or in series. In addition, a channel (or part thereof) may overlap with a source electrode or a drain electrode. When a structure in which a channel (or part thereof) overlaps with a source electrode or a drain electrode is employed, electric charges can be prevented from being accumulated in part of the channel and thus an unstable operation can be prevented. In addition, an LDD (Lightly Doped Drain) region may be provided. When an LDD region is provided, off-current can be reduced; the withstand voltage of the transistor can be increased, so that the reliability is increased; and even if drain-source voltage changes when the transistor operates in the saturation region, drain-source current does not change very much, and thus flat characteristics can be obtained.

[0103]

The method for manufacturing the semiconductor device in this embodiment mode can be applied to any of the semiconductor devices in the other embodiment modes.

[0104]

(Embodiment Mode 5)

Embodiment Mode 5 describes an example of a method for manufacturing the semiconductor device described in the above embodiment modes, with reference to drawings. This embodiment mode describes a structure in which an antenna circuit and a power supply circuit in a CPU are formed over the same substrate. It is to be noted that an antenna circuit and a power supply circuit are formed using transistors including

channel formation regions formed on a single crystal substrate, at a time over the same substrate. When transistors formed using a single crystal substrate are used as the transistors, a semiconductor device having transistors with few characteristic variations can be formed, which is preferable. In addition, this embodiment mode describes an example in which the thin-film secondary battery described in Embodiment Mode 4 is used as the storage capacitor of the power supply circuit.

[0105]

First, insulating films (also referred to as field oxide films) 2302 are formed on a semiconductor substrate 2300 to form regions (also referred to as element formation regions or element separation regions) 2304 and 2306 (see FIG. 11A). The regions 2304 and 2306 provided in the semiconductor substrate 2300 are insulated from each other by the insulating film 2302. The example shown here is the case where a single crystal Si substrate having n-type conductivity is used as the semiconductor substrate 2300, and a p well 2307 is formed in the region 2306 of the semiconductor substrate 2300.

[0106]

Any substrate can be used as the substrate 2300 as long as it is a semiconductor substrate. For example, a single crystal Si substrate having n-type or p-type conductivity, a compound semiconductor substrate (e.g., a GaAs substrate, an InP substrate, a GaN substrate, a SiC substrate, a sapphire substrate, or a ZnSe substrate), an SOI (Silicon on Insulator) substrate formed by a bonding method or a SIMOX (Separation by IMplanted OXygen) method, or the like can be used.

[0107]

The regions 2304 and 2306 can be formed by a LOCOS (LOCal Oxidation of Silicon) method, a trench isolation method, or the like.

[0108]

In addition, the p well 2307 formed in the region 2306 of the semiconductor substrate 2300 can be formed by selective doping of the semiconductor substrate 2300 with a p-type impurity element. As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used.

[0109]

In this embodiment mode, although the region 2304 is not doped with an impurity element because a semiconductor substrate having n-type conductivity is used as the semiconductor substrate 2300, an n well may be formed in the region 2304 by introduction of an n-type impurity element. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used. When a semiconductor substrate having p-type conductivity is used, on the other hand, the region 2304 may be doped with an n-type impurity element to form an n well, whereas the region 2306 may be doped with no impurity element.

[0110]

Next, insulating films 2332 and 2334 are formed so as to cover the regions 2304 and 2306, respectively (see FIG. 11B).

[0111]

For example, surfaces of the regions 2304 and 2306 provided in the semiconductor substrate 2300 are oxidized by heat treatment, so that the insulating films 2332 and 2334 can be formed of silicon oxide films. Alternatively, the insulating films 2332 and 2334 may be formed to have a stacked structure of a silicon oxide film and a film containing oxygen and nitrogen (a silicon oxynitride film) by the steps of forming a silicon oxide film by a thermal oxidation method and then nitriding the surface of the silicon oxide film by nitridation treatment.

[0112]

Further alternatively, the insulating films 2332 and 2334 can be formed by plasma treatment as described above. For example, the insulating films 2332 and 2334 can be formed using a silicon oxide (SiO_x) film or a silicon nitride (SiN_x) film which is obtained by application of high-density plasma oxidation or high-density plasma nitridation treatment to the surfaces of the regions 2304 and 2306 provided in the semiconductor substrate 2300. Furthermore, after applying high-density plasma oxidation treatment to the surfaces of the regions 2304 and 2306, high-density plasma nitridation treatment may be performed. In that case, silicon oxide films are formed on the surfaces of the regions 2304 and 2306, and then silicon oxynitride films are formed on

the silicon oxide films. Thus, the insulating films 2332 and 2334 are each formed to have a stacked structure of the silicon oxide film and the silicon oxynitride film. In addition, after silicon oxide films are formed on the surfaces of the regions 2304 and 2306 by a thermal oxidation method, high-density plasma oxidation or high-density nitridation treatment may be applied to the silicon oxide films.

[0113]

The insulating films 2332 and 2334 formed over the regions 2304 and 2306 of the semiconductor substrate 2300 respectively function as the gate insulating films of transistors which are completed later.

[0114]

Next, a conductive film is formed so as to cover the insulating films 2332 and 2334 which are formed over the regions 2304 and 2306, respectively (see FIG. 11C). Here, an example is shown in which the conductive film is formed by sequentially stacking conductive films 2336 and 2338. Needless to say, the conductive film may be formed using a single layer or a stacked structure of three or more layers.

[0115]

As materials of the conductive films 2336 and 2338, an element selected from tantalum (Ta), tungsten (W), titanium (Ti), molybdenum (Mo), aluminum (Al), copper (Cu), chromium (Cr), niobium (Nb), and the like, or an alloy material or a compound material containing such an element as its main component can be used. Alternatively, a metal nitride film obtained by nitridation of the above element can be used. Besides, a semiconductor material typified by polycrystalline silicon doped with an impurity element such as phosphorus can be used.

[0116]

In this case, a stacked structure is employed in which the conductive film 2336 is formed using tantalum nitride and the conductive film 2338 is formed thereover using tungsten. Alternatively, it is also possible to form the conductive film 2336 using a single-layer film or a stacked film of tungsten nitride, molybdenum nitride, and/or titanium nitride and form the conductive film 2338 using a single-layer film or a stacked film of tantalum, molybdenum, and/or titanium.

[0117]

Next, the stacked conductive films 2336 and 2338 are selectively removed by etching, so that the conductive films 2336 and 2338 remain above part of the regions 2304 and 2306, respectively. Thus, gate electrodes 2340 and 2342 are formed (see FIG. 12A).

[0118]

Next, a resist mask 2348 is selectively formed so as to cover the region 2304, and the region 2306 is doped with an impurity element, using the resist mask 2348 and the gate electrode 2342 as masks, so that impurity regions are formed (see FIG. 12B). As an impurity element, an n-type impurity element or a p-type impurity element is used. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used. As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used. Here, phosphorus (P) is used as the impurity element.

[0119]

In FIG. 12B, by introduction of an impurity element, impurity regions 2352 which form source and drain regions and a channel formation region 2350 are formed in the region 2306.

[0120]

Next, a resist mask 2366 is selectively formed so as to cover the region 2306, and the region 2304 is doped with an impurity element, using the resist mask 2366 and the gate electrode 2340 as masks, so that impurity regions are formed (see FIG. 12C). As the impurity element, an n-type impurity element or a p-type impurity element is used. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used. As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used. At this time, an impurity element (e.g., boron (B)) of a conductivity type different from that of the impurity element introduced into the region 2306 in FIG. 12B is used. As a result, impurity regions 2370 which form source and drain regions and a channel formation region 2368 are formed in the region 2304.

[0121]

Next, a second insulating film 2372 is formed so as to cover the insulating films 2332 and 2334 and the gate electrodes 2340 and 2342. Then, wirings 2374, which are

electrically connected to the impurity regions 2352 and 2370 formed in the regions 2306 and 2304 respectively, are formed over the second insulating film 2372 (see FIG. 13A).

[0122]

The second insulating film 2372 can be formed with a single layer or a stacked layer of an insulating film containing oxygen and/or nitrogen such as silicon oxide (SiO_x), silicon nitride (SiN_x), silicon oxynitride (SiO_xN_y where $x > y > 0$), or silicon nitride oxide (SiN_xO_y where $x > y > 0$); a film containing carbon such as DLC (Diamond-Like Carbon); an organic material such as epoxy, polyimide, polyamide, polyvinyl phenol, benzocyclobutene, or acrylic; or a siloxane material such as a siloxane resin by a CVD method, a sputtering method or the like. A siloxane material corresponds to a material having a bond of Si-O-Si. Siloxane has a skeleton structure with the bond of silicon (Si) and oxygen (O). As a substituent of siloxane, an organic group containing at least hydrogen (e.g., an alkyl group or aromatic hydrocarbon) is used. Also, a fluoro group may be used as the substituent, or both a fluoro group and an organic group containing at least hydrogen may be used.

[0123]

The wirings 2374 are formed with a single layer or a stacked layer of an element selected from aluminum (Al), tungsten (W), titanium (Ti), tantalum (Ta), molybdenum (Mo), nickel (Ni), platinum (Pt), copper (Cu), gold (Au), silver (Ag), manganese (Mn), neodymium (Nd), carbon (C), and silicon (Si), or an alloy material or a compound material containing such an element as its main component by a CVD method, a sputtering method, or the like. An alloy material containing aluminum as its main component corresponds to, for example, a material which contains aluminum as its main component and also contains nickel, or a material which contains aluminum as its main component and also contains nickel and one or both of carbon and silicon. The wirings 2374 are preferably formed to have a stacked structure of a barrier film, an aluminum-silicon (Al-Si) film, and a barrier film or a stacked structure of a barrier film, an aluminum-silicon (Al-Si) film, a titanium nitride film, and a barrier film. It is to be noted that the "barrier film" corresponds to a thin film formed of titanium, titanium nitride, molybdenum, or molybdenum nitride. Aluminum and aluminum silicon are

suitable materials for forming the wirings 2374 because they have high resistance values and are inexpensive. When barrier layers are provided as the top layer and the bottom layer, generation of hillocks of aluminum or aluminum silicon can be prevented. When a barrier film is formed of titanium which is an element having a high reducing property, even if a thin natural oxide film is formed on the crystalline semiconductor film, the natural oxide film can be reduced, and a favorable contact between the wirings 2374 and the crystalline semiconductor film can be obtained.

[0124]

It is to be noted that the structure of transistors of the present invention is not limited to the one shown in the drawing. For example, a transistor with an inverted staggered structure, a FinFET structure, or the like can be used. A FinFET structure is preferable because it can suppress a short channel effect which occurs along with reduction in transistor size.

[0125]

The semiconductor device of the present invention includes the storage capacitor by which power can be stored in the power supply circuit of the CPU. As the storage capacitor, a capacitor such as an electric double layer capacitor or a thin-film secondary battery is preferably used. In this embodiment mode, a connection between the transistor formed in this embodiment mode and a thin-film secondary battery is explained.

[0126]

In this embodiment mode, the secondary battery is stacked over the wiring 2374 connected to the transistor. The secondary battery has a structure in which a current-collecting thin film, a negative electrode active material layer, a solid electrolyte layer, a positive electrode active material layer, and a current-collecting thin film are sequentially stacked (see FIG. 13B). Therefore, the material of the wiring 2374 which also has a function of the current-collecting thin film of the secondary battery should have high adhesion to the negative electrode active material layer and also low resistance. In particular, aluminum, copper, nickel, vanadium, or the like is preferably used.

[0127]

Subsequently, the structure of the thin-film secondary battery is described. A negative electrode active material layer 2391 is formed over the wiring 2374. In general, vanadium oxide (V_2O_5) or the like is used. Next, a solid electrolyte layer 2392 is formed over the negative electrode active material layer 2391. In general, lithium phosphate (Li_3PO_4) or the like is used. Next, a positive electrode active material layer 2393 is formed over the solid electrolyte layer 2392. In general, lithium manganate ($LiMn_2O_4$) or the like is used. Lithium cobaltate ($LiCoO_2$) or lithium nickel oxide ($LiNiO_2$) may also be used. Next, a current-collecting thin film 2394 to serve as an electrode is formed over the positive electrode active material layer 2393. The current-collecting thin film 2394 should have high adhesion to the positive electrode active material layer 2393 and also low resistance. For example, aluminum, copper, nickel, vanadium, or the like can be used.

[0128]

Each of the above-described thin layers of the negative electrode active material layer 2391, the solid electrolyte layer 2392, the positive electrode active material layer 2393, and the current-collecting thin film 2394 may be formed by a sputtering technique or an evaporation technique. In addition, the thickness of each layer is preferably 0.1 to 3 μm.

[0129]

Next, an interlayer film 2396 is formed by application of a resin. The interlayer film 2396 is etched to form a contact hole. The interlayer film is not limited to a resin, and other films such as an oxide film formed by CVD method or the like may also be used; however, a resin is preferably used in terms of flatness. In addition, the contact hole may be formed without etching, but using a photosensitive resin. Next, a wiring layer 2395 is formed over the interlayer film 2396 and connected to a wiring 2397. Thus, an electrical connection of the secondary battery is secured.

[0130]

With the above-described structure, the semiconductor device of the present invention can have a structure in which transistors are formed on a single crystal substrate

and a thin-film secondary battery is formed thereover. Thus, by achieving thinning and reduction in size of the CPU, the semiconductor device of the present invention having a lot of flexibility in physical form can be provided.

[0131]

The method for manufacturing the semiconductor device in this embodiment mode can be applied to any of the semiconductor devices in the other embodiment modes.

[0132]

(Embodiment Mode 6)

Embodiment Mode 6 describes an example of a method for manufacturing a semiconductor device, which is different from that described in Embodiment Mode 4, with reference to drawings.

[0133]

First, an insulating film is formed over a substrate 2600. Here, a single crystal Si substrate having n-type conductivity is used as the substrate 2600, and insulating films 2602 and 2604 are formed over the substrate 2600 (see FIG. 14A). For example, silicon oxide (SiO_x) is formed as the insulating film 2602 by application of heat treatment to the substrate 2600, and then silicon nitride (SiN_x) is formed over the insulating film 2602 by a CVD method.

[0134]

Any substrate can be used as the substrate 2600 as long as it is a semiconductor substrate, without particular limitations. For example, a single crystal Si substrate having n-type or p-type conductivity, a compound semiconductor substrate (e.g., a GaAs substrate, an InP substrate, a GaN substrate, a SiC substrate, a sapphire substrate, or a ZnSe substrate), an SOI (Silicon on Insulator) substrate formed by a bonding method or a SIMOX (Separation by IMplanted OXygen) method, or the like can be used.

[0135]

In addition, the insulating film 2604 may be formed by nitridation of the insulating film 2602 by high-density plasma treatment, after forming the insulating film 2602. It is to be noted that the insulating film provided over the substrate 2600 may have a single-layer structure or a stacked structure of three or more layers.

[0136]

Next, patterns of a resist mask 2606 are selectively formed over the insulating film 2604, and selective etching is performed using the resist mask 2606 as a mask, so that recessed portions 2608 are selectively formed in the substrate 2600 (see FIG. 14B). For the etching of the substrate 2600 and the insulating films 2602 and 2604, plasma dry etching can be conducted.

[0137]

Next, the patterns of the resist mask 2606 are removed, and then an insulating film 2610 is formed so as to fill the recessed portions 2608 formed in the substrate 2600 (see FIG. 14C).

[0138]

The insulating film 2610 is formed of an insulating material such as silicon oxide, silicon nitride, silicon oxynitride (SiO_xN_y, where $x > y > 0$), or silicon nitride oxide (SiN_xO_y, where $x > y > 0$) by a CVD method, a sputtering method, or the like. As the insulating film 2610, a silicon oxide film is formed by an atmospheric pressure CVD method or a low-pressure CVD method using a TEOS (tetraethyl orthosilicate) gas.

[0139]

Next, the surface of the substrate 2600 is exposed by grinding treatment or polishing treatment such as CMP (Chemical Mechanical Polishing). Here, by exposure of the surface of the substrate 2600, regions 2612 and 2613 are formed between insulating films 2611 which are formed in the recessed portions 2608 of the substrate 2600. The insulating film 2610 formed over the surface of the substrate 2600 is removed by grinding treatment or polishing treatment such as CMP, so that the insulating films 2611 are obtained. Subsequently, by selective introduction of a p-type impurity element, a p well 2615 is formed in the region 2613 of the substrate 2600 (see FIG. 15A).

[0140]

As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used. In this case, boron (B) is introduced into the region 2613 as the impurity element.

[0141]

In this embodiment mode, the region 2612 is not doped with an impurity element because a semiconductor substrate having n-type conductivity is used as the substrate 2600. However, an n well may be formed in the region 2612 by introduction of an n-type impurity element. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used.

[0142]

When a semiconductor substrate having p-type conductivity is used, on the other hand, the region 2612 may be doped with an n-type impurity element to form an n well, whereas the region 2613 may be doped with no impurity element.

[0143]

Next, insulating films 2632 and 2634 are formed over the surfaces of the regions 2612 and 2613 in the substrate 2600, respectively (see FIG. 15B).

[0144]

For example, surfaces of the regions 2612 and 2613 provided in the substrate 2600 are oxidized by heat treatment, so that the insulating films 2632 and 2634 of silicon oxide films can be formed. Alternatively, the insulating films 2632 and 2634 may each be formed to have a stacked structure of a silicon oxide film and a film containing oxygen and nitrogen (a silicon oxynitride film) by the steps of forming a silicon oxide film by a thermal oxidation method and then nitriding the surface of the silicon oxide film by nitridation treatment.

[0145]

Further alternatively, the insulating films 2632 and 2634 may be formed by plasma treatment as described above. For example, the insulating films 2632 and 2634 can be formed with a silicon oxide (SiO_x) film or a silicon nitride (SiN_x) film which is obtained by application of high-density plasma oxidation or high-density nitridation treatment to the surfaces of the regions 2612 and 2613 provided in the substrate 2600. In addition, after application of high-density plasma oxidation treatment to the surfaces of the regions 2612 and 2613, high-density plasma nitridation treatment may be conducted. In that case, silicon oxide films are formed on the surfaces of the regions 2612 and 2613

and then silicon oxynitride films are formed on the silicon oxide films. Thus, the insulating films 2632 and 2634 are each formed to have a stacked structure of the silicon oxide film and the silicon oxynitride film. In addition, silicon oxide films are formed on the surfaces of the regions 2612 and 2613 by a thermal oxidation method, and then high-density plasma oxidation treatment or high-density plasma nitridation treatment may be performed to the silicon oxide films.

[0146]

It is to be noted that the insulating films 2632 and 2634 formed over the regions 2612 and 2613 of the substrate 2600 respectively function as the gate insulating films of transistors which are completed later.

[0147]

Next, a conductive film is formed so as to cover the insulating films 2632 and 2634 which are formed over the regions 2612 and 2613 provided in the substrate 2600, respectively (see FIG. 15C). In this embodiment mode, an example is shown where the conductive film is formed by sequentially stacking conductive films 2636 and 2638. Needless to say, the conductive film may be formed to have a single layer or a stacked structure of three or more layers.

[0148]

As a material of the conductive films 2636 and 2638, an element selected from tantalum (Ta), tungsten (W), titanium (Ti), molybdenum (Mo), aluminum (Al), copper (Cu), chromium (Cr), niobium (Nb), and the like, or an alloy material or a compound material containing such an element as its main component can be used. Alternatively, a metal nitride film obtained by nitridation of such an element can also be used. Furthermore, a semiconductor material typified by polycrystalline silicon doped with an impurity element such as phosphorus can also be used.

[0149]

In this case, a stacked structure is employed in which the conductive film 2636 is formed using tantalum nitride and the conductive film 2638 is formed thereover using tungsten. Alternatively, it is also possible to form the conductive film 2636 using a single-layer film or a stacked film of tantalum nitride, tungsten nitride, molybdenum

nitride, and/or titanium nitride and form the conductive film 2638 using a single-layer film or a stacked film of tungsten, tantalum, molybdenum, and/or titanium.

[0150]

Next, the stacked conductive films 2636 and 2638 are selectively removed by etching, so that the conductive films 2636 and 2638 remain above part of the regions 2612 and 2613 of the substrate 2600. Thus, conductive films 2640 and 2642 functioning as gate electrodes are formed (see FIG. 16A). Here, surfaces of the regions 2612 and 2613 of the substrate 2600 which do not overlap with the conductive films 2640 and 2642 respectively are exposed.

[0151]

Specifically, in the region 2612 of the substrate 2600, a part of the insulating film 2632 formed below the conductive film 2640, which does not overlap with the conductive film 2640, is selectively removed, so that the ends of the conductive film 2640 and the ends of the insulating film 2632 are almost aligned with each other. In addition, in the region 2613 of the substrate 2600, a part of the insulating film 2634 formed below the conductive film 2642, which does not overlap with the conductive film 2642, is selectively removed, so that the ends of the conductive film 2642 and the ends of the insulating film 2634 are almost aligned with each other.

[0152]

In this case, the part of the insulating films or the like which do not overlap with the conductive films 2640 and 2642 may be removed at the same time as the formation of the conductive films 2640 and 2642. Alternatively, the part of the insulating films which do not overlap with the conductive films 2640 and 2642 may be removed using resist masks which are left after the formation of the conductive films 2640 and 2642 or the conductive films 2640 and 2642 as masks.

[0153]

Then, the regions 2612 and 2613 of the substrate 2600 are selectively doped with an impurity element (see FIG. 16B). At this time, the region 2613 is selectively doped with an n-type impurity element at low concentration, using the conductive film 2642 as a mask, to form low concentration impurity regions 2650, whereas the region 2612 is

selectively doped with a p-type impurity element at low concentration, using the conductive film 2640 as a mask, to form low concentration impurity regions 2648. As an n-type impurity element, phosphorus (P), arsenic (As), or the like can be used. As a p-type impurity element, boron (B), aluminum (Al), gallium (Ga), or the like can be used.

[0154]

Next, sidewalls 2654 are formed so as to be in contact with the side surfaces of the conductive films 2640 and 2642. Specifically, the sidewalls are formed with a single layer or a stacked layer of an insulating film such as a film containing an inorganic material such as silicon, silicon oxide, or silicon nitride, and/or a film containing an organic material such as an organic resin. Then, the insulating film is selectively etched by anisotropic etching mainly in the perpendicular direction, so that the sidewalls 2654 can be formed so as to be in contact with the side surfaces of the conductive films 2640 and 2642. The sidewalls 2654 are used as masks in doping for forming LDD (Lightly Doped Drain) regions. In addition, the sidewalls 2654 are formed to be in contact with side surfaces of the insulating films formed below the conductive films 2640 and 2642.

[0155]

Next, the regions 2612 and 2613 of the substrate 2600 are doped with an impurity element, using the sidewalls 2654 and the conductive films 2640 and 2642 as masks, so that impurity regions which function as source and drain regions are formed (see FIG. 16C). At this time, the region 2613 of the substrate 2600 is doped with an n-type impurity element at high concentration, using the sidewalls 2654 and the conductive film 2642 as masks, whereas the region 2612 is doped with a p-type impurity element at high concentration, using the sidewalls 2654 and the conductive film 2640 as masks.

[0156]

As a result, impurity regions 2658 which form source and drain regions, low concentration impurity regions 2660 which form LDD regions, and a channel formation region 2656 are formed in the region 2612 of the substrate 2600. Meanwhile, impurity regions 2664 which form source and drain regions, low concentration impurity regions 2666 which form LDD regions, and a channel formation region 2662 are formed in the

region 2613 of the substrate 2600.

[0157]

In this embodiment mode, the impurity elements are introduced under the condition that parts of the regions 2612 and 2613 of the substrate 2600 which do not overlap with the conductive films 2640 and 2642 are exposed. Accordingly, the channel formation regions 2656 and 2662 which are formed in the regions 2612 and 2613 of the substrate 2600 respectively can be formed in a self-aligned manner, due to the conductive films 2640 and 2642.

[0158]

Next, an insulating film 2677 is formed so as to cover the insulating films, the conductive films, and the like which are provided over the regions 2612 and 2613 of the substrate 2600, and opening portions 2678 are formed in the insulating film 2677 (see FIG. 17A).

[0159]

The insulating film 2677 can be formed with a single layer or a stacked layer of an insulating film containing oxygen and/or nitrogen such as silicon oxide (SiO_x), silicon nitride (SiN_x), silicon oxynitride (SiO_xN_y where $x > y > 0$), or silicon nitride oxide (SiN_xO_y where $x > y > 0$); a film containing carbon such as DLC (Diamond-Like Carbon); an organic material such as epoxy, polyimide, polyamide, polyvinyl phenol, benzocyclobutene, or acrylic; or a siloxane material such as a siloxane resin, by a CVD method, a sputtering method, or the like. A siloxane material corresponds to a material having a bond of Si-O-Si. Siloxane has a skeleton structure with the bond of silicon (Si) and oxygen (O). As a substituent of siloxane, an organic group containing at least hydrogen (e.g., an alkyl group or aromatic hydrocarbon) is used. In addition, a fluoro group may be used as the substituent. Further, a fluoro group and an organic group containing at least hydrogen may be used as the substituent.

[0160]

Next, conductive films 2680 are formed in the opening portions 2678. Then, conductive films 2682a to 2682d and 2697 are selectively formed over the insulating film 2677 so as to be electrically connected to the conductive films 2680 (see FIG. 17B).

[0161]

The conductive films 2680, 2682a to 2682d and 2697 are formed with a single layer or a stacked layer of an element selected from aluminum (Al), tungsten (W), titanium (Ti), tantalum (Ta), molybdenum (Mo), nickel (Ni), platinum (Pt), copper (Cu), gold (Au), silver (Ag), manganese (Mn), neodymium (Nd), carbon (C), and silicon (Si), or an alloy material or a compound material containing such an element as its main component by a CVD method, a sputtering method, or the like. An alloy material containing aluminum as its main component corresponds to, for example, a material which contains aluminum as its main component and also contains nickel, or a material which contains aluminum as its main component and also contains nickel and one or both of carbon and silicon. For example, each of the conductive films 2680, 2682a to 2682d and 2697 is preferably formed to have a stacked structure of a barrier film, an aluminum-silicon (Al-Si) film, and a barrier film or a stacked structure of a barrier film, an aluminum-silicon (Al-Si) film, a titanium nitride film, and a barrier film. It is to be noted that the "barrier film" corresponds to a thin film formed of titanium, titanium nitride, molybdenum, or molybdenum nitride. Aluminum and aluminum silicon are suitable materials for forming the conductive films 2680, 2682a to 2682d and 2697 because they have high resistance values and are inexpensive. When barrier layers are provided as the top layer and the bottom layer, generation of hillocks of aluminum or aluminum silicon can be prevented. When a barrier film is formed of titanium which is an element having a high reducing property, even if a thin natural oxide film is formed on the crystalline semiconductor film, the natural oxide film can be reduced, and a favorable contact between the conductive films 2680 and 2682a to 2682d, and the crystalline semiconductor film can be obtained. Here, the conductive film 2680 can be formed by selective growth of tungsten (W) by a CVD method.

[0162]

Through the above steps, a p-channel transistor formed in the region 2612 of the substrate 2600 and an n-channel transistor formed in the region 2613 of the substrate 2600 can be obtained.

[0163]

It is to be noted that the structure of transistors included in the semiconductor device of the present invention is not limited to the one shown in the drawings. For example, a transistor with an inverted staggered structure, a FinFET structure, or the like can be used. A FinFET structure is preferable because it can suppress a short channel effect which occurs along with reduction in transistor size.

[0164]

The semiconductor device of the present invention is provided with the storage capacitor by which power can be stored in the power supply circuit of the CPU. As the storage capacitor, a capacitor such as an electric double layer capacitor or a thin-film secondary battery is preferably used. In this embodiment mode, a connection between the transistor formed in this embodiment mode and a thin-film secondary battery will be described.

[0165]

In this embodiment mode, a secondary battery is stacked over the conductive film 2682d connected to the transistor. The secondary battery has a structure in which a current-collecting thin film, a negative electrode active material layer, a solid electrolyte layer, a positive electrode active material layer, and a current-collecting thin film are sequentially stacked (see FIG. 17B). Therefore, the material of the conductive film 2682d which also has a function of the current-collecting thin film of the secondary battery should have high adhesion to the negative electrode active material layer and also low resistance. In particular, aluminum, copper, nickel, vanadium, or the like is preferably used.

[0166]

Subsequently, the structure of the thin-film secondary battery is described. A negative electrode active material layer 2691 is formed over the conductive film 2682d. In general, vanadium oxide (V_2O_5) or the like is used. Next, a solid electrolyte layer 2692 is formed over the negative electrode active material layer 2691. In general, lithium phosphate (Li_3PO_4) or the like is used. Next, a positive electrode active material layer 2693 is formed over the solid electrolyte layer 2692. In general, lithium manganate

($LiMn_2O_4$) or the like is used. Lithium cobaltate ($LiCoO_2$) or lithium nickel oxide ($LiNiO_2$) can also be used. Next, a current-collecting thin film 2694 to serve as an electrode is formed over the positive electrode active material layer 2693. The current-collecting thin film 2694 should have high adhesion to the positive electrode active material layer 2693 and also low resistance. For example, aluminum, copper, nickel, vanadium, or the like can be used.

[0167]

Each of the above-described thin layers of the negative electrode active material layer 2691, the solid electrolyte layer 2692, the positive electrode active material layer 2693, and the current-collecting thin film 2694 may be formed by a sputtering technique or an evaporation technique. In addition, the thickness of each layer is preferably 0.1 to 3 μm.

[0168]

Next, an interlayer film 2696 is formed by application of a resin. The interlayer film 2696 is etched to form a contact hole. The interlayer film 2696 is not limited to a resin, and other films such as an oxide film formed by CVD method or the like may also be used; however, a resin is preferably used in terms of flatness. In addition, the contact hole may be formed without etching, but using a photosensitive resin. Next, a wiring layer 2695 is formed over the interlayer film 2696 and is connected to the conductive film 2697. Thus, an electrical connection of the thin-film secondary battery is secured.

[0169]

With the above-described structure, the semiconductor device of the present invention can have a structure in which transistors are formed on a single crystal substrate and a thin-film secondary battery is formed thereover. Thus, by achieving thinning and reduction in size of the CPU, the semiconductor device of the present invention having a lot of flexibility in physical form can be provided.

[0170]

The method for manufacturing the semiconductor device in this embodiment mode can be applied to any of the semiconductor devices in the other embodiment modes.

[0171]

(Embodiment Mode 7)

The semiconductor devices of the present invention can be applied to various electronic devices, specifically to driving of display portions of electronic devices. Such electronic devices include cameras such as video cameras and digital cameras, goggle-type displays, navigation systems, sound reproducing devices (such as car audio systems and audio components), computers, game machines, portable information terminals (such as mobile computers, mobile phones, mobile game machines, and electronic books), image reproducing devices provided with a recording medium (specifically, devices for reproducing content of a recording medium such as a digital versatile disc (DVD) and having a light-emitting device for displaying the reproduced image), and the like.

[0172]

FIG. 18A shows a light-emitting device, which includes a housing 6001, a support base 6002, a display portion 6003, speaker portions 6004, a video input terminal 6005, and the like. The display portion 6003 can be driven by using the semiconductor device of the present invention. Note that the light-emitting device includes various light-emitting devices for displaying information, for example, light-emitting devices for personal computers, television broadcast reception, and advertisement. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the light-emitting device.

[0173]

FIG. 18B shows a camera, which includes a main body 6101, a display portion 6102, an image receiving portion 6103, operation keys 6104, an external connection port 6105, a shutter button 6106, and the like. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the camera.

[0174]

FIG. 18C shows a computer, which includes a main body 6201, a housing 6202, a display portion 6203, a keyboard 6204, an external connection port 6205, a pointing device 6206, and the like. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the computer.

[0175]

FIG. 18D shows a mobile computer, which includes a main body 6301, a display portion 6302, a switch 6303, operation keys 6304, an infrared port 6305, and the like. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the mobile computer.

[0176]

FIG. 18E shows a portable image reproducing device having a recording medium (specifically, a DVD player), which includes a main body 6401, a housing 6402, a display portion A 6403, a display portion B 6404, a recording medium (e.g. DVD) reading portion 6405, operation keys 6406, a speaker portion 6407, and the like. The display portion A 6403 can mainly display image information and the display portion B 6404 can mainly display text information. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the portable image reproducing device.

[0177]

FIG. 18F shows a goggle-type display, which includes a main body 6501, a display portion 6502, and an arm portion 6503. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the goggle-type display.

[0178]

FIG. 18G shows a video camera, which includes a main body 6601, a display portion 6602, a housing 6603, an external connection port 6604, a remote controller receiving portion 6605, an image receiving portion 6606, a battery 6607, an audio input portion 6608, operation keys 6609, and the like. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the video camera.

[0179]

FIG. 18H shows a mobile phone, which includes a main body 6701, a housing 6702, a display portion 6703, an audio input portion 6704, an audio output portion 6705, operation keys 6706, an external connection portion 6707, an antenna 6708, and the like. By using the semiconductor device of the present invention, reduction in power consumption can be achieved. Further, the semiconductor device of the present invention has a lot of flexibility in physical form, which leads to reduction in size of the mobile phone.

[0180]

As described above, the semiconductor device of the present invention can be applied to various electronic devices.

[0181]

The structure of the semiconductor device and the method for manufacturing the semiconductor device in this embodiment mode can be applied to any of the semiconductor devices in the other embodiment modes.

This application is based on Japanese Patent Application serial No. 2006-296650 filed in Japan Patent Office on October 31, 2006, the entire contents of which are hereby incorporated by reference.

CLAIMS

1. A semiconductor device comprising:

a plurality of CPUs;

a router circuit;

a thread control circuit connected to the router circuit through a first bus; and

an external device controller connected to the router circuit through a second bus,

wherein each of the plurality of CPUs includes:

a first wireless circuit which includes a first antenna circuit, a first demodulation circuit, and a first modulation circuit; and

a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register,

wherein the router circuit includes:

a data processing circuit; and

a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit,

wherein the first wireless circuit and the second wireless circuit each are configured to transmit and receive data between the CPU and the router circuit wirelessly,

wherein the first wireless circuit is configured to transmit data to the second wireless circuit by a backscattering method,

wherein the data processing circuit is configured to process and store first data to be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller,

wherein the thread control circuit is configured to allocate an instruction to be executed by the CPU core to the CPU core, and

wherein the external device controller is configured to transmit and receive data to and from an external device which is connected through an external data input line and

an external data output line.

2. A semiconductor device comprising:

a plurality of CPUs;

a router circuit;

a thread control circuit connected to the router circuit through a first bus; and

an external device controller connected to the router circuit through a second bus,

wherein each of the plurality of CPUs includes:

a first wireless circuit which includes a first antenna circuit, a first demodulation circuit, a first modulation circuit, and a power supply circuit; and

a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register,

wherein the power supply circuit is configured to generate a power supply voltage to be supplied to the CPU from a wireless signal received by the first antenna circuit,

wherein the router circuit includes:

a data processing circuit; and

a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit,

wherein the first wireless circuit and the second wireless circuit are configured to transmit and receive data between the CPU and the router circuit wirelessly,

wherein the first wireless circuit is configured to transmit data to the second wireless circuit by a backscattering method,

wherein the data processing circuit is configured to process and store first data to be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller,

wherein the thread control circuit is configured to allocate an instruction to be executed by the CPU core to the CPU core, and

wherein the external device controller is configured to transmit and receive data to and from an external device which is connected through an external data input line and an external data output line.

3. A semiconductor device comprising:

a plurality of CPUs;

a router circuit;

a thread control circuit connected to the router circuit through a first bus; and

an external device controller connected to the router circuit through a second bus,

wherein each of the plurality of CPUs includes:

a first wireless circuit which includes a first antenna circuit, a third antenna circuit, a first demodulation circuit, a first modulation circuit, a first power supply circuit, and a second power supply circuit; and

a CPU core which includes a control circuit, an arithmetic circuit, a cache memory, and a general purpose register,

wherein the first power supply circuit is configured to generate a power supply voltage to be supplied to the CPU from a first wireless signal received by the first antenna circuit,

wherein the second power supply circuit includes a step-up circuit and is configured to generate a power supply voltage to be supplied to the CPU from a second wireless signal received by the third antenna circuit,

wherein the router circuit includes a data processing circuit and a second wireless circuit which includes a second antenna circuit, a second demodulation circuit, and a second modulation circuit,

wherein the first wireless circuit and the second wireless circuit are configured to transmit and receive data between the CPU and the router circuit wirelessly,

wherein the first wireless circuit is configured to transmit data to the second wireless circuit by a backscattering method,

wherein the data processing circuit is configured to process and store first data to

be transmitted to or received from each of the plurality of CPUs, second data to be transmitted to or received from the thread control circuit, and third data to be transmitted to or received from the external device controller,

wherein the thread control circuit are configured to allocate an instruction to be executed by the CPU core to the CPU core, and

wherein the external device controller is configured to transmit and receive data to and from an external device which is connected through an external data input line and an external data output line.

4. The semiconductor device according to claim 1, wherein the external device controller is a DRAM controller.

5. The semiconductor device according to claim 1, wherein the external device controller is a PCI bus controller.

6. The semiconductor device according to claim 1, wherein the external device controller is a USB controller.

7. The semiconductor device according to claim 1, wherein each of the plurality of CPUs is formed using a thin film transistor which includes as an active layer a semiconductor thin film formed over a substrate having an insulating surface.

8. The semiconductor device according to claim 7, wherein the substrate having an insulating surface is one selected from the group consisting of a glass substrate, a plastic substrate, and an SOI substrate.

9. The semiconductor device according to claim 2, wherein the external device controller is a DRAM controller.

10. The semiconductor device according to claim 2, wherein the external

device controller is a PCI bus controller.

11. The semiconductor device according to claim 2, wherein the external device controller is a USB controller.

12. The semiconductor device according to claim 2, wherein each of the plurality of CPUs is formed using a thin film transistor which includes as an active layer a semiconductor thin film formed over a substrate having an insulating surface.

13. The semiconductor device according to claim 12, wherein the substrate having an insulating surface is one selected from the group consisting of a glass substrate, a plastic substrate, and an SOI substrate.

14. The semiconductor device according to claim 3, wherein the external device controller is a DRAM controller.

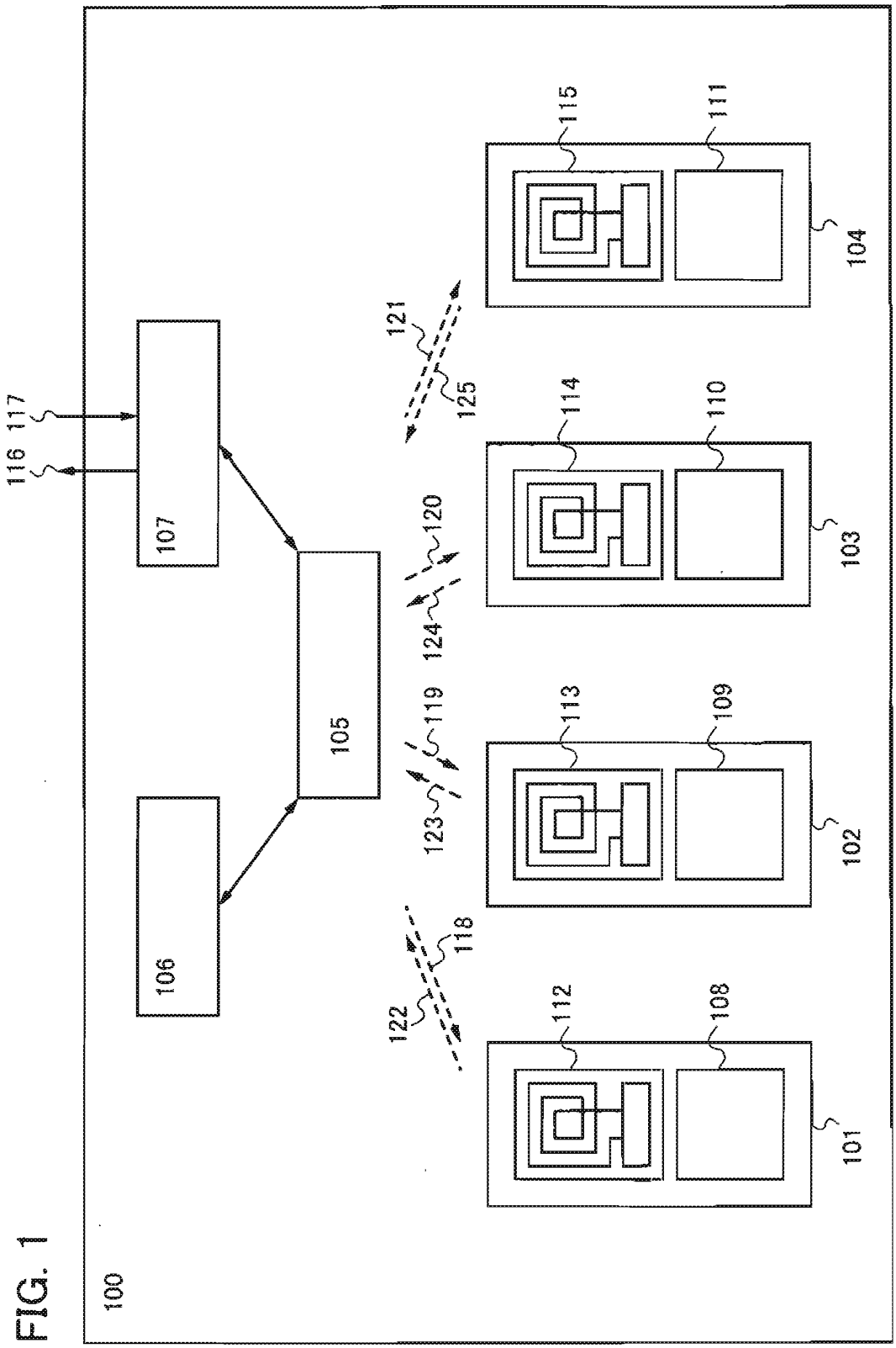
15. The semiconductor device according to claim 3, wherein the external device controller is a PCI bus controller.

16. The semiconductor device according to claim 3, wherein the external device controller is a USB controller.

17. The semiconductor device according to claim 3, wherein each of the plurality of CPUs is formed using a thin film transistor which includes as an active layer a semiconductor thin film formed over a substrate having an insulating surface.

18. The semiconductor device according to claim 17, wherein the substrate having an insulating surface is one selected from the group consisting of a glass substrate, a plastic substrate, and an SOI substrate.

FIG. 1


100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125

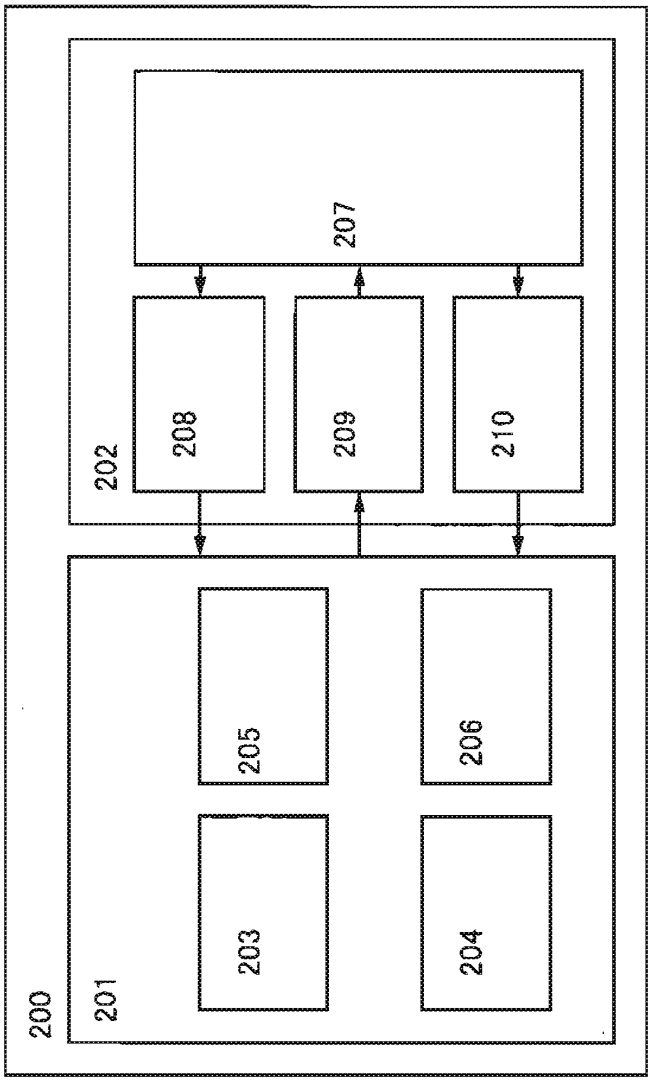


FIG. 2

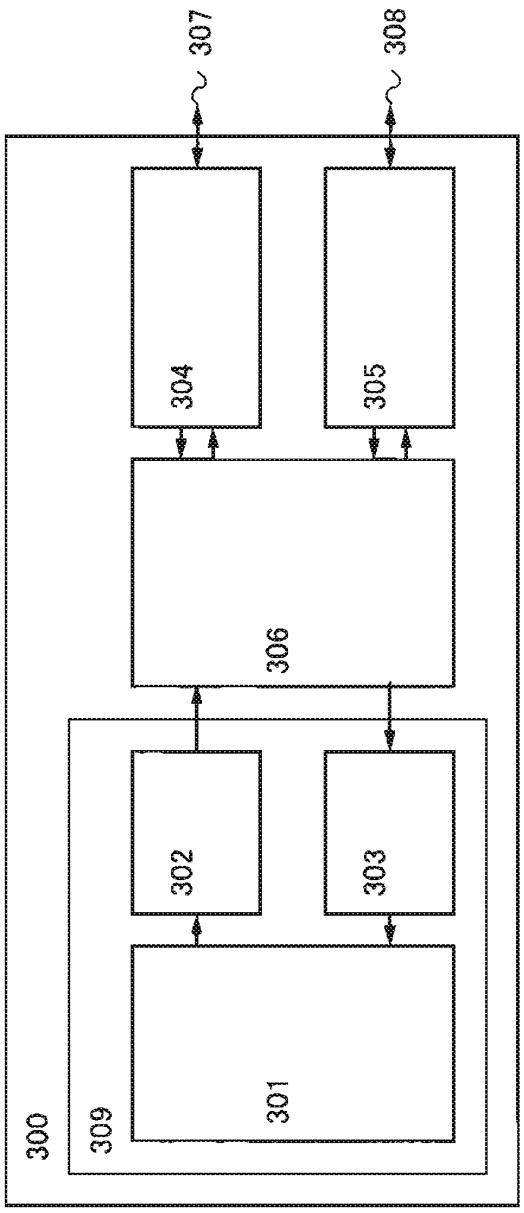


FIG. 3

FIG. 4

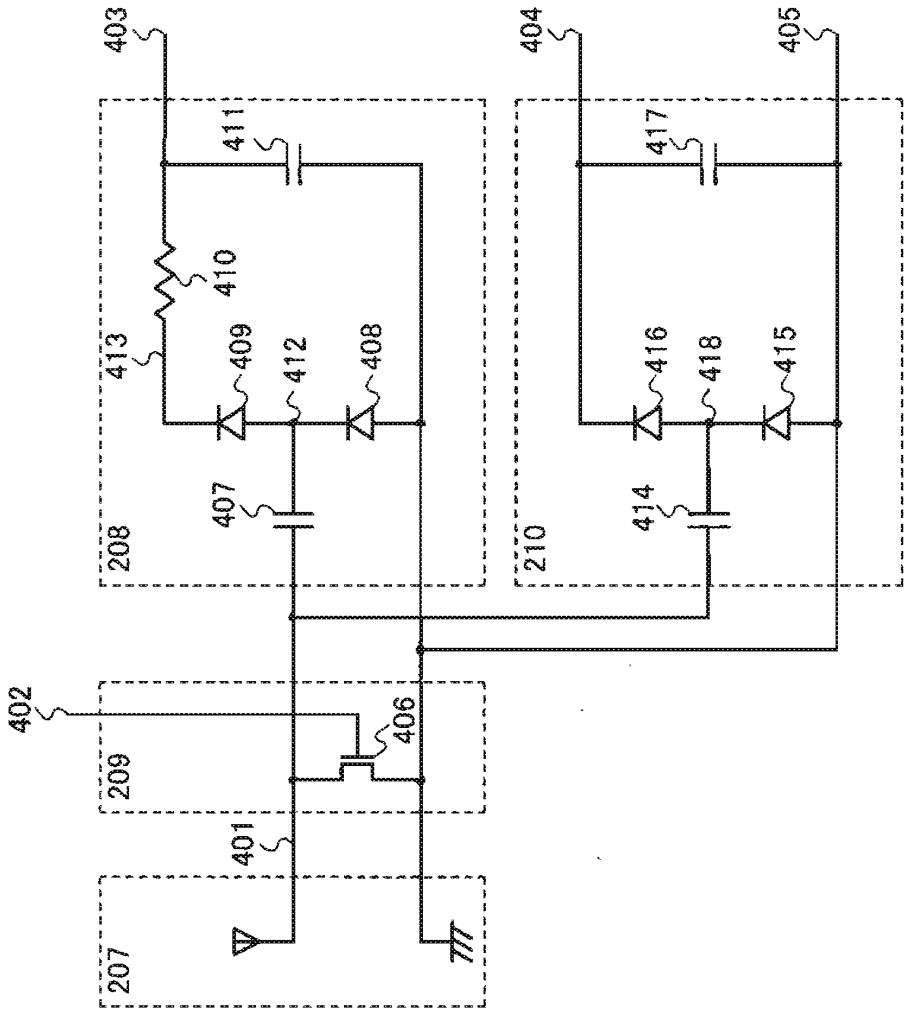

403
404
405
411
417
410
413
409
412
408
416
418
415
407
414
208
210
402
406
209
401
207

FIG. 5

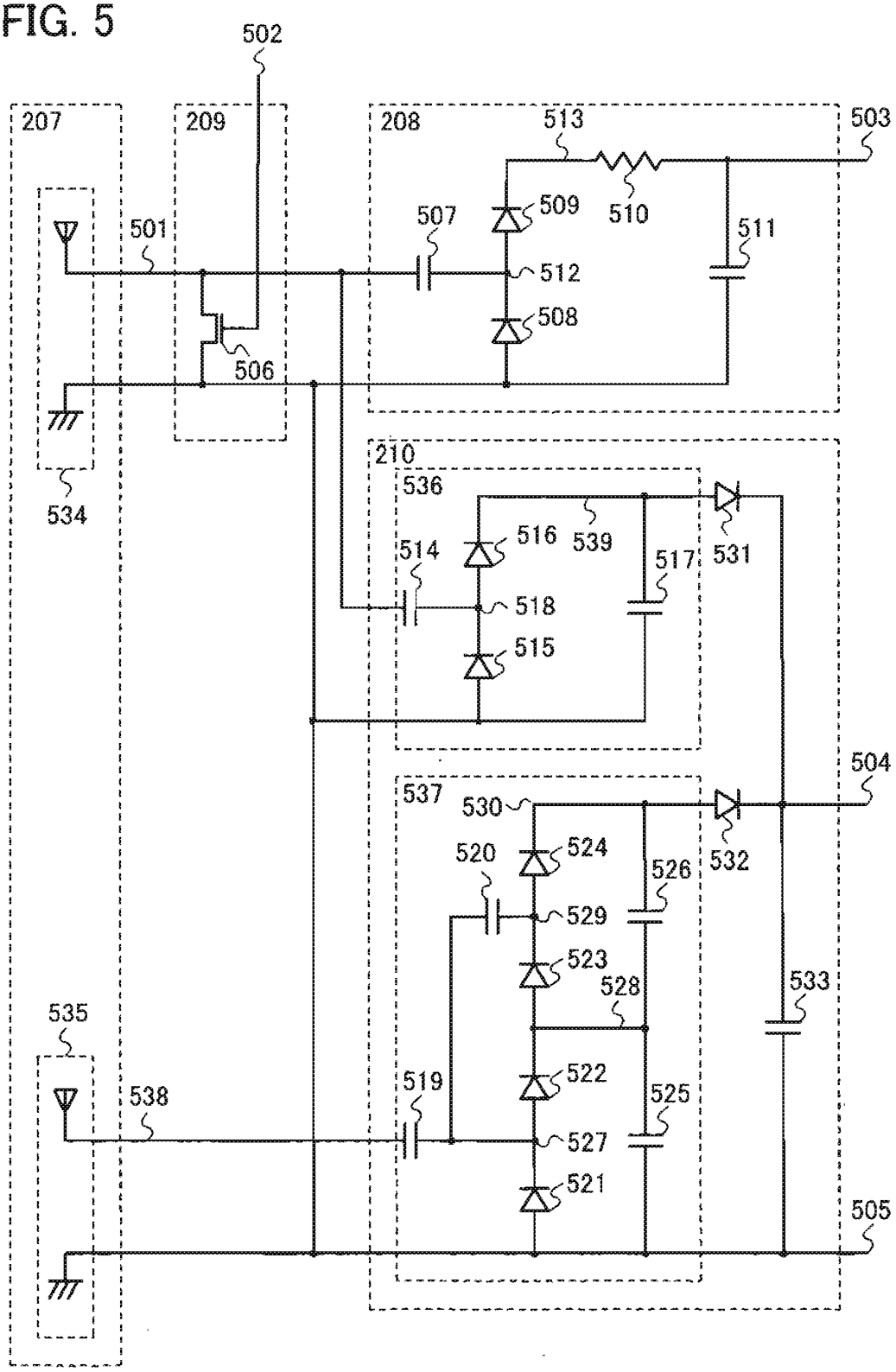

502
207
209
208
513
503
501
507
509
510
511
512
508
506
534
210
536
516
539
531
514
517
518
515
504
537
530
532
520
524
526
529
523
528
533
535
538
519
522
525
527
521
505

FIG. 6A

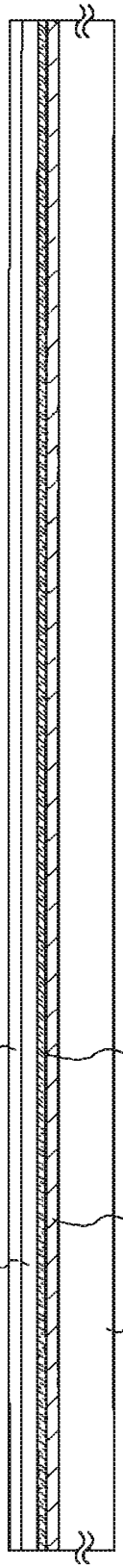


FIG. 6B

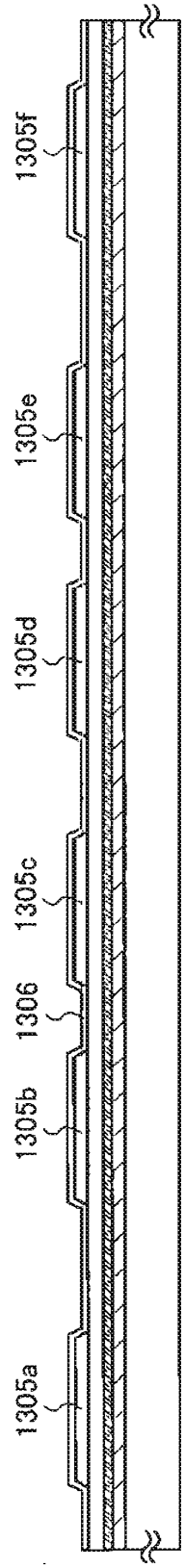


FIG. 6C

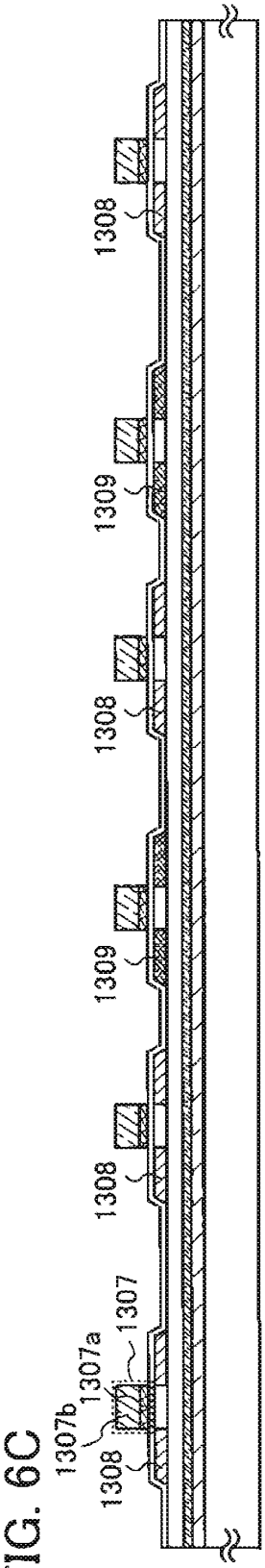


FIG. 6D

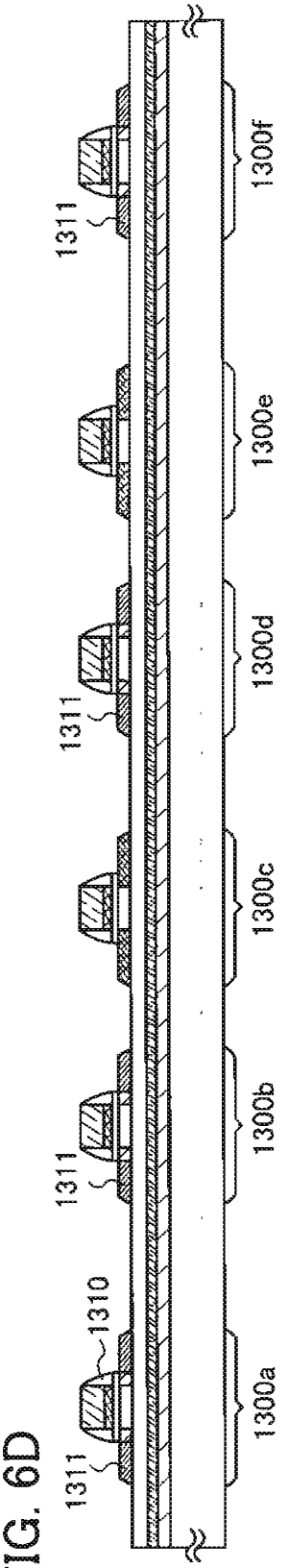


FIG. 7A

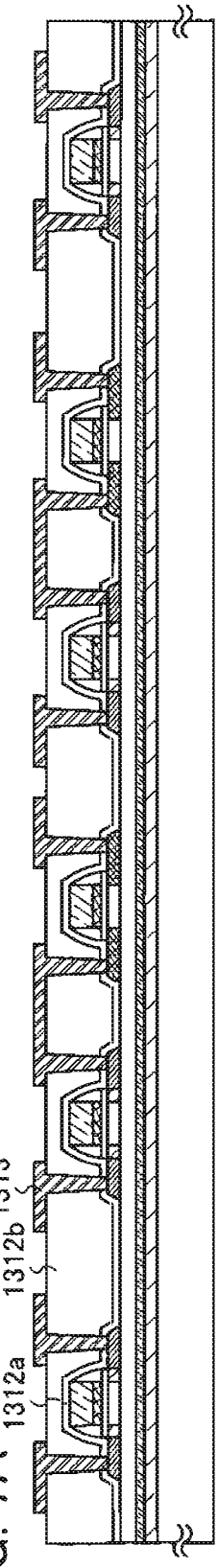


FIG. 7B

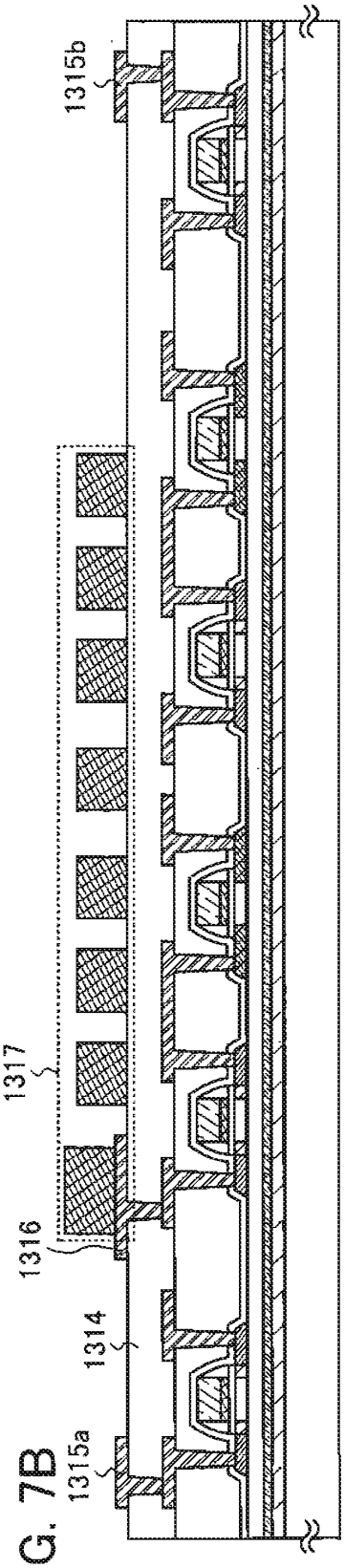


FIG. 7C

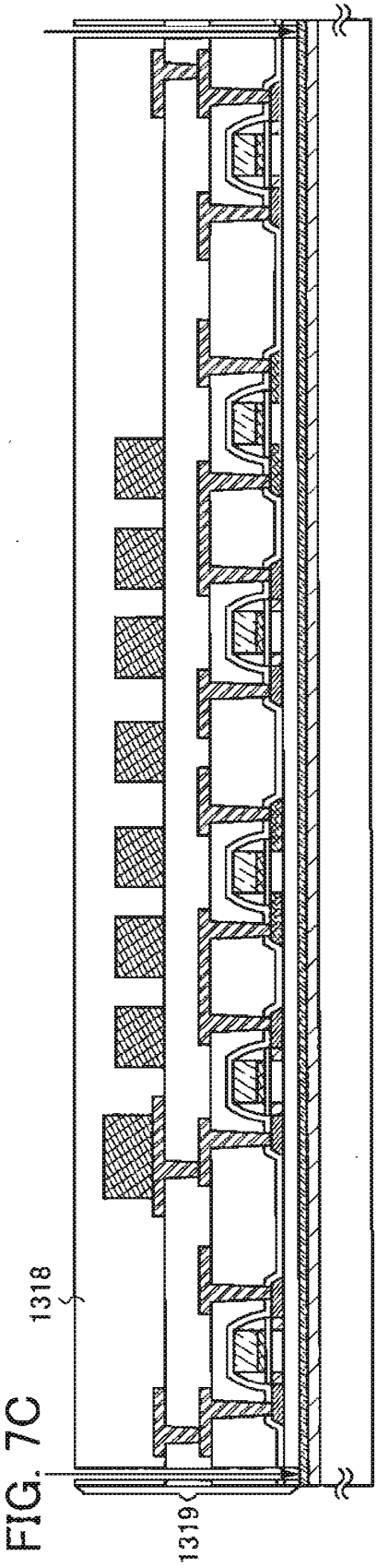


FIG. 8A

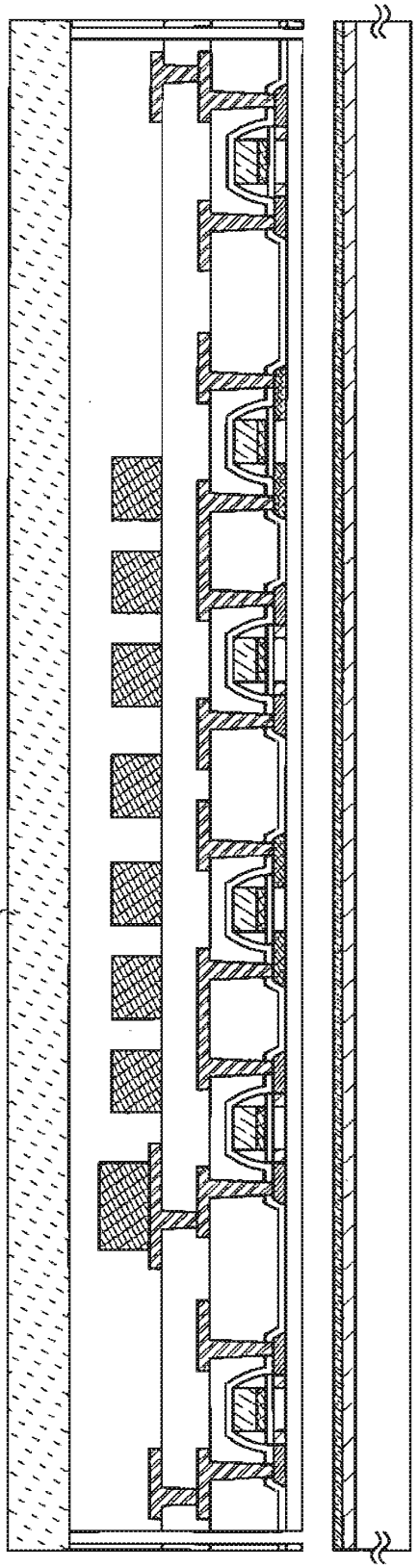
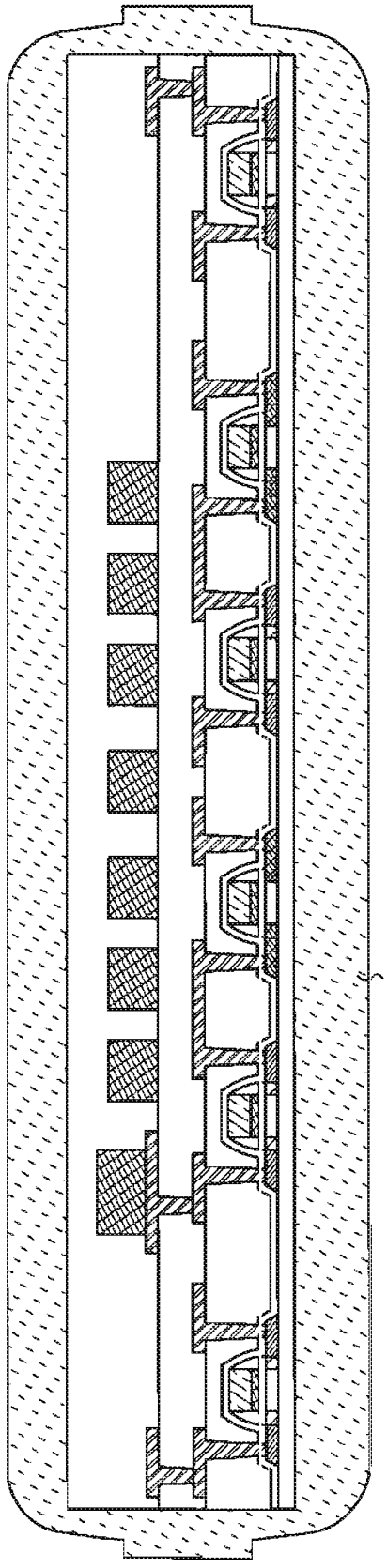


FIG. 8B



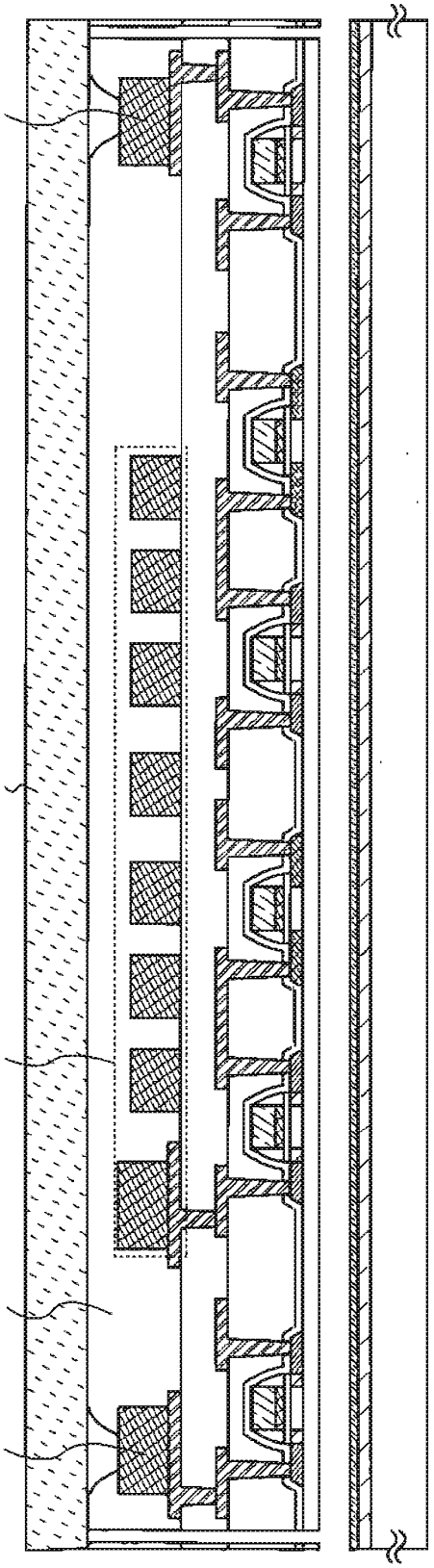


FIG. 9A

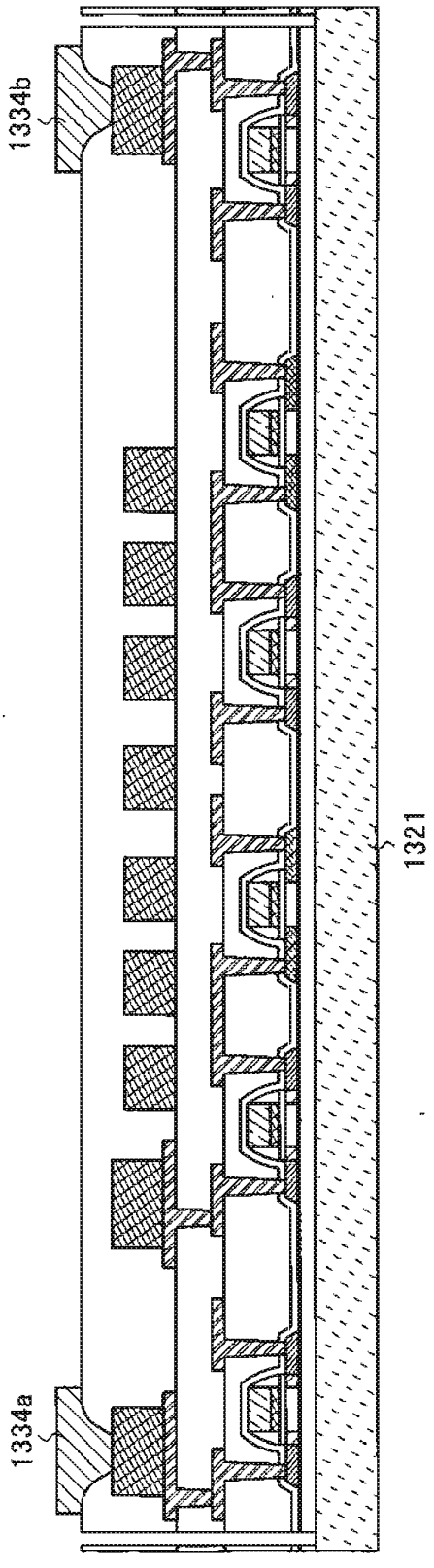


FIG. 9B

FIG. 10A

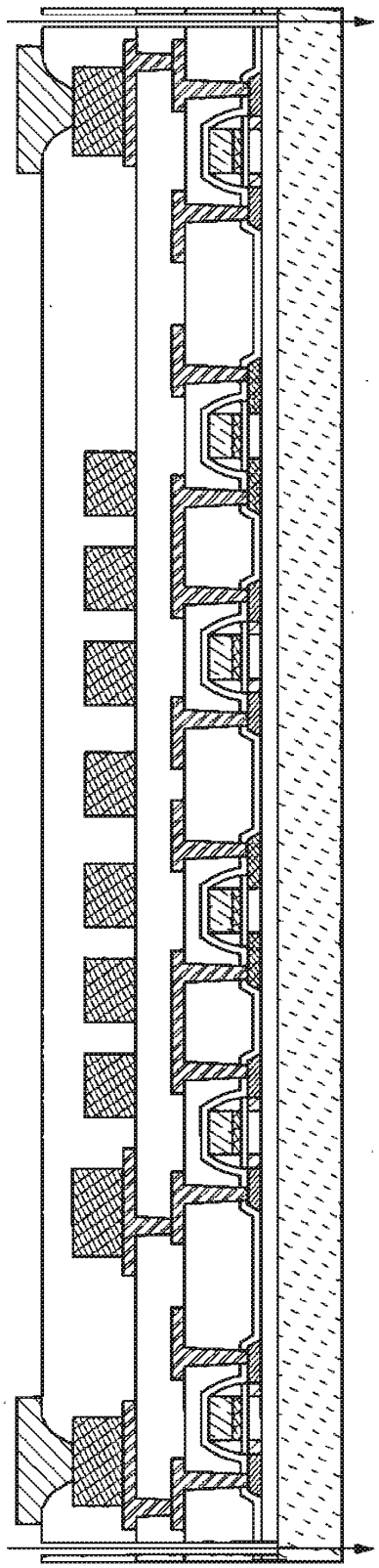
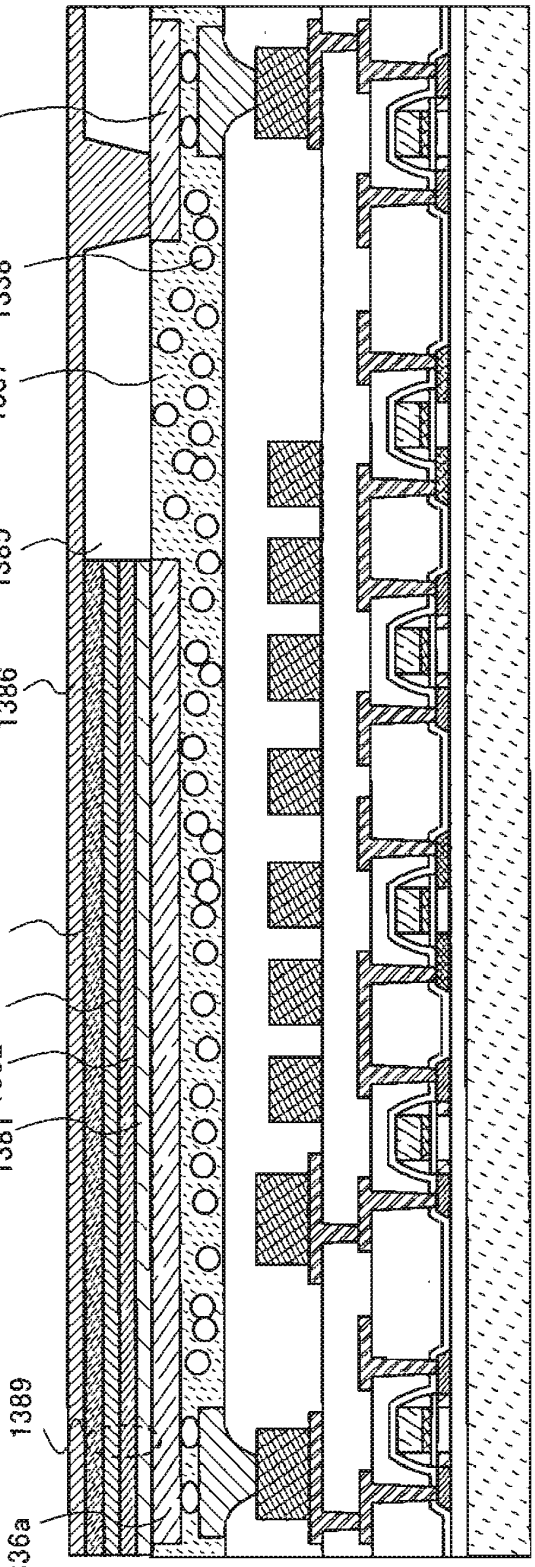


FIG. 10B



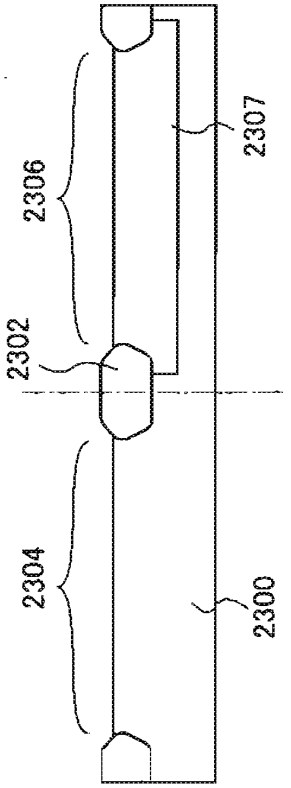


FIG. 11A

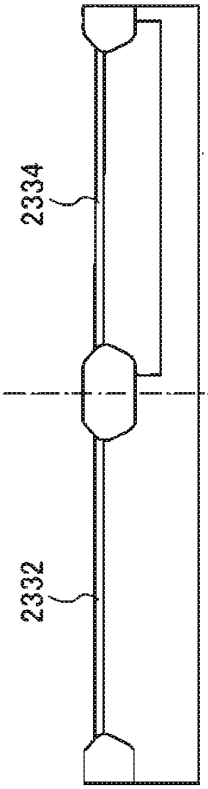


FIG. 11B

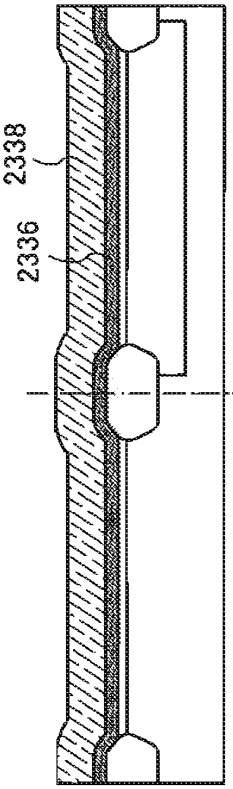


FIG. 11C

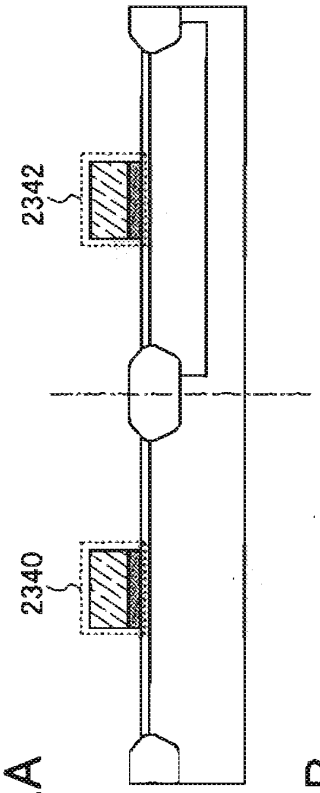


FIG. 12A

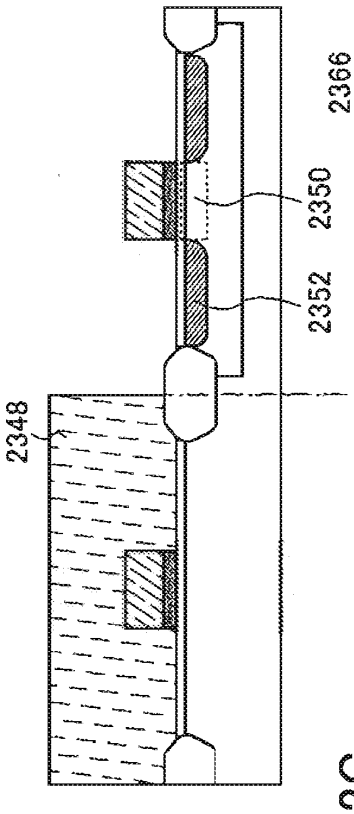


FIG. 12B

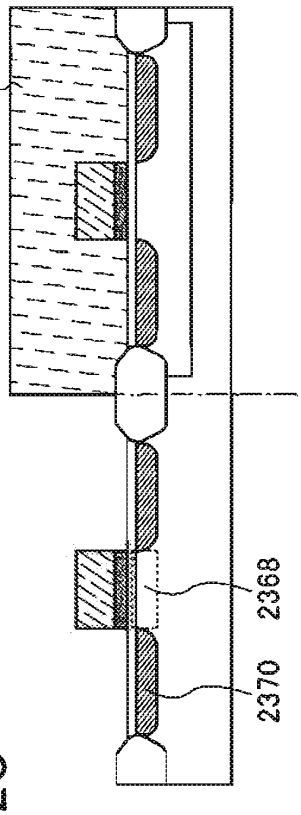


FIG. 12C

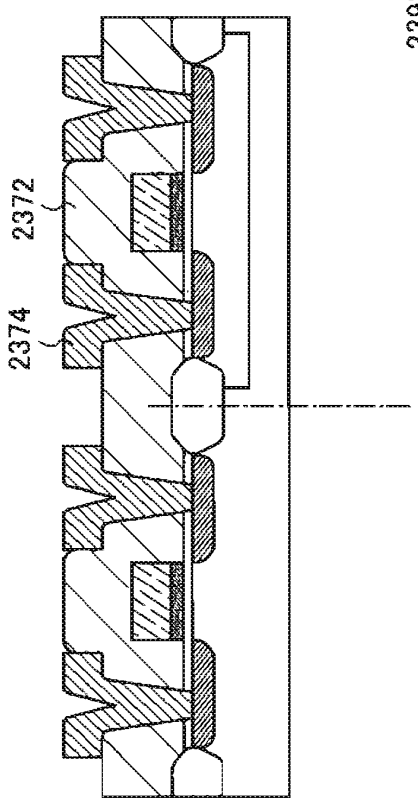


FIG. 13A

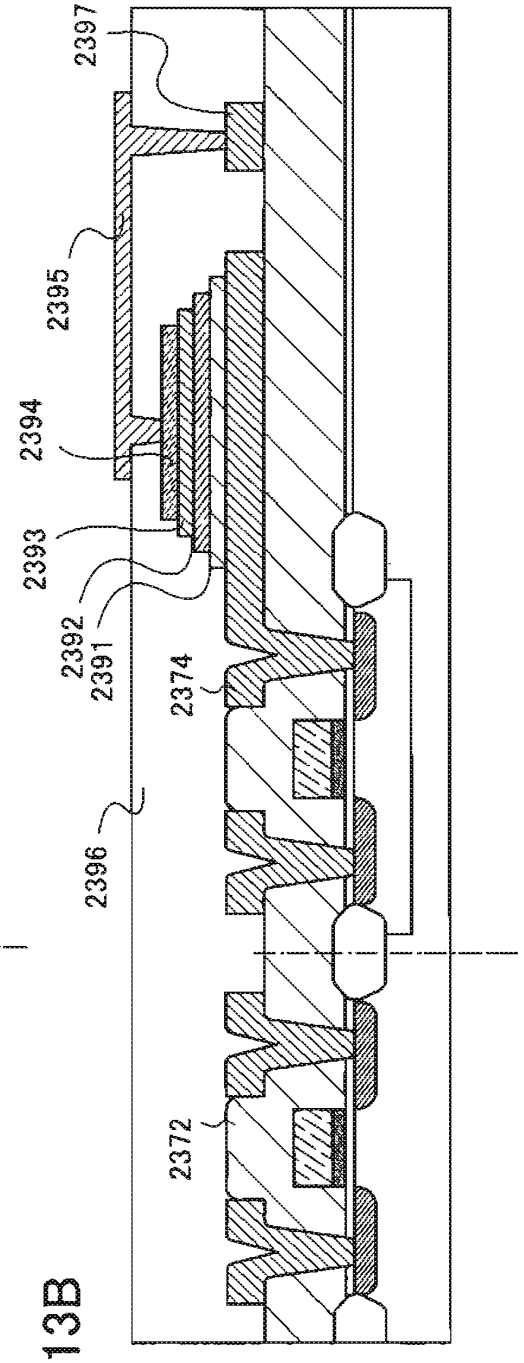


FIG. 13B

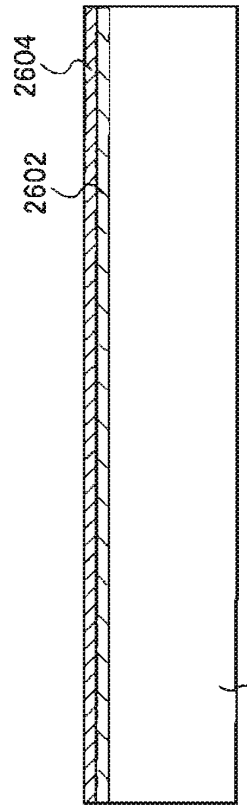


FIG. 14A

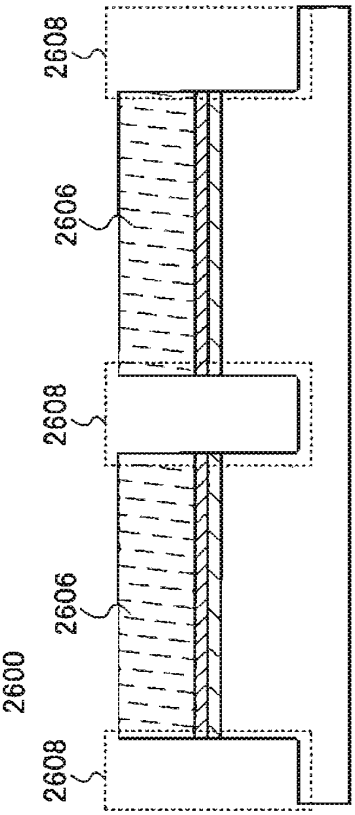


FIG. 14B

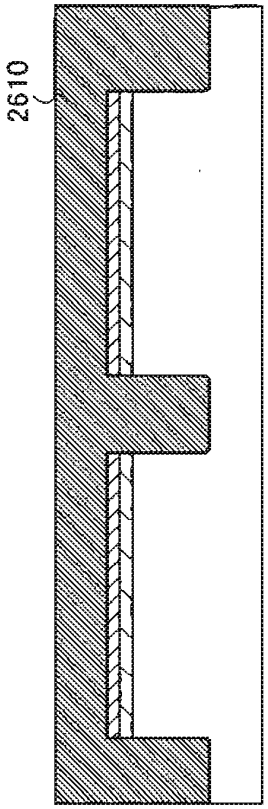


FIG. 14C

FIG. 15A

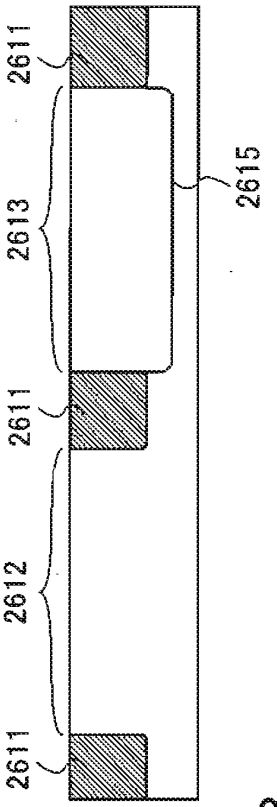


FIG. 15B

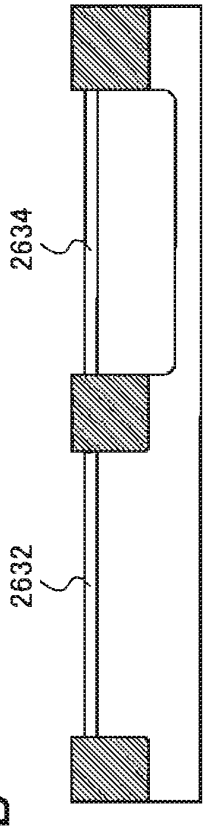
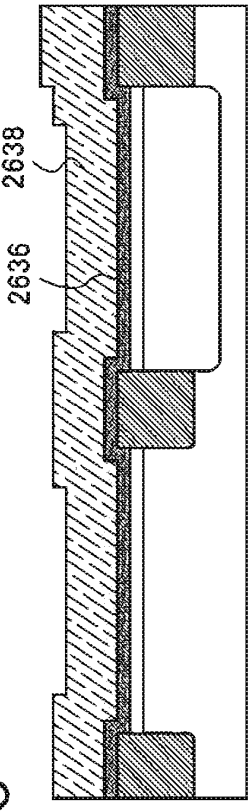


FIG. 15C



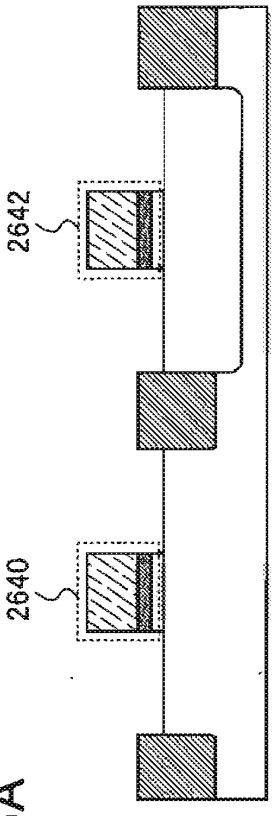


FIG. 16A

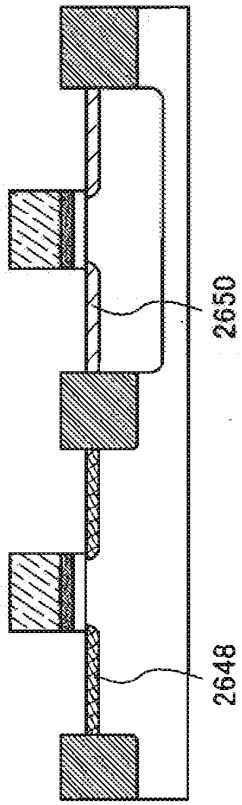


FIG. 16B

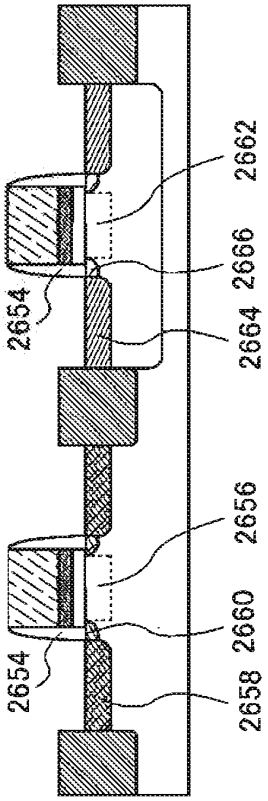


FIG. 16C

FIG. 17A

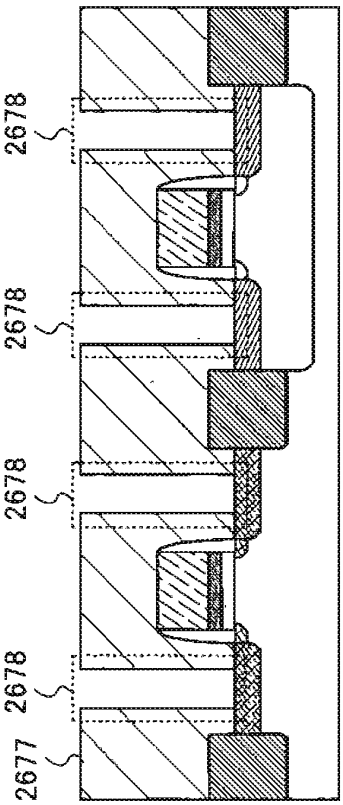


FIG. 17B

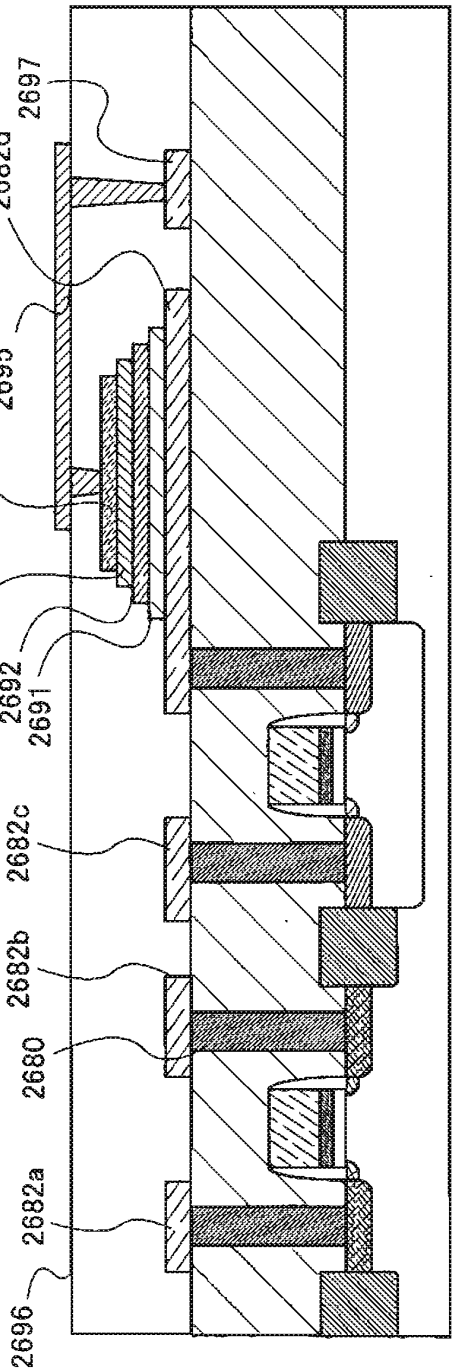


FIG. 18A

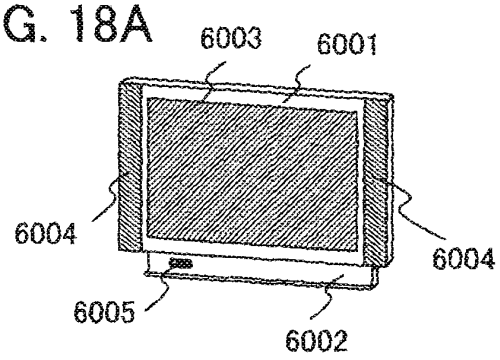


FIG. 18B

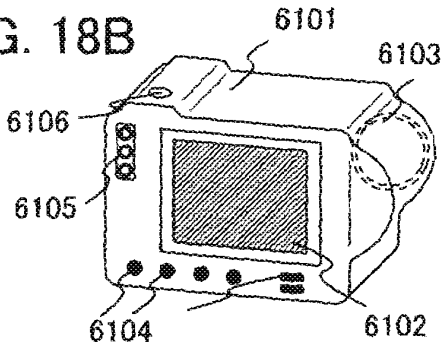


FIG. 18C

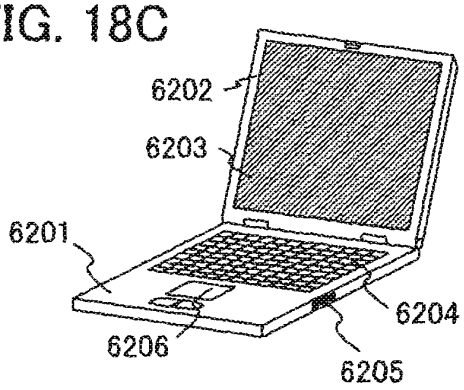


FIG. 18D

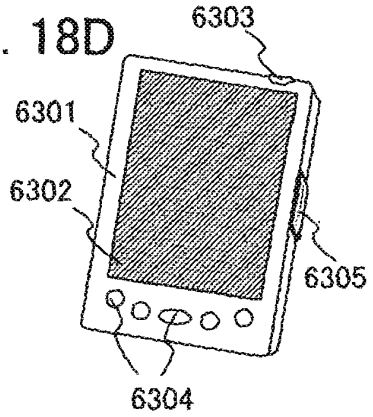


FIG. 18E

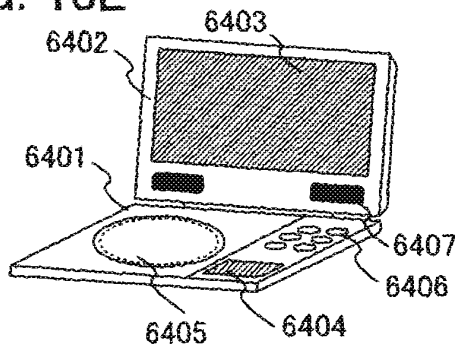


FIG. 18F

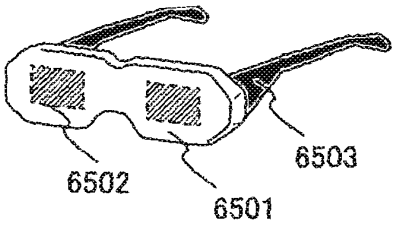


FIG. 18G

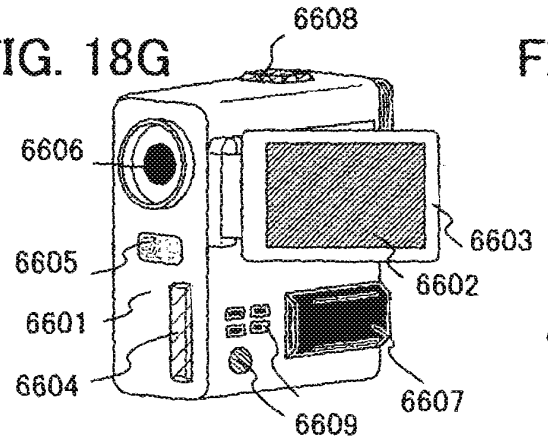
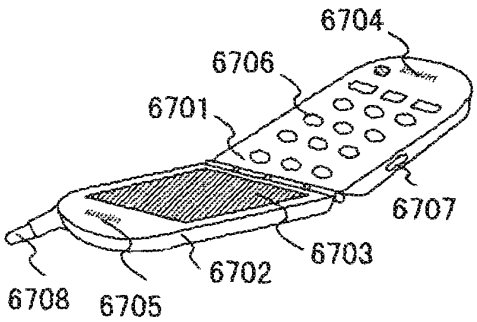


FIG. 18H



EXPLANATION OF REFERENCE

100, Semiconductor Device; 101, CPU; 104, CPU; 105, Router Circuit; 106, Thread Control Circuit; 107, External Device Controller; 108, CPU Core; 111, CPU Core; 112, Wireless Circuit; 115, Wireless Circuit; 116, External Data Output Line; 117, External Data Input Line; 118, Wireless Transmission Signal; 121, Wireless Transmission Signal; 122, Wireless Transmission Signal; 125, Wireless Transmission Signal; 200, CPU; 201, CPU Core; 202, Wireless Circuit; 203, Control Circuit; 204, Arithmetic Circuit; 205, Cache Memory; 206, General Purpose Register; 207, Antenna Circuit; 208, Demodulation Circuit; 209, Modulation Circuit; 210, Power Supply Circuit; 300, Router Circuit; 301, Antenna Circuit; 302, Demodulation Circuit; 303, Modulation Circuit; 304, Bus Controller Circuit; 305, Bus Controller Circuit; 306, Data Processing Circuit; 307, Bus; 308, Bus; 309, Wireless Circuit; 401, Wiring; 402, Modulation Signal Line; 403, Demodulation Signal Line; 404, Power Supply Wiring; 405, Ground Wiring; 406, Transistor; 407, Coupling Capacitor; 408, Diode; 409, Diode; 410, LPF; Resistor; 411, LPF Capacitor; 412, Wiring; 413, Wiring; 414, Coupling Capacitor; 415, Diode; 416, Diode; 417, Storage Capacitor; 418, Wiring; 501, Wiring; 502, Modulation Signal Line; 503, Demodulation Signal Line; 504, Power Supply Wiring; 505, Ground Wiring; 506, Transistor; 507, Coupling Capacitor; 508, Diode; 509, Diode; 510, LPF Resistor; 511, LPF Capacitor; 512, Wiring; 513, Wiring; 514, Coupling Capacitor; 515, Diode; 516, Diode; 517, Storage Capacitor; 518, Wiring; 519, Coupling Capacitor; 520, Coupling Capacitor; 521, Diode; 522, Diode; 523, Diode; 524, Diode; 525, Storage Capacitor; 526, Storage Capacitor; 527, Wiring; 528, Wiring; 529, Wiring; 530, Power Supply Wiring; 531, Diode; 532, Diode; 533, Storage Capacitor; 534, Antenna; 535, Antenna; 536, Power Supply Circuit; 537, Power Supply Circuit; 538, Wiring; 539, Power Supply Wiring; 1301, Substrate; 1302, Insulating Film; 1303, Peeling Layer; 1304, Insulating Film;

1305, Semiconductor Film; 1306, Gate Insulating Film; 1307, Gate Electrode; 1308, Impurity Region; 1309, Impurity Region; 1310, Insulating Film; 1311, Impurity Region; 1313, Conductive Film; 1314, Insulating Film; 1316, Conductive Film; 1317, Conductive Film; 1318, Insulating Film; 1319, Element Formation Layer; 1320, Sheet Material; 1321, Sheet Material; 1337, Resin; 1338, Conductive Particle; 1381, Negative Electrode Active Material Layer; 1382, Solid Electrolyte Layer; 1383, Positive Electrode Active Material Layer; 1384, Current-collecting Thin Film; 1385, Interlayer Film; 1386, Wiring Layer; 1389, Secondary Battery; 2300, Substrate; 2302, Insulating Film; 2304, Region; 2306, Region; 2307, P Well; 2332, Insulating Film; 2336, Conductive Film; 2338, Conductive Film; 2340, Gate Electrode; 2342, Gate Electrode; 2348, Resist Mask; 2350, Channel Formation Region; 2352, Impurity Region; 2366, Resist Mask; 2368, Channel Formation Region; 2370, Impurity Region; 2372, Insulating Film; 2374, Wiring; 2391, Negative Electrode Active Material Layer; 2392, Solid Electrolyte Layer; 2393, Positive Electrode Active Material Layer; 2394, Current-collecting Thin Film; 2395, Wiring Layer; 2396, Interlayer film; 2397, Wiring; 2600, Substrate; 2602, Insulating Film; 2604, Insulating Film; 2606, Resist Mask; 2608, Recessed Portion; 2610, Insulating Film; 2611, Insulating Film; 2612, Region; 2613, Region; 2615, P Well; 2632, Insulating Film; 2634, Insulating Film; 2636, Conductive Film; 2638, Conductive Film; 2640, Conductive Film; 2642, Conductive Film; 2648, Low-concentration Impurity Region; 2650, Low-concentration Impurity Region; 2654, Sidewall; 2656, Channel Formation Region; 2658, Impurity Region; 2660, Low-concentration Impurity Region; 2662, Channel Formation Region; 2664, Impurity Region; 2666, Low-concentration Impurity Region; 2677, Insulating Film; 2678, Opening Portion; 2680, Conductive Film; 2691, Negative Electrode Active Material Layer; 2692, Solid Electrolyte Layer; 2693, Positive Electrode Active Material Layer; 2694, Current-collecting Thin Film; 2695, Wiring Layer; 2696, Interlayer Film; 2697, Conductive Film;

1300a, Thin Film Transistor; 1300b, Thin Film Transistor; 1300c, P-channel Thin Film Transistor; 1300e, P-channel Thin Film Transistor; 1305a, Semiconductor Film; 1305c, Semiconductor Film; 1307a, Conductive Film; 1307b, Conductive Film; 1312a, Insulating Film; 1312b, Insulating Film; 1315a, Conductive Film; 1331a, Conductive Film; 1334a, Conductive Film; 1334b, Conductive Film; 1336a, Conductive Film; 1336b, Conductive Film; 6001, Housing; 6002, Support Base; 6003, Display Portion; 6004, Speaker Portion; 6005, Video Input Terminal; 6101, Main Body; 6102, Display Portion; 6103, Image Receiving Portion; 6104, Operation Key; 6105, External Connection Port; 6106, Shutter Button; 6201, Main Body; 6202, Housing; 6203, Display Portion; 6204, Keyboard; 6205, External Connection Port; 6206, Pointing Device; 6207, Battery; 6208, Audio Input Portion; 6209, Operation Key; 6301, Main Body; 6302, Display Portion; 6303, Switch; 6304, Operation Key; 6305, Infrared Port; 6401, Main Body; 6402, Housing; 6403, Display Portion A; 6404, Display Portion B; 6405, Reading Portion; 6406, Operation Key; 6407, Speaker Portion; 6501, Main Body; 6502, Display Portion; 6503, Arm Portion; 6601, Main Body; 6602, Display Portion; 6603, Housing; 6604, External Connection Port; 6605, Remote Controller Receiving Portion; 6606, Image Receiving Portion; 6607, Battery; 6608, Audio Input Portion; 6609, Operation Key; 6701, Main Body; 6702, Housing; 6703, Display Portion; 6704, Audio Input Portion; 6705, Audio Output Portion; 6706, Operation Key; 6707, External Connection Port; 6708, Antenna; 2682a, Conductive Film; and 2682d, Wiring.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/070868

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. G06F15/78(2006.01)i, H01L27/08(2006.01)i, H01L29/786(2006.01)i

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)

Int.Cl. G06F15/78, H01L27/08, H01L29/786

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2008
Registered utility model specifications of Japan 1996-2008
Published registered utility model applications of Japan 1994-2008

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.
Y	JP05-012220 A (Fuji Xerox Co., Ltd.) 1993.01.22, paragraph [0012]-[0021], Fig.1-2 (Family:none)	1,2,4-13
Y	JP04-305757 A (Ricoh Co., Ltd.) 1992.10.28, entire document (Family:none)	1,2,4-13
Y	JP2003-241980 A (International Business Machines Corporation) 2003.08.29,paragraph[0014]-[0015],Fig.1 & US 2003/0149716 A1	1,2,4-13
Y	JP07-084971 A (Canon Inc.) 1995.03.31, paragraph[0014]-[0018],[0046]-[0047],Fig.1,Fig.6 (Family:none)	1,2,4-13

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

* 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	Date of mailing of the international search report
16.01.2008	29.01.2008

Name and mailing address of the ISA/JP	Authorized officer	
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Katsumi Suda Telephone No. +81-3-3581-1101 Ext. 3545	5B 8941

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/070868

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2005-101892 A (Sony Corporation) 2005.04.14, paragraph[0001]-[0050],Fig.1 (Family:none)	1,2,4-13
Y	JP 2003-196612 A (DENSO WAVE INCORPORATED) 2003.07.11, paragraph[0012]-[0013],Fig.3 (Family:none)	2,9-13
Y	JP 2001-298197 A (Semiconductor Energy Laboratory Co., Ltd.) 2001.10.26 ,paragraph[0002] & US 5897346 A	7,8,12,13

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/433,703	06/06/2019	Martin Koebler	INVN-00142

CONFIRMATION NO. 8048

141471
Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

PUBLICATION NOTICE



Title: Electric Vehicle Power Management System

Publication No.US-2019-0283596-A1
Publication Date:09/19/2019

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently https://portal.uspto.gov/pair/PublicPair. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PLUS Search Results for S/N 16433703, Searched Thu Sep 19 08:59:57 EDT 2019

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

4625210 99
5734316 99
6169495 99
5477217 92
5959572 92
6098048 92
4768916 85
4797049 85
4833442 85
5026153 85
5231253 85
5702223 85
5808372 85
5809480 85
5878361 85
5928294 85
5964572 85
6059899 85
6059899 85
6122571 85
4284941 78
4403208 78
4469210 78
4621856 78
4775939 78
5222906 78
5254996 78
5360287 78
5415505 78
5454672 78
5469676 78
5525026 78
5540158 78
5589827 78
5628596 78
5634339 78
5711368 78
5732785 78
5775858 78
5777451 78
5777565 78
5818356 78
5838251 78
5846045 78
5854987 78
5863026 78
5864831 78
5873250 78
5878362 78
5896554 78

PLUS Search Results for S/N 16433703, Searched Wed Sep 18 16:22:30 EDT 2019

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

4625210 99
5734316 99
6169495 99
5477217 92
5959572 92
6098048 92
4768916 85
4797049 85
4833442 85
5026153 85
5231253 85
5702223 85
5808372 85
5809480 85
5878361 85
5928294 85
5964572 85
6059899 85
6059899 85
6122571 85
4284941 78
4403208 78
4469210 78
4621856 78
4775939 78
5222906 78
5254996 78
5360287 78
5415505 78
5454672 78
5469676 78
5525026 78
5540158 78
5589827 78
5628596 78
5634339 78
5711368 78
5732785 78
5775858 78
5777451 78
5777565 78
5818356 78
5838251 78
5846045 78
5854987 78
5863026 78
5864831 78
5873250 78
5878362 78
5896554 78

PLUS Search Results for S/N 16433703, Searched Wed Sep 18 16:22:30 EDT 2019

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

3578190 99
3581918 99
3583772 99
3590845 99
3595199 99
3597992 99
3598441 99
3608669 99
3610653 99
3611945 99
3612491 99
3617031 99
3631940 99
3635132 99
3635189 99
3637036 99
3638598 99
3641473 99
3645039 99
3649046 99
3655081 99
3662860 99
3664448 99
3665866 99
3669290 99
3670831 99
3673969 99
3679071 99
3692119 99
3693290 99
3706385 99
3712126 99
3712640 99
3717364 99
3718921 99
3726538 99
3727974 99
3746116 99
3758074 99
3759187 99
3762649 99
3774784 99
3775640 99
3776353 99
3780666 99
3782508 99
3782509 99
3788666 99
3791662 99
3802022 99

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/433,703	06/06/2019	3661	785	INVN-00127	20	2

CONFIRMATION NO. 8048

FILING RECEIPT

141471
Stevens Law Group - Invently Automotive
1754 Technology Drive
Suite 226
San Jose, CA 95110

OC000000108904236

Date Mailed: 06/14/2019

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Martin Koebler, Saal/Donau, GERMANY;
Nicole G. Goldstein, Woodside, CA;
Stephen J. Brown, Malibu, CA;
Jason H. Harper, Pleasanton, CA;

Applicant(s)

Invently Automotive Inc., Los Altos, CA;

Power of Attorney: The patent practitioners associated with Customer Number 141471

Domestic Priority data as claimed by applicant

This application is a CON of 15/720,032 09/29/2017
which is a CON of 15/626,676 06/19/2017
which is a CON of 14/566,848 12/11/2014 PAT 9682624
which is a CON of 14/206,138 03/12/2014 PAT 8972162
which is a CON of 13/066,189 04/08/2011 PAT 8712650
which is a CIP of 11/283,137 11/17/2005 PAT 7925426

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 06/13/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/433,703**

Projected Publication Date: 09/19/2019

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Electric Vehicle Power Management System

Preliminary Class

701

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor

community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/433,703

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	785		TOTAL	

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	06/06/2019
First Named Inventor	Martin Koebler
Title	Electric Vehicle Power Management System
Art Unit	
Examiner Name	
Attorney Docket Number	INVN-00127

SIGNATURE of Applicant or Patent Practitioner

Signature	/David R. Stevens/	Date (Optional)	06/06/2019
Name	David R. Stevens	Registration Number	38626
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Best Available Copy

RECEIVED
CENTRAL FAX CENTER

DEC 11 2017

PTO/AIA/82B(07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): 141471

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

☒ The address associated with the above-mentioned Customer Number.
OR
☐ The address associated with Customer Number:
OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant:

☐ Inventor or Joint Inventor
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor
☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature		Date	July 19, 2017
Name	Greg Madia	Telephone	630-450-0578
Title and Company	Chief Executive Officer, Invently Automotive Inc.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below *.

☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

ABSTRACT

An apparatus comprising an interface, a memory and a processor. The interface may be configured to receive sensor data samples during operation of a vehicle. The memory may be configured to store the sensor data samples over a number of points in time. The processor may be configured to analyze the sensor data samples stored in the memory to detect a pattern. The processor may be configured to manage an application of brakes of the vehicle in response to the pattern.

CLAIMS

1. A method of electric vehicle operation, comprising:

determining a segment of a vehicle route;

determining information about an external environment of a vehicle, information about operational status of the vehicle, information from external command input telemetry in combination with user command inputs to the vehicle including voice command inputs; and

applying calculated electric power to the vehicle to travel along the segment of the vehicle route at a calculated speed.

2. The method of claim 1, wherein electric power can be derived from operation of an internal combustion engine.

3. The method of claim 1, further comprising the step of selecting a destination using historical data associated with a driver.

4. The method of claim 1, further comprising the step of selecting a destination using statistical destination logic.

5. The method of claim 1, further comprising the step of selecting a destination by at least one of

a driver and a passenger.

6. The method of claim 1, wherein vehicle route segment determination further comprises determining multiple route segments, each route segment having a separate calculated speed and selected drive train parameters.

7. The method of claim 1, wherein the step of determining information about an external environment of a vehicle further comprises the step of communicating with a remote database.

8. The method of claim 1, wherein the step of determining information about operational status of a vehicle further comprises the step of communicating with a remote database.

9. The method of claim 1, wherein voice command inputs are provided to the vehicle by a separate source.

10. The method of claim 1, wherein voice command inputs are provided to the vehicle by a device having GPS functionality.

11. An electric vehicle, comprising:
a vehicle having an electric power source, a communication system, and a user interface system capable of accepting voice command inputs; and

a power management system for the electric power source able to determine information about an external environment of a vehicle, information about operational status of the vehicle, information from external command input telemetry combinable with user command inputs to the vehicle including voice command inputs provided by the user interface system, and one or more operational parameters of the vehicle, with the power management system set to calculate electric power and speed over a segment of a vehicle route and act to apply calculated electric power to the vehicle to travel along the segment of the vehicle route at the calculated speed.

12. The apparatus of claim 11, wherein electric power from the electric power source can be derived from operation of an internal combustion engine.

13. The apparatus of claim 11, wherein vehicle route is set based on a destination determined at least in part using historical data associated with a driver.

14. The apparatus of claim 11, wherein vehicle route is set based on a destination determined at least in part using statistical destination logic.

15. The apparatus of claim 11, wherein vehicle route is set based on a destination determined by at least one of a driver and a passenger via the user interface system.

16. The apparatus of claim 11, wherein vehicle route segment determination is based at least in

part on determining multiple route segments, each route segment having a separate calculated speed.

17. The apparatus of claim 11, wherein determining information about an external environment of a vehicle further comprises communicating with a remote database.

18. The apparatus of claim 11, wherein determining information about operational status of a vehicle further comprises communicating with a remote database.

19. The apparatus of claim 11, wherein calculated speed is based at least in part on a determined probable optimal speed using historical route information.

20. The apparatus of claim 11, wherein target speed is presented as a range of target speeds.

Electric Vehicle Power Management System

This application relates to U.S. Serial No. 15/720,032, filed September 29, 2017, which relates to U.S. Serial No. 15/626,676, filed June 19, 2017, which relates to U.S. Serial No. 14/566,848, filed December 11, 2014, now U.S. Patent No. 9,682,624, which relates to U.S. Serial No. 14/206,138, filed March 12, 2014, now U.S. Patent No. 8,972,162, which relates to U.S. Serial No. 13/066,189, filed April 8, 2011, now U.S. Patent No. 8,712,650, which relates to which U.S. Serial No. 11/283,137, filed November 17, 2005, now U.S. Patent No. 7,925,426, which are each incorporated by reference in their entirety.

FIELD OF THE INVENTION

The invention relates to devices, methods and systems for controlling power applied to a vehicle engine.

BACKGROUND OF THE INVENTION

Currently, drivers of automotive vehicles have only very imprecise methods for managing the fuel consumption of their cars. For example, drivers can slow down, they can brake lightly, and they can carry lighter loads. Generally, however, fuel consumption cannot be precisely controlled by the driver. More accurate and precise control of fuel consumption is one of the best ways to improve the energy efficiency of most cars. In particular, accurate control of fuel consumption may optimize the energy efficiency of a car.

It has been shown that you can reduce fuel usage by efficient driving. According to Amory Lovins of the Rocky Mountain Institute, a 35% improvement in miles per gallon (mpg) for all 2001 vehicles (whose overall average mpg was 20) would have reduced oil use in the

United States by 2.7 Mbbl/d, approximately the same amount that the U.S. imported from the Gulf. See, for example, "Winning the Oil Endgame," Rocky Mountain Institute, 2004. p.50. Empirical evidence also supports the assertion that efficient driving can reduce fuel usage. For example, the Honda Insight™, a car available to the general public that normally gets 60 mpg, broke records in 2000 by getting 102 miles per gallon in a 7-day drive around the circumference of Britain. The team responsible did this purely by driving more efficiently, and not by modifying the car in any manner.

In most automotive vehicles, an operator controls the power applied to the vehicle (e.g., the engine of the vehicle) by operating the ignition, break and gas petals. Additional control is typically provided by operational assisting devices, such as a cruise control, that help to keep the vehicle at a constant speed, or within a range of speeds. However, such operational assisting devices typically do not optimize the power consumption of the vehicle, or control the speed and/or power provided to the vehicle based on an optimal power consumption level.

Many parameters may impact the optimal power consumption of a vehicle, including external factors (e.g., forces and conditions that act on the vehicle), internal conditions (e.g., the current status of the vehicle and it's component parts.), operator commands (e.g., control commands from the operator driving or preparing to drive the vehicle), and operational parameters of the vehicle (e.g., performance capabilities of the vehicle based on the make and model and/or the component parts of the vehicle, as well as the historical performance of the vehicle).

In recent years the need for energy efficient vehicles has increased as the cost and availability of traditional fossil fuels has fluctuated. However, the need for fuel efficiency spans all types of vehicles, including currently available vehicles (e.g., internal combustion,

solar, electric, and hybrid vehicles), as well as vehicles proposed or under development (e.g., hydrogen fuel cell vehicles and other electrically-fueled vehicles). In all of these types of vehicles, the overall fuel efficiency (regardless of the type of fuel), can be improved by optimizing the power supplied to the engine. As described herein, energy efficiency may be fuel efficiency or power efficiency. Energy supplied to the vehicle (e.g., the engine) may come from any appropriate source (e.g., gas, solar, battery, hydrogen, ethanol, etc.).

Thus, there is a need for devices and systems for controlling the power applied to a vehicle engine. The devices, systems and methods described herein address many problems identified for controlling the power supplied to automotive engines raised above.

SUMMARY OF THE INVENTION

The invention concerns an apparatus comprising an interface, a memory and a processor. The interface may be configured to receive sensor data samples during operation of a vehicle. The memory may be configured to store the sensor data samples over a number of points in time. The processor may be configured to analyze the sensor data samples stored in the memory to detect a pattern. The processor may be configured to manage an application of brakes of the vehicle in response to the pattern.

Described herein are devices, systems, and methods for managing the power consumption of an automotive vehicle, and thereby for optimizing the power consumption of the vehicle. The devices and systems for managing the power consumption of the vehicle typically include power management logic that can calculate an applied power for the vehicle engine based on information provided from the external environment of the vehicle, the operational status of the vehicle, one or more command inputs from a driver, and one or more operational parameters of the vehicle. The information provided to the power management

logic may come from data inputs (e.g., sensors, telemetries, etc.), memory, user commands, or it may be derived. The power management logic may comprise software, hardware, or any combination of software or hardware. In some variations, the devices and systems include a processor (e.g., a microprocessor) that can perform the power management logic, and provide an applied power. The applied power that is determined by the power management logic may be used to control the vehicle engine. For example, the power management logic may be used by a motor control mechanism to control the application of power to the vehicle engine as the vehicle travels along a route (either a predetermined or a non-predetermined route). The applied power may also be expressed as an optimized speed or speeds to which the vehicle is controlled. For example, the motor control mechanism may adjust the speed of the vehicle to an optimized speed or speeds as the vehicle travels. Or, the device or system may provide a suggested fuel-efficient speed to the driver, who in turn will manually adjust his/her speed. Thus, the devices, systems, and methods described herein may optimize the power consumption of an automotive vehicle by controlling the final speed of the vehicle, for example, by controlling the power applied to the vehicle motor.

The system may be manually engaged by the operator either when the vehicle is turned on, or in the midst of a trip (e.g., "on the fly"). In one variation, the operator sets a preferred speed, and a range at which to manage that speed (e.g., the preferred speed may be 60 mph, and the range can be 5 mph) over at least a portion of the trip. The system may determine an optimal (e.g., fuel efficient) speed within the range selected. By calculating and then averaging the efficient speed over a given route, the system can optimize energy usage within the driver's stated speed and range. The power management logic may determine energy efficiency over the course of a trip, based on current location and destination. The destination of the driver does not have to be known (e.g., input into a GPS or other similar

system by the driver). The system (e.g., anticipated destination logic) may infer the driver's destination based on a subset of the information inputs to the system, such as the time of day, current location, previous driving habits, and other inputs. In some variations, the driver can manually accelerate (e.g., override the system) for passing, braking and the like. In some variations, the device or system may provide a suggested speed to the driver to match, in order for the driver to better optimize power usage.

In some variations, the system is automatically enabled whenever the vehicle is turned on. In this case, the operator of the vehicle does not have to set any a destination, target speed or range, or the like. By automatically monitoring the operator's real-time speed, braking and acceleration, and by utilizing applicable inputs (e.g., from sensors and/or from a database), the power management system may determine the most efficient speed to travel a route. In some variations, the device or system may adjust the vehicle speed automatically. The power management devices or systems described herein may operate whether or not the driver has entered a destination into the GPS, because the system may infer the destination based on previous driving habits if the driver has not explicitly provided a destination.

In some variations, the driver (or other user) provides the system a destination and the vehicle determines the optimal speeds to drive throughout the route. The system may use speed limits, traffic conditions, physical calculations, and statistical models from previous trips to the same destination to select the target speeds to optimize around. Thus, in some variations, the driver only needs to steer, although hard acceleration or braking by the driver may override the system.

Described herein are devices for managing the power consumption of an automotive vehicle comprising a power management logic operable to calculate an applied power for the vehicle engine from information about the external environment of the vehicle,

information about the operational status of the vehicle, one or more command inputs, and one or more operational parameters of the vehicle. The power management device may also include a processor responsive to the power management logic (e.g., a microprocessor), and a motor control mechanism, wherein the motor control mechanism controls the application of power to the vehicle engine.

The power management logic may determine an applied power for the vehicle engine based on information about the external environment of the vehicle that is selected from the group consisting of: the current location of the vehicle, the elevation of the vehicle, upcoming elevations of the vehicle, the current slope/grade of the route, the predicted slope/grade of the next segments (or upcoming segments) of the route, speed limit information of the current route segment, speed limit information of upcoming route segments, the condition of the known or predicted route (or a portion thereof), traffic information or data, traffic surrounding the vehicle, the location of stoplights, the timing of stoplights, a map of the roadway, the present angle of the sun, the predicted angle of the sun for upcoming route segments, the weather around the vehicle, present wind direction, the predicted wind direction for upcoming route segments, present wind velocity, the predicted wind velocity for upcoming route segments, current temperature, the predicted temperature for upcoming route segments, current air pressure, predicted air pressure for upcoming route segments, time of day, date, day of week, visibility, present road conditions, predicted road conditions for upcoming route segments, and the distance to/from other vehicles. Any of this information may be acquired by measuring (e.g., from sensors), or it may be detected or input (e.g., from manual inputs, telemetry, detectors, a memory, etc.), or it may be derived (e.g., based on other information, including other environmental information).

The power management logic may determine an applied power for the vehicle

engine based on information about the operational status of the vehicle. The operational status information input may be selected from the group consisting of: the vehicle's current speed, the motor speed, the vehicle's current orientation, the RPM of the vehicle's motor, wheel rotations per minute, the battery state, the voltage of the battery, the amp hours from the battery, the state of the battery, temperature of battery, the age of the battery, and the number of times the battery has charged and discharged, the tire pressure, the drag force due to rolling resistance of the vehicle, the weight of vehicle, the amount of air going to the engine, the amount of gas going to engine, and the weight of driver. Any of this information may be acquired by measuring (e.g., by sensors), or it may be input (e.g., from an external telemetry, a memory, etc.), or it may be derived (e.g., based on other information, including other operational status information).

The power management logic may determine an applied power for the vehicle engine based on command input information. Command input information may be selected from the group consisting of: the acceleration applied by a driver, the braking applied by a driver, the intended destination, preferred speed, maximum and minimum range over which speed should adjust, and preferred route. Any of this information may be acquired by input (e.g., from an external telemetry, keyboard, mouse, voice command, a memory, etc.), sensor (e.g., optical detectors, etc.), or it may be derived (e.g., based on other information, including other command information).

The power management logic may determine an applied power for the vehicle engine based on information about one or more operational parameters of the vehicle. Operational parameters may be selected from the group consisting of: aerodynamic parameters (CDA), rolling resistance parameters (Crr1 and Crr2), drive train efficiency parameters, motor efficiency parameters, and battery model parameters, battery charge and

discharge relationships, type of battery. Any of this information may be input (e.g., from an external telemetry, a memory, etc.), or it may be derived (e.g., based on other information, including historical information or other operational parameter information).

The power management device or system may further comprise a memory containing vehicle information about one or more operational parameters for the vehicle. The memory may store any of the information about the external environment, operational status or command inputs, including derived or historical information.

The devices and systems described herein may be used with any appropriate vehicle, including internal combustion vehicles (which run on gasoline, diesel, or ethanol for example), a hybrid internal combustion/electric vehicles, electric vehicles powered by the electric grid (plug-in), electric vehicles powered by the sun (solar), and hydrogen fuel cell vehicles.

Also described herein are systems for managing the power consumption of an automotive vehicle, comprising a first input, operable to receive information about the external environment of the vehicle, a second input, operable to receive information about the operational status of the vehicle, a third input, operable to receive one or more command inputs from a driver of the vehicle, a memory containing information about one or more operational parameters of the vehicle, power management logic operable to calculate an applied power for the vehicle engine from the first input, the second input, the third input, and the memory, and a processor responsive to the power management logic. The system may also include a motor control mechanism, wherein the motor control mechanism regulates the application of power to the vehicle engine.

Also described herein are methods of managing the power consumption of a vehicle, including calculating an applied power for the vehicle using a processor. The processor

(e.g., a microprocessor, etc.) receives a first input comprising information about the environment of the vehicle, a second input comprising information about the operational status of the vehicle, a third input comprising a command input from the driver of the vehicle, and a fourth input comprising vehicle information about the operational parameters of the vehicle. The method may also include the step of applying the applied power to the engine of the vehicle, and/or to notifying the driver of the optimal speed.

The step of calculating an applied power may include determining a route, segmenting the route into one or more segment (or intermediate) destinations, calculating an energy efficient speed for the vehicle to travel to the segment destination, determining an optimized speed for the vehicle to travel to the segment destination, and calculating the applied power from the optimized speed for all of the segments. The applied power may be calculated continuously. For example, the applied power may be calculated at each point (e.g., every segment, or points within a segment) as the vehicle is driven. Thus, over an entire route, the most energy efficient speed at which to drive may be continuously calculated. This may be done by determining a destination, and then coming up with a route for that destination. If the destination is not known (e.g., has not been provided to the power management device or system), a predicted destination may be estimated, based on statistical destination logic (e.g., using map coordinates, and the historical operation of the vehicle). Energy efficient speeds for current and upcoming route segments can then be calculated based on the route. In some variations, the route is divided up into segments. In some variations, the optimized speed for the vehicle is determined based on historical speeds for similar destinations. The route can be revised (e.g., continuously revised) during operation.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B show an example of a vehicle controlled by a traditional cruise control device and the same vehicle controlled by one variation of this power management system described herein. FIG. 2 illustrates steps that may be used to optimize power applied to a motor, as described herein.

FIG. 3A shows a schematic route as described herein. FIG. 3B shows steps that may be followed to determine a route destination.

FIGS. 4A, 4B show steps that may be followed to determine a calculated optimized velocity for segments of a route.

FIG. 5 shows steps that may be followed for determining a probable optimal speed based on historical route information.

FIG. 6 shows a schematic diagram of one variation of the power management logic described herein.

FIG. 7 illustrates one variation of a vehicle including a power management system, as described herein.

FIG. 8 illustrates a user interface for a power management device.

FIG. 9 shows inputs that may be coordinated by the power management user interface.

FIG. 10 shows a schematic diagram of a portion of a power management system, as described herein.

FIG. 11 illustrates a power management system remotely communicating with a server, as described herein.

FIGS. 12A, 12B show exemplary charge and discharge characteristics for one type of battery.

FIGS. 13A, 13B show examples of engine characteristics.

DETAILED DESCRIPTION

The power supplied and used by a motorized vehicle can be optimized based on information inputs including: user demands, environmental conditions, the current or anticipated operational state of the vehicle, and the operational parameters for the vehicle. These parameters can be estimated, directly measured, or derived, and may be used to determine the driving route, and therefore an estimated power requirement for the route. The estimated power requirement for a route and a historical power requirement from the same vehicle traveling over the same route may be used to determine the optimal power supplied to the vehicle. The power required of a vehicle and the optimal power supplied to a vehicle may also be expressed in terms of the speed or velocity of the vehicle.

Management of a vehicle's power supply typically involves optimization of the power supplied to the engine. As described herein, the "engine" may refer to any portion of the vehicle to which power is supplied, including the motor, powertrain, etc. As will be apparent below, optimizing the power supplied to the engine typically means minimizing the energy loss from the vehicle, thereby increasing fuel efficiency. The power supplied to the engine may alternatively be optimized based on other criterion. For example, the power supplied to the engine may be optimized with respect to speed or travel time. Furthermore, the devices, methods and systems described herein may be used with any appropriate vehicle, and are not limited to internal combustion vehicles. For example, the devices, methods and systems described herein may be used with vehicles having a hybrid internal combustion/electric engine, an electric engine powered by the electric grid (e.g., a plug-in vehicle), an electric engine powered by the sun (e.g., a solar vehicle), and an electric engine powered by hydrogen fuel cell. Thus the term "fuel" does not necessarily refer exclusively to

hydrocarbon fuels, but may refer to any appropriate power source for the engine.

FIGS. 1A and 1B compare a traditional "cruise control" device (in FIG. 1A) to one variation of the power management device described herein (in FIG. 1B). In FIG. 1A, a typical cruise control device regulates the speed of a vehicle as it drives from point A to point B when the vehicle speed is set to 50 mph. As the vehicle moves across different terrain (e.g., roads having different elevations), or through different weather conditions, the traditional cruise control device adjusts the power supplied to the vehicles (and thus the speed) based only on the set velocity and the actual velocity of the vehicle. Thus, the cruise control device receives information on the current speed of the vehicle, and adjusts the power supplied to the engine to maintain the vehicle at the set speed. This type of device is a "velocity control" cruise control device. In contrast, FIG. 1B shows a vehicle with a power management device for optimizing the power supplied to the vehicle, as described further herein.

In FIG. 1B, the power management system receives external inputs, including information on the location and grade (e.g., steepness of any uphill/downhill portions) of the road, the distances traveled. The power management system also includes or deduces information about the route (e.g., from point A to point B), and the acceptable range of speeds that the vehicle may travel over this route (e.g., between 45 and 55 mph). The power management system may also receive information about the state of the vehicle, including the velocity at which it is traveling, and the weight of the vehicle. Finally, the power management system may include operational parameters such as the performance of the engine, aerodynamic performance, and rolling resistance of the vehicle. Given this information, the power management system may calculate applied power to the engine, and may derive a speed (or set of speeds) that optimizes the applied power. As shown in FIGS. 1A and 1B, the total energy used by the power management system in FIG. 1B is 0.9 kwh compared to 1 kwh

for the cruise control system shown in FIG. 1A for identical vehicles traveling over the same pathway.

In general, there are many ways to optimize energy efficiency, as described in more detail below. As will be described, any of the methods, devices and system described herein may be used together, individually, or in different combinations.

Inputs

The power management devices and systems described herein manage the power of the vehicle using inputs from four categories of information input: information from the external environment of the vehicle, information about the operational status of the vehicle, information from one or more command inputs, and operational parameters of the vehicle. Typically, at least one input from each of these sources of information is used to determine an optimal speed (or applied power) for the vehicle. Some of the information inputs for each of these categories are described below. In every case, the information may be directly measured (e.g., by sensors or other inputs), communicated from an external source, or it may be derived from other information inputs, or from stored data.

Information from the external environment of the vehicle may be used to determine the optimal power to apply to the vehicle. External environment information generally includes any information about the environment surrounding or acting on the vehicle. External information may be used to determine forces acting on the vehicle (e.g., drag, wind resistance, tire resistance, etc.), the location of the vehicle relative to the destination (e.g., position, direction, etc.), and the environment surrounding the vehicle (e.g., traffic patterns, surrounding traffic, etc.). In some variations, the external information may be used to help describe the power available to the vehicle, particularly in solar powered vehicles (e.g., amount

of light energy, time of day, position of the sun, etc.).

Examples of environmental information inputs include, but are not limited to: the current location of the vehicle, geographical information about the surrounding area, the elevation of the vehicle, upcoming elevations of the vehicle, the current slope/grade of road, the predicted slope/grade of the next segments of road, traffic surrounding the vehicle, the location of stoplights, the timing of stoplights, a map of the roadway, the present angle of the sun, the predicted angle of the sun for upcoming route segments, the weather around the vehicle, present wind direction, the predicted wind direction for upcoming route segments, present wind velocity, the predicted wind velocity for upcoming route segments, current temperature, the predicted temperature for upcoming route segments, current air pressure, predicted air pressure for upcoming route segments, time of day, date, day of week, visibility, present road conditions, predicted road conditions for upcoming route segments, and the distance from other vehicles.

Some of the information inputs may be redundant, or may be derived from related information. For example, the vehicle location may be provided by a GPS device which may be either a separate device or a portion of the power management device that receives a GPS signal and locates the vehicle based on the received signal. Geographical and topographical information about the area surrounding the vehicle may be determined from the location information. For example, the location may be used to index an atlas of the surrounding area. Some variations of the power management device include a memory or database of information, including information about maps and road information. In some variations, the power management device communicates with one or more such databases to identify the location and surrounding road features (e.g., suggested speed limits, stop signs, traffic patterns, etc.).

The power management device may include or may be connected to sensors or other inputs to directly determine some of the information inputs. For example, the power management device may include a pre-set clock (e.g., for the current time and date), one or more optical sensors (e.g., to determine the intensity of sunlight, visibility, distance from nearby vehicles, etc.), and/or weather sensors (e.g., temperature, wind direction and velocity, air pressure, etc.). In some variations, the power management system receives some of this information by telemetry with off-board information sources such as databases and the like. For example, the power management system may communicate with a weather service, a map service, a traffic service, etc.

These examples of information about the external environment are only intended to illustrate the kinds of external information that may be used by the power management devices and systems described herein and are not intended to be limiting. Any appropriate information about the external environment may be provided to the power management device or used by the power management device.

Information about the operational status of the vehicle may be used to determine the optimal power to apply to the vehicle. Operational status information generally includes any information about the current operational status of the vehicle itself. Operational status information may be used to determine the current condition of the vehicle's engine and component parts (e.g.,. motor, powertrain, battery, tires, etc.), the current fuel supply, the manner in which the vehicle is traveling (e.g., velocity, acceleration, etc.), and the like.

Examples of environmental information inputs include, but are not limited to: the vehicle's current speed, the motor speed, the vehicle's current orientation, the RPM of the vehicle's motor, wheel rotations per minute, the battery state, the voltage of the battery, the amp hours from the battery, the state of the battery, temperature of battery, the age of the

battery, and the number of times the battery has charged and discharged, the tire pressure, the drag force due to rolling resistance of the vehicle, the weight of vehicle, the amount of air going to the engine, the amount of gas going to engine, and the weight of driver.

As described above, some of the information inputs may be redundant, or may be derived from related information. Furthermore, the power management system may use any of the sensors, gauges and detectors already present in the vehicle as information inputs. For example, the velocity of the vehicle may be detected by a speedometer which may pass information on to the power management system. The power management device may also include additional sensors, inputs or detectors to determine or derive any information about the operational status of the vehicle. For example, the power management device or system may include one or more weight sensors (to determine the load in the vehicle, including the driver's weight).

The examples of operational status information inputs are only intended to illustrate the kinds of operational status information that may be used by the power management devices and systems described herein. Any appropriate information about the operational state of the vehicle may be provided to the power management device or used by the power management device.

Information from one or more command inputs may be used to determine the optimal power to apply to the vehicle. Command inputs generally include any instructions from the driver of the vehicle about the operation (or intended operation) of the vehicle. Command inputs may be directly input by the user, or they may be derived by the actions of the driver or the identity of the driver. Examples of command inputs include, but are not limited to: the acceleration applied by a driver, the braking applied by a driver, the vehicle's known or predicted final destination, the vehicle's known or predicted interim destination, preferred

speed, maximum and minimum range over which speed should be adjusted, and preferred route.

As with all of the information inputs, some of the command inputs may be redundant, or may be derived from related information. For example, a route destination may be input by the driver, or it may be inferred from the driving behavior and/or identity of the driver. The identity of the driver may also be input by the driver, or it may be inferred. For example, the identity of the driver may be matched to the weight of the driver. Command inputs may include any of the drivers actions to control the vehicle. For example, command inputs may include steering, breaking, shifting, or application of the accelerator. The power management device may include sensors, inputs or detectors to monitor the manipulations of the driver. In some variations, the driver may directly input commands to the power management system or to other devices in the vehicle that communicate these command to the power management system. For example, the driver may use an on-board navigational system to select a destination, and this destination may be communicated to the power management system. In some variations, the user may provide commands directly to the power management system. In some variations, the command inputs may be derived from other information, including the environmental information and the operational status information. For example, the destination (either a final or an intermediate destination) may be estimated based on the current location of the vehicle, the direction that the vehicle is traveling, the time of day and/or the driver of the vehicle (e.g., if it's 8:00 am, and driver X is driving the car on interstate 280, then the final destination is most likely to the address of X's work place).

Information inputs, including command inputs, may have default or pre-set values. For example, the power management device or system may have a preset or default

maximum and minimum range of speeds for traveling part of the route (e.g., if the maximum and minimum range has not been explicitly input, the maximum and minimum range may be set to +/- 4 mph). In some variations, the information inputs may include metadata describing one or more features of an information input. Metadata may include information about the information input. For example, metadata may indicate the last time a particular data input was updated, or may indicate that the data is a default setting, or the like.

These examples of command inputs are only intended to illustrate the kinds of command inputs that may be used by the power management devices and systems described herein. Any appropriate command input may be provided to the power management device or used by the power management device.

Information from one or more operational parameters of the vehicle may be used to determine the optimal power to apply to the vehicle. Operational parameters generally include information about characteristics that are specific to the vehicle (e.g., characteristics of component parts of the vehicle, including the battery, the engine, the powertrain, the tires, etc.). Operational parameters of the vehicle may be stored and retrieved from a memory that is part of the power management device or system, or they may be retrieved from a remote information source.

Examples of operational parameters include, but are not limited to: aerodynamic parameters (CDA), rolling resistance parameters (Crr1 and Crr2), drive train efficiency parameters, motor efficiency parameters, and battery model parameters, battery charge and discharge relationships, type of battery.

The operational parameters may be fixed (e.g., may not vary with operation of the vehicle), or they may be changed. In some variations, the operational parameters may comprise a database (e.g., a lookup table), so that the value of the operational parameter may

depend upon another information input, and may be retrieved from the database by using one or more information inputs as a search key. In some variations, the operational parameter may comprise an equation or relationship that has other information inputs as variables.

Examples of operational parameters are provided below. In general, operational parameters may be determined experimentally (e.g., by testing) or may be provided by product manufacturers. In some variations, general (or generic) operation parameters may be used if more specific parameters are not available. For example, battery charge and discharge graphs (showing operational characteristics of the battery) can be obtained from battery manufacturers. Operational parameters for various types of batteries (e.g., Lithium polymer batteries, etc.) can include material characteristics, energy densities, power densities, thermal characteristics, cycle life, charge and discharge characteristics (e.g., voltage over time), and current flux over time. For example, FIGS. 12A and 12B show exemplary charge and discharge characteristics for one type of Lithium polymer battery (e.g., the Li-Po 40Ah from Leclanche SA, Switzerland). Complete characterization may also be made by taking charge and discharge measurements from either a specific battery, or a specific model and make of a battery.

Motor efficiency data may be obtainable from the manufacturer. A full model dynamometer testing may also be used to determine motor characteristics. For example, FIGS. 13A and 13B show some examples of motor characteristics that may be provided. Aerodynamic parameters of the vehicle (e.g., the outer chassis) can also be provided by the auto manufacturer, or could be measured (e.g., in a wind tunnel). Aerodynamic properties may also be estimated or calculated for different vehicles (or vehicle shapes, makes, or models) using literature values. Examples of aerodynamic parameters may be found, for example in "GM Sunraycer Case History/M-101" (Published by the Society for Automotive Engineers, Inc, December 1, 1990), The Leading Edge: Aerodynamic Design of Ultra-Streamlined Land Vehicles

(Engineering and Performance) by Goro Tamai (Robert Bentley, Inc, 1999), and The Winning Solar Car: A Design Guide for Solar Race Car Teams by Douglas R. Carroll (SAE International, 2003), each of which is herein incorporated by reference in its entirety. Examples of drag coefficients are also readily available (e.g., online: http://www.answers.com/topic/drag-coefficient-1, last visited October 12, 2005).

Rolling resistance parameters may also be provided by the tire manufacturer, or may be measured. An example of one variation of a published rolling resistance formula may be found in "Fahrwerktechnik: Reifen und Raeder"' by Jörnsen Reimpell and Peter Sponagel (published by Vogel-Fachbuch Technik, ISBN 3-8023-0737-2, 1988), herein incorporated by reference in its entirety. Similarly, a drivetrain efficiency model may be provided by the vehicle manufacturer, or may be measured from the power input vs. the power output for the entire drivetrain. In some variations, (e.g., some variations of solar cars, for example) do not have a drivetrain, since the motor is built directly into the wheel.

Examples of operational parameters are only intended to illustrate the kinds of operational parameters of the vehicle that may be used by the power management devices and systems described herein. Any appropriate operational parameter may be provided to the power management device or used by the power management device.

The information inputs described herein may be used to determine the optimally efficient energy to supply to the engine.

Optimization of Engine Efficiency

FIG. 2 illustrates some of the steps that may be followed to optimize the energy supplied to an engine so that the vehicle travels at a fuel-efficient speed. To determine an optimally efficient speed (or the optimal power to be supplied to the engine), a route is

determined 201 from the starting position and an actual or estimated ending position, the route is segmented 203 into one or more segments, a model optimal speed (or power) is calculated 205, statistical data from previous trips along the same segment of the route are retrieved 207, and an overall efficiency applied power is calculated from at least the model power and the statistical data 209. Finally, the overall efficient applied power is provided to the engine. In some variations, the vehicle operator may be notified of the overall efficient applied power instead of (or in addition to) automatically applying this optimal power. Each of these steps is described more fully below. The statistical data from previous trips may be an optional element. For instance, one may choose not the use statistical data or one may not have statistical data.

1. Determine route

The route is determined based on the current position of the vehicle and a final destination position. The destination position may be explicitly provided by the operator of the vehicle (e.g., as an operator input), or it may be derived. In some variations, the operator may provide a destination directly to the power management device, or to a device that communicates with the power management system (e.g., an on-board navigation system, etc.). The operator may also select the preferred route to the final destination either before beginning the trip, or after beginning the trip. For example, the operator may choose a destination using a navigation system including navigation systems that are not part of the power management device (such as any commercially available GPS navigation systems), which may also generate a route. The GPS navigation system may communicate the destination and route information to the power management device. In some variations, the power management system includes a GPS component or module, and may at least partly act as a

navigation system.

The destination may be derived from information about the operator, the current location, the time of day, or the like. The power management device may include statistical destination logic that determines one (or more) most likely destinations based on information provided from environmental inputs, user command inputs, and vehicle operational status inputs. In some variations, the destination is derived by generating a series of statistically weighted (e.g., likely) destinations based on any, all, or some of these inputs. Examples of some of the inputs that may be used by the statistical destination logic to determine a likely destination may include, but are not limited to: the weight of the driver, the time of the day, the current location of the vehicle, the direction that the vehicle is facing (or traveling in), the day of the week, and the speed of the vehicle.

The statistical destination logic may identify one or more destinations based on information held in a memory. For example, the statistical destination logic may use any of the information inputs to select among a record of destinations to which the vehicle has previously driven. These destinations may be assigned a probability weighting based on the information inputs. For example, the statistical destination logic may continuously infer the vehicle's destination. The information inputs can be used to assign a probability to a particular destination. It is important to note that the word "destination" in this context is not necessarily the driver's final destination. It may be an intermediate destination along the route that the statistical destination logic determines has a greater chance than some threshold likelihood (e.g., X%) of being the destination. A threshold likelihood may be preset, and may be varied by the user or by the power management device.

For instance, if a driver leaves her house to go to work, and drives toward the highway, the statistical destination logic may determine that there is a 95% chance that she is

going to the highway but only a 75% chance that she is going to go South on the highway. So, if the threshold (X) is 90%, the "destination" in this case would be the highway onramp. Once she gets on the highway going south, the probability that she is going to work may have increased to 92%. Now, the "destination" would be her work. Thus, as the vehicle drives around, the probable destination determined by the statistical destination logic may constantly change to revise the destination or intermediate destination.

In some variations, the statistical destination logic accesses (and may also write to) a memory comprising past destinations that are correlated to some or all of the information inputs (such as location, driver weight, time of day, day of week, direction, velocity, etc.), and/or information derived from these inputs (e.g., driver identity, driving habits, etc.). The list of possible locations may be weighted by the statistical destination logic based on how closely the information inputs correspond to the associated information inputs for these destinations, and may be influenced or refined by the number of times that the driver has driven to this destination. Some of the information inputs (or some combination of the information inputs) may be weighted more heavily than others in determining the likelihood of a destination. Furthermore, the statistical destination logic may select more than one likely destination, including selecting a final destination and one or more intermediate destinations.

One variation of a procedure for determining the most likely destination is described below, and illustrated in FIG. 3B. For example, the schematic route shown in FIG. 3A has 10 junctions (A to J). The probably that a driver will take any particular route from the start position may be described as "P". Thus, Pold is the previous (or old) percentage likelihood of taking a route, whereas P is the newly calculated percentage likelihood. Pold is initially set to 1 because there is a 100% likelihood that your route will go through the place that you are currently at. As used in this example, an intersection is as a junction having more than one

choice of direction that you may go in. Examples include highway exits (e.g., you can stay on the highway or take the exit), a four-way stop, and a fork in the road.

Referring now to FIG. 3A, assume that you have taken the following trips:

1. start ➔ A ➔ C ➔ E
2. start ➔ A ➔ C ➔ D ➔ F
3. start ➔ A ➔ G ➔ I
4. start ➔ A ➔ G ➔ I
5. start ➔ A ➔ C
6. start ➔ A ➔ C ➔ E
7. start ➔ A ➔ C ➔ E
8. start ➔ A ➔ G ➔ J ➔ C ➔ E
9. start ➔ A ➔ C ➔ E
10. start ➔ A ➔ C ➔ D ➔ F

Based on this trip history, the probably of your taking moving from any junction in the route shown in FIG. 3A can be determined based on this trip history. These probabilities are tabulated in the table:

Position	Probably of continuing in the possible directions	Probably of going through each location based on past behavior
start	10/10 A	

A	7/10 C 3/10 G 0/10 B	A: 10/10 = 100%
B	0/0	B: 0/0 = 0%
C	2/8 D 5/8 E 1/8 end	C: (10/10)*(7/10) + (10/10)*(3/10)*(1/3)*(1/1) = 71%
D	2/2 F	D: (.71)*(2/8) = 17.75%
E	5/5 end	E: (.71)*(5/8) = 44.375%
F	2/2 end	F: (.1775)*(2/2) = 17.75%
G	2/3 I 1/3 J	G: (10/10)*(3/10) = 30%
H	0/0	H: 0/0 = 0%
I	2/2 end	I: (.30)*(2/3) = 20%
J	1/1 C	J: (.30)*(1/3) = 10%

The Table also shows the probably of going through each location based on my previous driving behavior in the next trip. For a new trip, at each junction, the probabilities may be recalculated. For example (on the same trip), once you have reached point A and decided to turn toward C, the new probabilities are recalculated as: A: 0%, B: 0%, C: 100%, D: 25%, E: 62.5%, F: 25%, G: 0%, H: 0%, I: 0%, J: 0%. In real world examples, it could take hundreds of drives before the statistics become useful at predicting where the driver is likely to go. FIG. 3B illustrates one variation of a statistical destination logic that may be used.

2. Segment route

The route used by the power management device typically includes a starting position (e.g., the current position of the vehicle, which may be indicated by GPS), an ending position, as described above, and any intermediate positions between the initial and the final

positions. In some variations, the route may be broken up into segments that may be used by a power management device to optimize the power needed to travel this segment. A segment may comprise any distance to be traveled, including the entire route, or small portions of the route. Different segments in the same route may be of different lengths.

The route may be segmented in any appropriate manner. For example, the route may be broken into segments based on predetermined or anticipated changes in speed (e.g., switching from 65 to 55 mph), changing traffic patterns (e.g., turns, stops, yields, etc.), traffic or anticipated traffic, distance (e.g., x miles), terrain (e.g., the gradient or condition of a road), or the like. In some variations, the route may be segmented based on a combination of such factors.

A route may be entirely segmented, or only partially segmented. For example, the power management device may segment only the first part of the route (e.g., the portion containing the current position of the vehicle), or the first few segments. This may be particularly useful when the destination is an anticipated destination determined by the statistical destination logic, for example. The route may be continuously re-segmented. For example, as the vehicle moves, the power management device may become aware of changing road conditions (e.g., traffic, weather, etc.), or the user may change the route, necessitating re-segmenting. As used herein, "continuously" may mean repeated multiple times, including repeating regularly or periodically.

In some variations, the entire route (or the entire predicted route) may be divided up into N segments. The number (N) of segments may be fixed or may depend upon the route. The more segments that the route is split into, the more accurate the model may be. However, more segments may also require more computing power. Thus, the number of segments N may be decided based on the tradeoff between computing power and accuracy.

3. Calculated energy for the route

The power required by the vehicle to travel along a route, or a segment of the route, may be estimated or calculated, and this calculation may be used to determine a calculated speed for the vehicle so that the power usage is optimized or minimized. Such calculations of power requirements at different speeds typically use information inputs from the vehicle, the user, and the environment over the route from the initial position to a destination (e.g., a final destination or an intermediate destination). Any appropriate information input may be used.

Simulation of the power requirement of the vehicle may estimate power requirements at different speeds. Thus, the speed(s) that the vehicle travels the route (or a segment of the route) can be optimized. For example, the simulation could determine the most energy efficient speed for the vehicle to travel over one or more segments by minimizing the power requirement for the vehicle while allowing the speed to vary within the range of acceptable speeds.

In some variations, the power management device includes simulated energy requirement logic that determines the power requirement given the information inputs (e.g., information from the external environment of the vehicle, the operational status of the vehicle, information from one or more command inputs, and operational parameters of the vehicle). The simulated energy requirement logic can calculate the required applied power for the vehicle by calculating different power requirements for all or a portion of the route (e.g., the first segment) when the speed of the vehicle is within the range of speeds acceptable for traveling this section of the route. For example, if the target speed for a portion of the route is 60 mph with a range of +/- 5 mph, the simulated energy requirement logic may determine the

speed at which the energy requirement is lowest that is closest to the desired speed (60 mph). Any appropriate method of calculating and/or optimizing this velocity may be used, including iteratively simulating different speeds within the target range.

The optimal speed may be calculated by energy calculation logic. A simplified example is provided below, using the following parameters, assuming an electric car with regenerative brakes.

mass of the vehicle and the driver (m)	4000 kg
CdA of the car	.25
The rolling resistance coefficients: Crr1 Crr2	 .01 .05
Drivetrain efficiency (eff)	80%
air density (rho)	1.3 kg/m3
acceleration due to gravity (g)	9.8 m/s2
number of wheels (n)	4
headwind velocity (vhw)	10 kph or 2.78 m/s

In this example, the route may be split into five segments of 5 km each with the following altitudes measured at the end of each segment: 0 (beginning of segment 1), 200 m (end of 1), 100 m (end of 2), 400 m (end of 3), 100 m (end of 4), 0 (end of 5). We may also make the simplifying assumption that the road grade is constant between measured points, and the road grades are calculated to be: +0.04 (seg 1), -0.02 (seg 2), +0.06 (seg 3), -0.06 (seg 4), -0.02 (seg 5). The target average speed is 100 kph.

For the sake of simplicity in this example, we can then calculate the amount of

energy required to drive at a constant 100 kph speed for the entire route, as well as for 16 other combinations of the speeds 95 kph (26.39 mps), 100 kph (27.78 mps), and 105 kph (29.17 mps). In practice, this simulation may be run for hundreds or even thousands of combinations of speeds which may be tested to find the optimal speed to drive each segment. It is assumed that we enter the first segment traveling 100 kph (27.78 mps). It is also assumed that the speed listed for the segment is the final speed of the segment and the vehicle accelerates linearly throughout the segment.

The Table below shows the results of the energy calculation for all of the combinations tried. The lowest energy usage is 4275.94 Watt-hours. This was obtained by going 95 kph (seg1), 105 kph (seg2), 95 kph (seg3), 105 kph (seg4), 100 kph (seg5). The average speed over all 5 segments is still 100 kph, but the energy used is 10.2% less.

iterations	seg 1	seg 2	seg 3	seg 4	seg 5	Energy	units
1	27.78	27.78	27.78	27.78	27.78	4763.2484	Whr
2	26.39	29.17	27.78	27.78	27.78	4536.889	Whr
3	26.39	29.17	26.39	29.17	27.78	4275.938	Whr
4	26.39	29.17	26.39	27.78	29.17	4382.5026	Whr
5	26.39	29.17	27.78	26.39	29.17	4950.1438	Whr
6	26.39	29.17	27.78	29.17	26.39	4438.3467	Whr
7	26.39	26.39	29.17	29.17	27.78	4942.6325	Whr
8	26.39	26.39	29.17	27.78	29.17	5055.9124	Whr
9	26.39	26.39	27.78	29.17	29.17	4784.1865	Whr

10	29.17	26.39	27.78	27.78	27.78	5013.2565	Whr
11	29.17	26.39	26.39	29.17	27.78	4745.585	Whr
12	29.17	26.39	26.39	27.78	29.17	4852.1495	Whr
13	29.17	26.39	27.78	26.39	29.17	5137.6625	Whr
14	29.17	26.39	27.78	29.17	26.39	4914.7142	Whr
15	29.17	29.17	26.39	26.39	27.78	4602.8845	Whr
16	29.17	29.17	26.39	27.78	26.39	4493.3028	Whr
17	29.17	29.17	27.78	26.39	26.39	4765.4617	Whr

In general, any appropriate relationship between the information inputs, the speed (e.g., the applied power) and the required energy may be used to determine an optimized speed. In some variations, the energy requirement may be calculated from

$$E = \frac{V_{tarn}}{eff}\left(CdA\frac{\rho}{2}(V_{tarn}+V_{hw})^2 + (mgC_{rr1}+nV_{tarn}C_{rr2})\cos(\tan^{-1}(G)) + mg\sin(\tan^{-1}(G)) + ma \right)$$

aerodynamic information, rolling resistance, potential energy change due to road gradient and acceleration. FIGS. 4A, B show one method of determining the target speeds for a route by an iterative method. One variation of a method for determining target speeds is described by the equation:

where E is the total energy used over the segment. The terms of the equation include:

$\left(mgC_{rr1} + nV_{tarn}C_{rr2}\right)\cos\left(\tan^{-1}\left(G\right)\right)$ where V_{tarn}t = target velocity over time, and eff is the efficiency of the powertrain.

$$\frac{V_{tarn}}{eff}$$

The terms inside of the parenthesis calculates the total drag force on the vehicle. However, we want to calculate the total amount of energy. In general, Power = Force * Velocity, and Energy = Power * time = Force * Velocity * Time. The total amount of energy used is increased based on the power lost due to the inefficient powertrain.

$$CdA\frac{\rho}{2}(V_{tarn} + V_{hw})^2$$

The drag force due to the aerodynamics of the car is expressed as:

where CdA is the coefficient of drag time area (which can be a measured value), and rho (ρ) is the density of air, V_{tarn} is the target velocity in the nth iteration, and V_{hw} is the headwind velocity. The drag force due to the rolling resistance of the tires is expressed as:

where m is the mass of the car, g is the acceleration due to gravity, n is the number of wheels, Vtarn is the target velocity in the nth iteration, C_{rr1} and C_{rr2} are the coefficients of rolling

resistance, and G is the grade of the road. The coefficients of rolling resistance may be measured values or they may be values supplied by tire manufacturer (e.g., tire manufacturer). The numbers may vary for different road surfaces as well.

The force due to the road gradient is:

5

where m is the mass of the car, g is the gravitational constant, and G is the grade of the road. The force due to the acceleration of the car is ma (the mass of the car times the acceleration over the segment, assuming linear acceleration for the segment).

10 Putting everything together, the equation can be solved for E, the total energy $mg\sin\left(\tan^{-1}(G)\right)$ used over the segment. Similar equation are described for calculating the total energy used over a segment in "The Speed of Light, The 1996 World Solar Challenge" by Roche, Schinckel, Storey, Humphris, and Guelden (UNSW, 1997), herein incorporated by reference in its entirety.

15 FIGS. 4A, B describe a method of calculating an array of optimized velocities for an entire route that has been broken up into segments. In some variations, only one or a subset of optimized speeds are calculated.

Variations on the above equations may be made to simplify the relationships or to include additional factors. For example, the speed varying part of the rolling resistance

20 equation may be removed to simplify the equation to:

$mgC_{rr}\cos(\tan^{-1}(G))$.

Additional factors could be added as well, for example, by including the variation of the motortrain efficiency with speed, or by including the variations of the CdA depending on the directionality of the wind.

4. Historical route information

The power management device may refer to a record of historical route information. For example, the power management device may include a memory or a data structure that holds information on routes or segments or routes that the vehicle has previously traveled. The memory may comprise a database, a register, or the like. In some variations, a power management system communicates with a memory or other data structure that is located remotely. The record of historical route information may include the route information (e.g., starting location and any intermediate locations), as well as information about the actual or optimized velocities and/or applied power for the vehicle traveling the route. The record of historical route information may also include any informational from information inputs (described below). For example, the record of historical route information may include information about the time of day, weather conditions, road conditions, driver, etc. Multiple records for the same route (or segments of a route) may be included as part of the record of historical route information.

The record of historical route information may provide statistical information on driving habits. The driving habits of an operator over a particular route or segment of a route may be determined by analyzing the previous times that the driver has taken this route, and by looking at the efficiency (e.g., the power efficiency) for each previous trip, and for the combination of previous trips. Thus, the historical route information may be analyzed by statistical route analysis logic that can determine a probable optimal speed at each point along a route (e.g., at segments along the route). The more times that a driver has driven the route, the more data can be used to estimate a probable optimal speed for all or part of the route.

Historical data may be particularly useful when there is a large amount of such

data available. Instead of trying to calculate the predicted power usage based on physics modeling, this method merely looks at all of the previous data to determine the power that would be utilized to drive each segment at a particular speed. For example, in the past, a driver may have driven a particular segment 1000 times. Out of those thousand times, she may have driven it at speeds ranging from 80 kph to 120 kph. For each of those 1000 times that she drove the segment, the car recorded how fast she drove it, and how much energy was used. Therefore, to estimate how much energy would be required to drive the segment at 95 kph, the power may be estimated by taking an average of all of the previous times the driver drove that segment at 95 kph to arrive at an estimated energy usage, rather than calculating the power from the physics calculations, as described above. In one variation, only the previous trips along the segment made under approximately similar conditions are considered (e.g., similar cargo weight, headwinds, etc.).

FIG. 5 describes one method of using historical data to determine a Probable Optimal Speed. This speed most likely approximates the optimal speed, based on previous trips. In general, this method is most accurate when there are many similar previous trips to be in the database. FIG. 5 shows that, the location of the vehicle is periodically determined (e.g., via GPS, manual entry, etc.), and this location can then be used to determined a historical segment corresponding to the current location. As described above, every route may be divided into a finite number of segments, and the more segments that the route is split into, the more accurate the algorithms may be. However, additional segments also increase the computing power needed. The destination is also determined periodically 505 (e.g. as the vehicle is moving), and is reevaluated based on the current location. It can then be determined if the vehicle is in the same segment as previously determined or if it has entered a new segment 507 since reevaluating the vehicle location. If the answer is "yes," then nothing needs

to be done until the next time the location is measured. If the answer is "no," then the database is examined to find the historical information about this segment. For example, the historical information is queried to determine what speed the vehicle was traveling every time that the vehicle (or the specific driver of the vehicle) was in the same segment going to the predicted destination. In particular, the historical information is queried to determine how fast the vehicle was traveling during the trip in which the vehicle used the least amount of energy over the same route. The result of this query gives a speed that is most likely the best (e.g., most efficient) speed to travel for the current trip. The process can iteratively repeat for the next location measurement as the vehicle continues.

FIG. 5 describes a method of determining a probable optimal speed using historical route information. In FIG. 5, the probable optimal speed is identified from the historical route information as the most efficient speed (e.g., the speed having the lowest energy requirement) used by the vehicle when traversing the segment, when that segment is part of a route having the same destination as the current destination. The flowchart shown in FIG. 5 illustrates a continuous process, in which the power management device can determine a probable optimal speed as the current segment changes (e.g., as the vehicle moves).

In some variations, probable optimal speeds may be identified for the entire route. For example, the predicted or actual route may be segmented, and an array of probable optimal speeds may be identified from the historical route information for each segment. In some variations, the probable optimal speed is not a single most efficient speed for a segment of a route, but is derived from a combination (e.g., an average, median, weighted average, etc.) of all or a subset of the historical route information speeds. In some variation, only a subset of the historical route information is used. For example the probable optimal speed may be driver specific, so that only information for a specific driver is used to calculate a probable optimal

speed. Drivers may be identified by bodyweight, or some other information input, including self-identification. If there is no historical route information for the segment or route being examined, then the probable optimal speed may be set to a predetermined value (e.g., zero), or some other indicator may be toggled so that the probable optimal speed is not relied upon.

In one variation, a reliability estimate may be assigned to the probable optimal speed. For example, a reliability estimate may be related to the number of data points (e.g., the number of times that the vehicle (or a driver driving the vehicle) has driven that segment or route. For example, if there are no records of the vehicle driving the route, the reliability estimate may be set very low. Generally, the more records for a route in the historical route information, or the more closely the identifying information in the record matches the information about the current route (e.g., the driver, weather conditions, traffic, etc.), the higher the setting of the reliability estimate.

5. Calculation of an efficient speed output

Finally, an efficient speed for the vehicle to travel the route (or a part of the route) may be determined from the calculated optimized speed and the probable optimal speed. The optimum speed is the most efficient speed (E), as described above. This efficient speed (or efficient speed output of the power management system) may also be expressed as the applied power that is provided to the engine to achieve the speed at which the fuel efficiency is optimal. Thus, an efficient speed is typically a function of the driver's current operational demands, the current operational conditions of the vehicle, the operational parameters for the vehicle, and any historical behavior of the vehicle taking the same (or a similar) route.

In general, an efficient speed output is determined by a combination of the calculated optimized speed and the probable optimized speed after they have been

appropriately weighted. In some variations, this weighting takes into account the total energy predicted by the calculated optimized speed (e.g., by the simulated energy requirement logic) and the total energy required for the route predicted by the probable optimized speed (e.g., by the statistical route analysis logic). The reliability estimate for the probable optimized speed may also contribute to the weighting. The power management device may include derived efficient speed logic that can determine efficient speeds for the vehicle to travel the route, or a portion of the route. In some variations, the efficient speeds are expressed as power or energy to be applied to the vehicle engine (e.g., the applied power).

As previously mentioned, the methods and logic described above may be used to calculate a speed or an applied power for running the vehicle at an optimal fuel efficiency. As will be apparent to one of skill in the art, the same procedures may be used to determine a speed (or speeds) over the route that minimize or maximize other factors, and are not limited to optimizing only fuel efficiency. For example, the power management device may control the speed of the vehicle so as to minimize the duration of the trip instead of (or in addition to) fuel efficiency. Thus, the simulated energy requirement logic may be expressed as a simulated time requirement, and may calculate the time required to travel a segment of the route as a function of the speed or energy, and additional information input. In this case, calculated optimized speeds may be determined by minimizing the duration of the trip over each segment. Furthermore, the probable optimal speed may be determined from the historical route information based on the duration of travel, rather than the power applied, for each segment.

Control Logic

The power management device may include control logic for controlling the operation of the power management device. Control logic may include logic for acquiring

information inputs, communicating with different components of the power management system, estimating the destination of the vehicle from information inputs, segmenting the route into segments, simulating the energy requirements of the engine from information inputs, and controlling the entire power management device or system.

For example, the power management device or system may include polling logic for acquiring information inputs and may also coordinate writing of information from the power management device to a memory. In some variations, the polling logic polls sources of information data that are provided to the power management device. For example, the polling logic may poll data from sensors, inputs, memories, or any other source of information data. The polling logic may further coordinate storing of this data in a memory, such as a memory register or a memory device or database that may be accessed by the power management device or system. In some variations, the polling logic causes old data (e.g., greater than x weeks old) to be overwritten. The polling logic may also control how often the various information data sources are polled. For example, the polling logic may continuously poll data from external environmental sensors (e.g., detecting location, direction, elevation, traffic, weather, etc.) and operational status detectors (e.g., detecting vehicle speed, well velocity, motor speed, etc.). The polling logic may also coordinate writing of route information. For example, the polling logic may coordinate recording the decisions made at intersections, and information about routes traveled by the vehicle, and the like. In some variations, the polling logic also coordinates the writing of information derived from the information inputs to a memory. For example, the polling logic may coordinate recording the optimal speed or energy used to traverse a segment or other portion of a route.

As described above, the power management device or system may also include statistical destination logic. Statistical destination logic may infer one or more likely

destinations based on the information inputs. For example, the power management system may infer the destination of the route based on the current location and direction of the vehicle, and the date and time of day. In some variations, the power management system is unable to infer a final destination, but it can generate an intermediate destination or segment for the route, as described above. The probable destination(s) identified by the statistical destination logic may then be used to optimize the power needed to travel the route or a segment of the route, and to determine a historical probable optimal speed.

In some variations, the power management device or system includes simulated energy requirement logic and statistical route analysis logic. As described above, simulated energy requirement logic may determine a calculated optimized speed for the vehicle, and statistical route analysis logic may be used to determine a probable optimal speed. The power management device or system may also include derived efficient speed logic that determines the most efficient speed or power to be applied to the vehicle engine, as described above.

Power management logic can coordinate different components of the power management system, including the logic components, user interfaces, informational data inputs, memory, processors, motor control mechanisms, and the like. Thus, the power management system may include power management logic to control the overall activity of the power management system. FIG. 6 shows a graphical representation of one variation of the power management device, indicating that the power management logic controls and coordinates the various components of the system. In FIG. 6, the polling logic 607 coordinates the activity of information inputs 601, 603, 605. The information inputs are also linked to each other and to the statistical destination logic 609, statistical route analysis logic 611, and simulated energy requirement logic 613. In particular, these elements are all connected to the memory, and may read and write to this memory. The derived efficient speed logic also

controls these three logic elements 609, 611, and 613. As described above, the derived efficient speed logic 615 may produce an efficient speed output for each part of the route (e.g., the speeds or applied powers resulting from optimizing the fuel efficiency over the route or parts of the route). Before this applied power can be used to control the motor (via a motor control mechanism 619), the power management logic may check for overrides such as operator overrides (e.g., breaking), or other overrides that may be indicated by the headway cruise control box 617. For example, the operator may override the power management device by applying the brakes, etc. The power management device may also be preempted by an obstruction (such as another vehicle) in the "headway" that blocks the vehicle, requiring the vehicle to slow or stop.

FIG. 6 shows one variation of the power management device descried herein. As will be apparent to those of skill in the art, different variations are possible. For example, additional components (e.g., communications elements, microprocessors, memories, etc.), and/or additional logic (e.g., route segmentation logic, operator interface logic, etc.) may also be included. In some variations, some of the elements may be omitted (e.g., the separate polling logic), or may be combined with other elements. In some variations, the organization of the elements may be different. For example, the statistical destination logic may be controlled by the polling logic, rather than the derived efficient speed logic.

Power Management Devices

In general, the power management device comprises power management logic that receives information input about the external environment of the vehicle, the operational status of the vehicle, one or more command inputs from the driver, and one or more operational parameters of the vehicle. The power management device may also include

additional components such as information inputs (e.g., sensors, detectors, relays, etc.), one or more processors (e.g., microprocessors), memories (e.g., databases, ROM, RAM, EPROM, etc.), communications devices (e.g., wireless connections), user interfaces (e.g., screens, control panels, etc.), and/or motor control mechanisms. In some variations, the power management device may be installed into the vehicle by the vehicle manufacturer. In other variations, the power management device may be retrofitted into a vehicle. In general, the power management device or system intervenes between the driver and the engine. In practice, the power management system may be physically located in any appropriate location in the vehicle. FIG. 7 shows one example of a vehicle having a power management system 701 as described herein. In FIG. 7, the power management system is shown in the front of the car 700, connecting the motors 705 and batteries 707. Any appropriate sensors, detectors or data inputs may be used with the power management devices and systems described herein. For example, sensors for detecting external environmental information may be used (e.g., optical, mechanical, electrical, or magnetic sensors). Sensors may be monitored (e.g., polled) in real-time, as described above. For example, polling logic may coordinate continuous or periodic polling of Global Positioning System (GPS) information (e.g., giving information on the vehicle's current location, current elevation, upcoming elevations, upcoming terrain, vehicle's destination, etc.), speedometer information (e.g., vehicle's current speed, motor speed), date and time information (e.g., the date and time may be used to determine personal driving habits and sun angle), gyroscope information (e.g., vehicle's current orientation, current slope/grade of road), RPM (e.g., motor and wheel rotations per minute), accelerator and brake pedal position (e.g., pressure applied and/or current angle of the petals), the angle of sun (e.g., sensors may detect latitude, longitude, time of day, date), weather (e.g., wind direction and velocity, rain, sun, snow, etc.), battery state (e.g., voltage, amp hour meter, etc.), tire pressure

(e.g., may be used to calculate the drag force due to rolling resistance), headway control information (e.g., the distance from a car in front of the vehicle), the weight of car (e.g., weight of cargo, passengers, driver), airflow (e.g., the amount of air going to the engine), gas flow sensor (e.g., the amount of gas going to engine of a hybrid or ICE car), weight of driver (e.g., may be used identify the driver and linked to personal driving habits). Different detectors or sensors may be polled at different intervals, including continuously, or only occasionally. Polling may also depend upon the availability of a resource. For example, information may be available only when a telecommunications network (e.g., satellite, cellular, etc.) is available.

In some variations, a memory may be used. The memory may be read/write memory, or read only memory. The memory may include information, such as information on the operational parameters of the vehicle related to the make and model of the vehicle. As described above, operational parameters may include look up tables, charts, or the like. For example, a memory may include information about an aerodynamic model (CDA) for the vehicle, a rolling resistance model (Crr1 and Crr2), a drive train efficiency model, a motor efficiency model, and/or a battery model (e.g., charge and discharge graphs for the battery). In some variations, these models are not part of a memory, but are algorithms or logic.

Any appropriate memory may be used, including ROM, RAM, removable memories (e.g., flash memory), erasable memories (e.g., EPROM), digital media (e.g., tape media, disk media, optical media), or the like. In some variations, the memory may comprise a database for holding any of the route information (including historical route information), about the segments traveled, the speeds traveled, energy usage measured or calculated for this route or segment, who the driver was, external environmental conditions while driving the route, operational status of the vehicle while driving the route, and command inputs while driving the route. The power management system may include more than one memory.

The power management system may also include one or more user interfaces. A user interface may allow input of user command information (e.g., selecting a destination, selecting a route, selecting a target speed or speeds, selecting a range of acceptable speeds, etc.). In some variations, a user interface may also provide output from the power management system that can be viewed by the user. For example, the user interface may provide visual or auditory output, or suggest target speeds that the user can match to optimize power supplied to the vehicle. In some variations the user interface may provide status information to the user about the power management system. For example, the user interface may indicate that the power management system is engaged, what the destination (or predicted destination) is, what the optimal speed (or speeds) is, what inputs are missing or estimated, or the like. In some variations, the user interface may display any of the information inputs.

FIG. 8 shows one variation of a user interface for a power management device or system. In FIG. 8, the user interface 800 includes a screen region 801, that shows a two-dimensional map indicating at least part of the route 805 and the direction of travel 803, the temperature of the external environment 807, the weather 809 (indicated by an icon), the current or derived efficient speed 811, the set (or cruising) speed 813, and the range within which the speed should be maintained 815. The screen region of the user interface shown in FIG. 8 also shows the destination 819.

In some variations, the user interface of the power management system may include multiple screens for displaying information, or for accepting user input. In FIG. 8, the user interface also includes a plurality of buttons 821, including a toggle 823 allowing menu-driven interaction. The user interface may also include messaging features. For example, when the vehicle is turned on but stopped, a user interface may indicate a message has been

sent/received (e.g., by flashing, etc.). When the user presses a "Messages" button, the system may display feedback messages. For example, if the tire pressure sensor notices that the tire pressure is low, a message to that effect will be displayed to the user. Diagnostic/test messages can also be sent to this screen for testing, development, or repair purposes. The messaging features may be included on the face of the user interface (e.g., as a "Messages" button 821, etc.).

FIG. 9 illustrates the flow of information in one variation of a power management system. Information inputs into the power management system 901, 903, 905 enter the system and some (or all of them) may be displayed by the user interface. For example, external information inputs 901 may be shown. The status of some of the information inputs (or the status of the detectors that receive the information inputs) may also be shown. For example, the user interface can indicate when the system is connected to an external information input. In some variations, the external information inputs may be connected to the power management system by a wireless transmission (e.g., from an external source), and the connection to the external source may be indicated by the user interface. As described above, the user interface may accept command inputs from the driver (or a passenger) 905. In some variations, user commands may be accepted directly by using buttons on the user interface, or by voice commands. In other variations, at least some of the user commands may be entered into the power management system from another source (e.g., a separate cruise control or GPS device). Finally, the user interface may indicate the output of the power management device or system 909, typically an efficient speed output for the engine.

In some variations, the power management system may include a headway cruise control. The headway cruise control can prevent collisions when the vehicle is in motion

by overriding the power management control system's control of the vehicle speed. In some variations, the headway cruise control detects the proximity of other vehicles or obstacles in the road ahead. The headway cruise control may include sensors on the vehicle, such as laser, ultrasound or other electronic distance measurement devices. Increasingly, more vehicles are including some sort of GPS interface to communicate with other vehicles to determine distance between the vehicles to avoid collisions.

The power management devices and systems described herein may also include a motor control mechanism. The motor/engine controller changes the motor speed by mechanical operations such as pulling on a cable to adjust gas/airflow mixture or by electrical means with either analog or digital inputs by the driver. With electric driven motors, a variable may be changed to increase or decrease motor speed. In the cruise control settings, the speed of the motor may change based algorithm in the processor.

The power management devices and systems described herein may be organized in any appropriate manner, as described above. For example, in some variations, the power management device described herein may include component parts that are connected as illustrated in FIG. 10. FIG. 10 shows a schematic of one variation of a power management device. In FIG. 10, the power management system includes a central processor 1001 (CPU) that can execute control logic such as power management control logic, statistical destination logic, simulated energy requirement logic, statistical route analysis logic, derived efficient speed logic, polling logic, etc. This CPU receives inputs from sensors 1005, GPS receiver 1007, a clock 1011, a telemetry data receiver 1009, a speech recognition processor 1021 (including a microphone 1019, 1025), user interface buttons 1039, 1037, and memory components (including RAM 1035, a long-term memory 1033, firmware ROM 1031, and a removable memory 1029, 1041). The CPU may also coordinate output through the LCD display 1015, 1017, a speaker 1023, 1027, and

the motor control mechanism (motor controller) 1043. In some variations, the sensors 1045 may also be included as part of the power management devices or systems.

As described above, the power management system may also be used with a telemetry system. Thus, the power management system may communicate with one or more external components. For example, the power management system may store information in a remote memory. The power management system may also contribute to a database of information about route, road conditions, and the like, such as a database of historical route information. In some variations, the motor control system may remotely communicate with a processor, so that at least some of the control logic is applied remotely.

FIG. 11 shows a schematic illustrating the use of telemetry by the motor control system. In FIG. 11, a power management device 1101 communicates by wireless communication with a database 1107 through a transmitter/receiver 1105 (shown as a satellite). Any reasonable type of wireless communications may be used, including cellular, wireless internet connections, radio, or the like. In this example, the database may both receive data from the power management device and/or transmit data or instructions to the power management device. Communication between the power management device and other components that are remotely located (e.g., memory, processor, information inputs) may also be used to update or correct the power management device. For example, the operational parameters of the vehicle may be revised or updated from a remote source. In some variations, control logic (e.g., power management control logic) may be remotely updated or revised.

The concepts described above may be used in various combinations to optimize the power used by a vehicle. Examples of power management systems, including methods of using them, are described below.

EXAMPLES

1. Fuel Efficient Hybrid vehicle

Using one variation of the power management system described herein (e.g., a power management system having an integrated with a GPS), a hybrid car approaching a large hill or grade can adjust the ratio of electric to ICE such that the batteries would be empty at the crest of the hill and fully charged at the bottom of the hill, and therefore would use less gasoline.

The same methods described above could be used to calculate the energy usage of the vehicle as in the previous example. The mix of electric to ICE can be based on the calculated energy usage and the energy stored in the batteries. The exact mechanism for instructing the hybrid vehicle to alter its electric/ICE ratio may vary between manufacturers.

2. Fuel Efficient Internal Combustion Engine (ICE) vehicle

Using one variation of the power management system described herein, an ICE car will speed up on a downhill when it knows that an uphill is the next terrain, and thereby use momentum to get up the hill, using less gasoline. FIG. 1B illustrates this Example. As described previously, the system may determine the optimum energy using external and internal sensors and information, including the operational parameters appropriate to the vehicle. Such operational parameters may vary from manufacturer to manufacturer (or vehicle to vehicle), and, as described above, could involve sending an electrical signal to a computer-based motor controller or even mechanically controlling the gas/air-flow mixture to the engine.

3. Energy efficient Solar-powered vehicle

Using one variation of the power management system described herein, a solar-powered car can ensure that it has adequate power to traverse a predetermined route. The power management system may ensure that there is enough solar energy power for the route by slowing and speeding the car as necessary based on current energy levels and anticipated energy needs.

This example is similar to the example discussed when determining the optimum speed above, with a couple of additional steps. In addition to calculating the energy usage, the system may also include a solar array model that could model the power generated by the solar array throughout the route base on the predicted weather, geographic location, and time of day. A battery model may also be included to keep track of the energy put into the batteries by the solar array, and the energy drawn from the batteries by the motor. When selecting the optimum speeds to drive the segments of the route, the system logic (e.g., software, hardware or both), may apply or access the battery model to prevent the battery from becoming completely drained.

4. Preventing Engine Flooding

One of the keys to efficient driving is not to step on the accelerator more than the engine can actually burn and use efficiently. Flooding the engine not only wastes gas but it doesn't maximize power, despite the drivers' demands. According to one variation of the power management system described herein, a traditional ICE engine may be protected from flooding of the engine using the power management device.

In this variation of a power management device, power management device receives information inputs including a command input (acceleration), at least two environmental inputs (air resistance), the operational status of the vehicle (velocity and engine

temperature), and at least one operational parameter (e.g., maximum fuel volume). For example, the power management device may receive information about the amount of pressure that the driver is applying to the accelerator. The power management system may also detect the current speed, resistance and temperature of the vehicle. This information input may be used to select the proper operational parameter of the vehicle. For example, the device may include a memory having a table of maximum fuel volumes for a given velocity, resistance and temperature. Thus, the velocity, resistance and temperature data may be used to look up a maximum fuel volume. In some variations, the maximum fuel volume may be calculate or estimated from this data. By comparing the operator demand (for acceleration) to supply fuel with the maximum amount of fuel that the engine can handle, the power management control logic may correct for the drivers inefficiency, and instruct the motor control mechanism to provide the actual maximum amount of fuel to the engine, thereby avoiding flooding of the engine.

This is a last example is a very simplified case of the overall actions of the power management control system. In general, the power management device intervenes between the driver and the engine. Thus, the power management device may interpret the driver commands so that the driving objective is achieved while maximizing the efficiency of the vehicle based on information that is not generally accessible or interpretable by the driver. While the invention has been described in terms of particular variations and illustrative figures, those of skill in the art will recognize that the invention is not limited to the variations or figures described.

For example, in one variation the system would be able to notify the driver the most fuel efficient speed for a route segment or segment destination. The notification might be via voice, written word, numbers, symbols, colors and/or the like. The vehicle operator can

then manually adjust the vehicle speed based in response to the notification. In this example, the calculated power would not necessarily be directly applied to the vehicle engine as it would just be used as a driver alert.

In still another variation, the power consumption calculation could further include or be based on calculating an optimal acceleration to (gradually) accelerate to the determined efficient speed to travel the segment destination or optimal deceleration to (gradually) decelerate to the determined efficient speed to travel the segment destination. The calculation could for example incorporate GPS information, the determined efficient speed to travel the segment destination, or a combination thereof.

In still another variation, the information could be based on past history information of the vehicle, information of one or more other vehicles traveling one or more of the same route segments, or a combination thereof. For example, if one drives the same route to work each day, the energy consumption of those various trips can be stored along with the speeds driven along different segments of the route. From enough historical data, an optimized route could be determined.

In still another variation, the information could be stored information of vehicles traveling overlapping route segments. If many cars drive along overlapping segments, their energy usage for those segments could be uploaded to e.g. a centralized server where optimized speeds for those segments could be calculated. Those optimized speeds could be shared in several ways such as, but not limiting to, (i) transmitted directly to cars, where they could be used in fuel economy optimizing cruise control, (ii) transmitted to cars where they could used to provide recommendations to drivers, (iii) shared via a web site where drivers could view recommendations, (iv) shared via a web site where drivers could compare their fuel economy to that of other drivers. The data could be used by state or local governments to

adjust speed limits to improve the overall fuel economy of the cars that drive along their roads.

In still another variation, an automatic transmission vehicle could use the determined efficient speed to intelligently shift gears, i.e., the optimized speed for (upcoming) route segments could be used by the automatic transmission to make intelligent decisions about shifting gears which would improve overall drive train efficiency.

In addition, where methods and steps described above indicate certain events occurring in certain order, those of skill in the art will recognize that the ordering of certain steps may be modified and that such modifications are in accordance with the variations of the invention. Additionally, certain steps may be performed concurrently in a parallel process when possible, as well as performed sequentially as described above. Therefore, to the extent there are variations of the invention, which are within the spirit of the disclosure or equivalent to the inventions found in the claims, it is the intent that this patent will cover those variations as well. Finally, all publications and patent applications cited in this specification are herein incorporated by reference in their entirety as if each individual publication or patent application were specifically and individually put forth herein.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Filer:	David R. Stevens/TRAM RICHARDS
Attorney Docket Number:	INVN-00127

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**785**

Electronic Acknowledgement Receipt	
EFS ID:	36227245
Application Number:	16433703
International Application Number:	
Confirmation Number:	8048
Title of Invention:	Electric Vehicle Power Management System
First Named Inventor/Applicant Name:	Martin Koebler
Customer Number:	141471
Filer:	David R. Stevens/TRAM RICHARDS
Filer Authorized By:	David R. Stevens
Attorney Docket Number:	INVN-00127
Receipt Date:	06-JUN-2019
Filing Date:	
Time Stamp:	16:28:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$785
RAM confirmation Number	060719INTEFSW00003383502421
Deposit Account	502421
Authorized User	TRAM RICHARDS
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	Application_Data_Sheet.pdf	103994 5d30be42e355c3b68a946b3a4d635086ac6e873d	no	4
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Oath or Declaration filed	Declaration_Executed.pdf	82450 d3b3ec4d92860c28583da44e7fa0bc5d126e4d22	no	2
Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings_Final.pdf	278854 25f3f5e97f78db572ddaeb96379ada83dbcc91a2	no	15
Warnings:					
Information:					
4	Power of Attorney	POA_Executed.pdf	276998 43b6b245611fc491e264958b51df93a2c69d0692	no	2
Warnings:					
Information:					
5		Specification_Final.pdf	360310 8302e70cfa44ea7e7903b0c8480915ab47ee344b	yes	56

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Abstract	56	56
	Claims	52	55

	Specification		1	51	
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	35170 be14ecc52bb53489383b1e83ac951e97cd54c7b0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1137776		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Application Data Sheet 37 CFR 1.76

Secrecy Order 37 CFR 5.2

Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)	No

Inventor Information

Given Name::	Martin
Middle Name::	
Family Name::	Koebler
Residence Information::	Non US Residency
City of Residence::	Saal/Donau
State/Province of Residence::	Bavaria
Country of Residence::	DE
Street of Mailing Address::	650B Fremont Avenue, #650
City of Mailing Address::	Los Altos
State/Province of Mailing Address::	CA
Postal Code of Mailing Address::	94024
Country of Mailing Address::	US

Given Name::	Nicole
Middle Name::	G.
Family Name::	Goldstein
Residence Information::	US Residency
City of Residence::	Woodside
State/Province of Residence::	CA
Country of Residence::	US
Street of Mailing Address::	650B Fremont Avenue, #650
City of Mailing Address::	Los Altos
State/Province of Mailing Address::	CA
Postal Code of Mailing Address::	94024
Country of Mailing Address::	US

Given Name::	Stephen
Middle Name::	J.
Family Name::	Brown

Residence Information::	US Residency
City of Residence::	Malibu
State/Province of Residence::	CA
Country of Residence::	US
Street of Mailing Address::	650B Fremont Avenue, #650
City of Mailing Address::	Los Altos
State/Province of Mailing Address::	CA
Postal Code of Mailing Address::	94024
Country of Mailing Address::	US

Given Name::	Jason
Middle Name::	H.
Family Name::	Harper
Residence Information::	US Residency
City of Residence::	Pleasanton
State/Province of Residence::	CA
Country of Residence::	US
Street of Mailing Address::	650B Fremont Avenue, #650
City of Mailing Address::	Los Altos
State/Province of Mailing Address::	CA
Postal Code of Mailing Address::	94024
Country of Mailing Address::	US

Correspondence Information

Customer Number::	141471
Email Address::	uspto@stevenslawgroup.com

Application Information

Title of the Invention::	Electric Vehicle Power Management System
Attorney Docket Number::	INVN-00127
Small Entity Status Claimed::	Yes
Application Type::	Nonprovisional
Subject Matter::	Utility
Total Number of Drawing Sheets::	15
Suggested Figure for Publication::	9

Publication Information

Request Early Publication:: No

Request Not to Publish:: No

Representative Information

Customer Number:: 141471

Domestic Benefit/National Stage Information

Prior Application Status::	Application Number::	Continuity Type::	Prior Application Number::	Filing Date (YYYY-MM-DD)::
Pending	This application	Continuation	15/720,032	2017-09-29
Pending	15/720,032	Continuation	15/626,676	2017-06-19
Patented	15/626,676	Continuation	14/566,848	2014-12-11
Patented	14/566,848	Continuation	14/206,138	2014-03-12
Patented	14/206,138	Continuation	13/066,189	2011-04-08
Patented	13/066,189	Continuation in part of	11/283,137	2005-11-17

Foreign Priority Information

Application Number::	Country::	Filing Date (YYYY-MM-DD)::	Access Code

Statement under 37 CFR 1.55 or 1.78 for AIA Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. No

Authorization or Opt-Out of Authorization to Permit Access

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed

and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h) (1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Applicant Information

Applicant Type::	Assignee
Applicant is an Organization::	Yes
Organization Name::	Invently Automotive Inc.
Street of Mailing Address::	650B Fremont Avenue, #650
City of Mailing Address::	Los Altos
State/Province of Mailing Address::	CA
Postal Code of Mailing Address::	94024
Country of Mailing Address::	US

Signature

Signature::	/David R. Stevens/
Date (YYYY-MM-DD):	2019-06-06
First Name::	David R.
Last Name::	Stevens
Registration Number::	38626

Docket No. 9748.00301c

DECLARATION FOR PATENT APPLICATION

We the undersigned inventors, hereby declare that:

Our residence and post office address are given next to our name;

We believe that we are an original joint inventor of the subject matter claimed in the application for patent entitled **"POWER MANAGEMENT SYSTEMS AND DESIGNS"**, which:

__X__ is submitted herewith;

____ was filed on _____ as Application Serial No. _____;

The above-identified application was made or authorized to be made by us.

We declare that all statements made herein were made with the knowledge that any willful false statement made in this declaration is punishable by fine or imprisonment of not more than five (5) years, or both, under Section 1001 of Title 18 of the United States Code.

Martin Koebler
Name of First Joint Inventor

/Martin Koebler/ (Oct 22, 2013)
Signature of First Joint Inventor

Oct 22, 2013
Date

Post Office Address:
Lindenstrasse 11
Saal/Donau, D-93342 Germany

Residence:
Lindenstrasse 11
Saal/Donau, D-93342 Germany

Jason H. Harper
Name of Second Joint Inventor

/Jason H. Harper/ (Oct 22, 2013)
Signature of Second Joint Inventor

Oct 22, 2013
Date

Post Office Address:
5250 Crestline Way
Pleasanton, CA 94566

Residence:
5250 Crestline Way
Pleasanton, CA 94566

/Stephen J. Brown/
e-Signed 2013-10-21 12:36PM PDT
brown2020@gmail.com

/ Nicole G. Goldstein /
e-Signed 2013-10-21 09:30PM PDT
nicolegoldstein@yahoo.com

/Jason H. Harper/
e-Signed 2013-10-22 06:07AM PDT
jhharper1@yahoo.com

/Martin Koebler/
e-Signed 2013-10-22 08:21AM PDT
mkoebler@yahoo.com

Document Integrity Verified
EchoSign Transaction Number: XXRYR4P7O2J7Y78

Docket No. 9748.00301c

Stephen J. Brown
Name of Third Joint Inventor
/Stephen J. Brown/ (Oct 21, 2013)
Signature of Third Joint Inventor
Oct 21, 2013
Date

Post Office Address:
2995 Woodside Road #400-444
Woodside, CA 94062

Residence:
2995 Woodside Road #400-444
Woodside, CA 94062

Nicole G. Goldstein
Name of Fourth Joint Inventor
/Nicole G. Goldstein/ (Oct 21, 2013)
Signature of Fourth Joint Inventor
Oct 21, 2013
Date

Post Office Address:
188 Alta Mesa Road
Woodside, CA 94062

Residence:
188 Alta Mesa Road
Woodside, CA 94062

/Stephen J. Brown/
e-Signed 2013-10-21 12:36PM PDT
brown2020@gmail.com

/ Nicole G. Goldstein /
e-Signed 2013-10-21 09:30PM PDT
nicolegoldstein@yahoo.com

/Jason H. Harper/
e-Signed 2013-10-22 06:07AM PDT
jhharper1@yahoo.com

/Martin Koebler/
e-Signed 2013-10-22 08:21AM PDT
mkoebler@yahoo.com

Document Integrity Verified — EchoSign Transaction Number: XXRYR4P7D2J7Y78

TYPICAL CRUISE CONTROL TODAY (VELOCITY CONTROL)

OVERALL TRIP TIME FROM POINT A TO POINT B IS 15 MIN.

THE TOTAL ENERGY USED FROM POINT A TO POINT B IS 1 KWH.

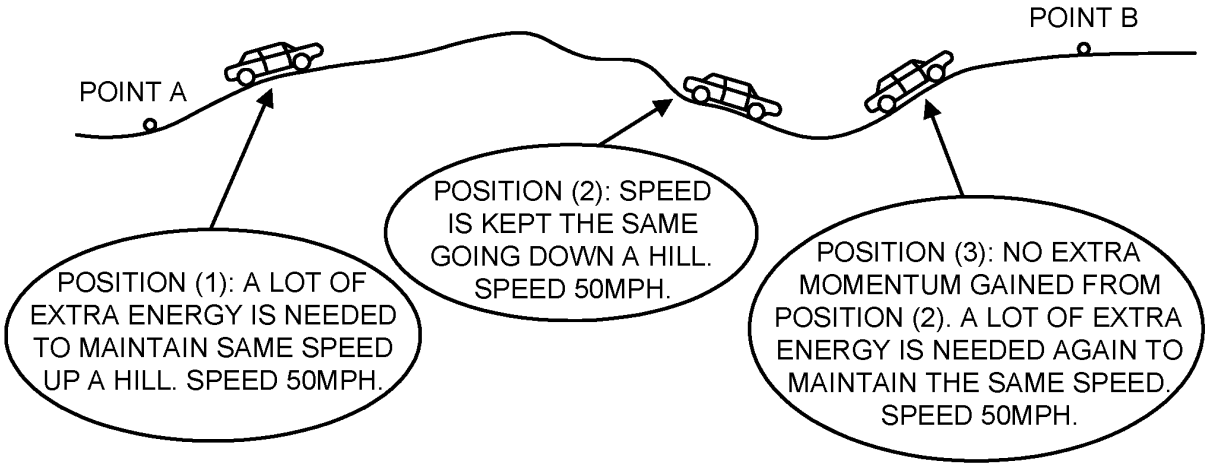


FIG. 1A

OVERALL TRIP TIME FROM POINT A TO POINT B IS 15 MIN.

THE TOTAL ENERGY USED FROM POINT A TO POINT B IS 0.9 KWH.

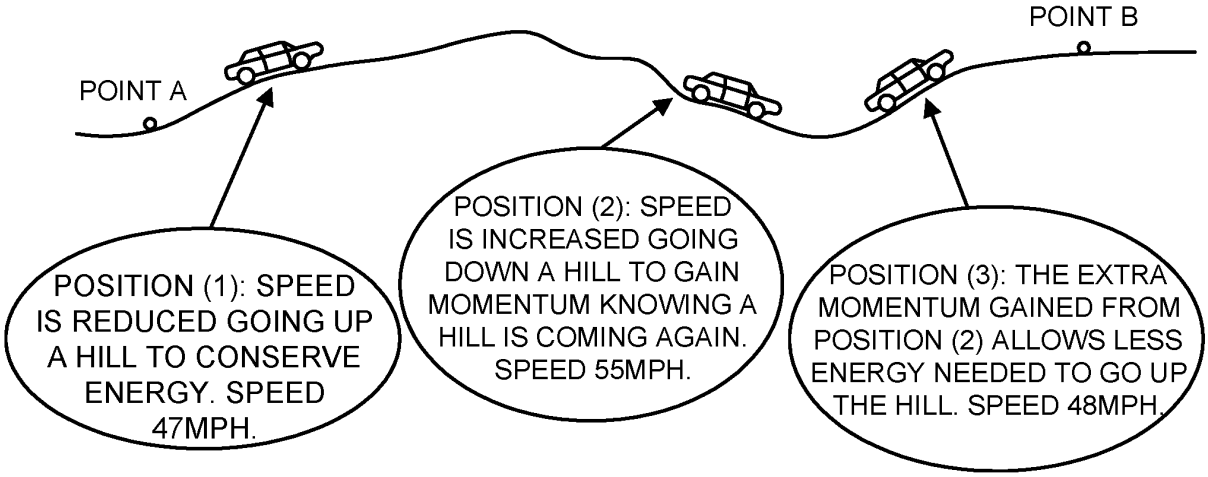


FIG. 1B

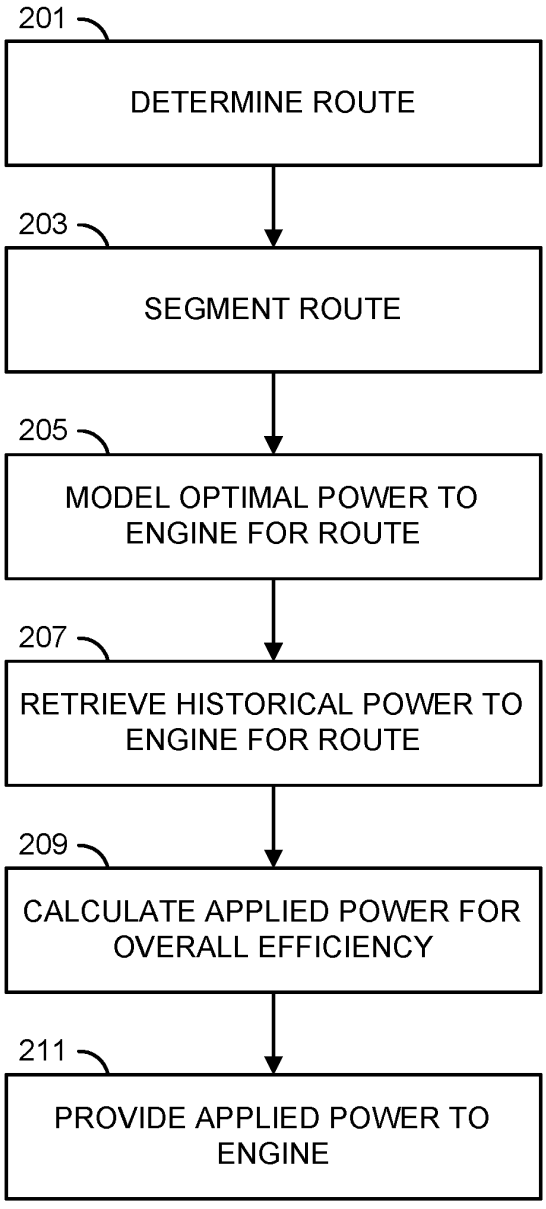

201
DETERMINE ROUTE
203
SEGMENT ROUTE
205
MODEL OPTIMAL POWER TO ENGINE FOR ROUTE
207
RETRIEVE HISTORICAL POWER TO ENGINE FOR ROUTE
209
CALCULATE APPLIED POWER FOR OVERALL EFFICIENCY
211
PROVIDE APPLIED POWER TO ENGINE

FIG. 2

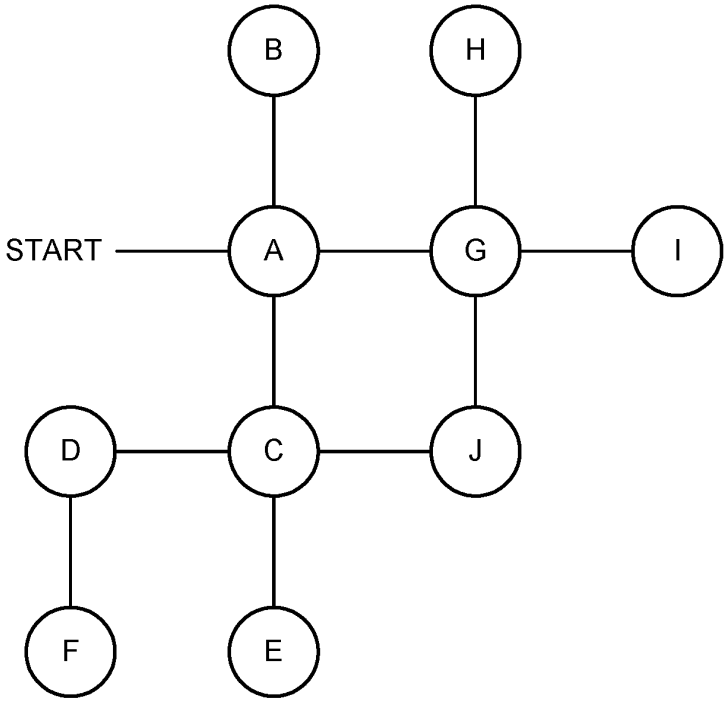


FIG. 3A

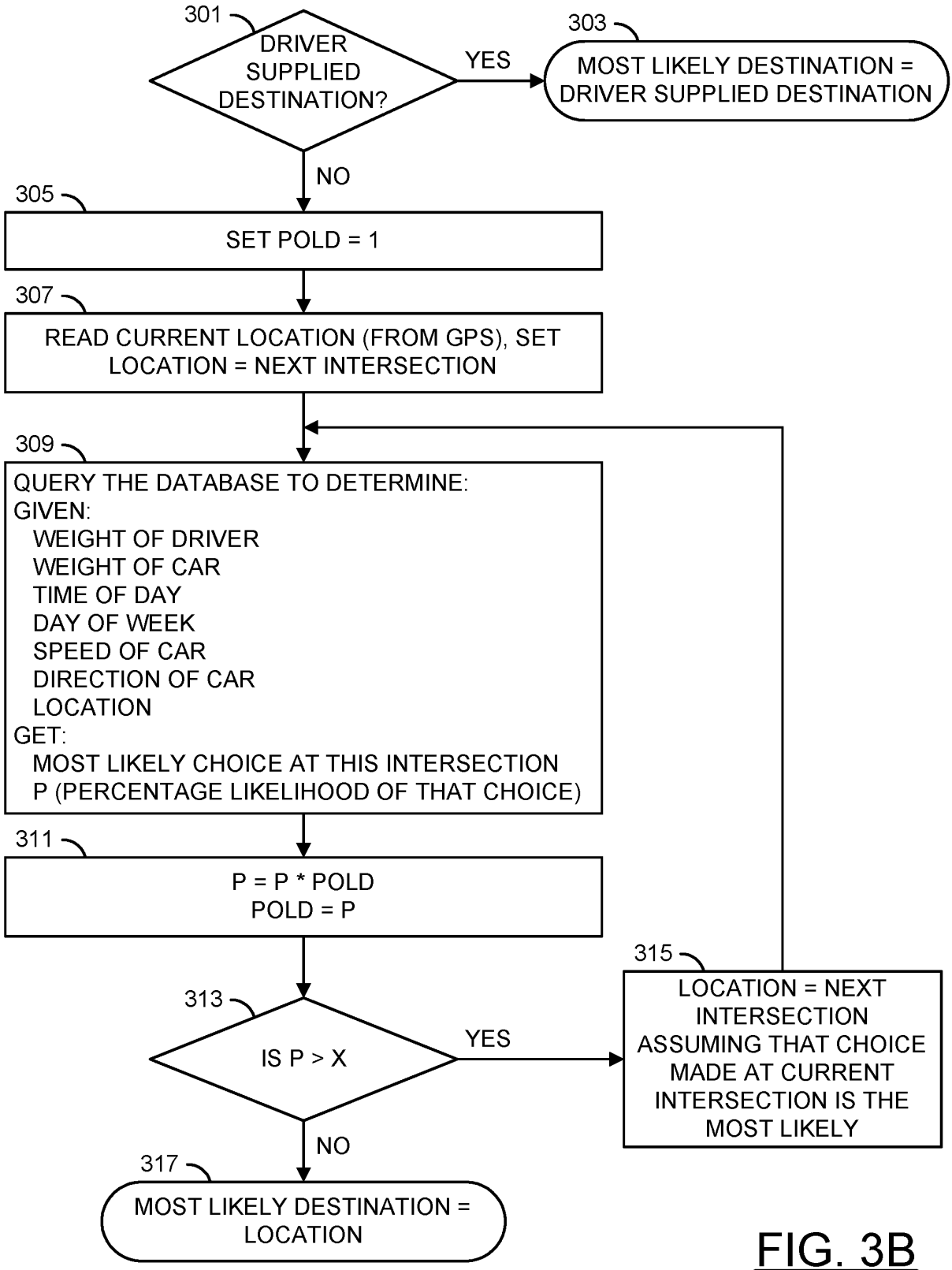

301
DRIVER SUPPLIED DESTINATION?
YES
303
MOST LIKELY DESTINATION = DRIVER SUPPLIED DESTINATION
NO
305
SET POLD = 1
307
READ CURRENT LOCATION (FROM GPS), SET LOCATION = NEXT INTERSECTION
309
QUERY THE DATABASE TO DETERMINE:
GIVEN:
WEIGHT OF DRIVER
WEIGHT OF CAR
TIME OF DAY
DAY OF WEEK
SPEED OF CAR
DIRECTION OF CAR
LOCATION
GET:
MOST LIKELY CHOICE AT THIS INTERSECTION
P (PERCENTAGE LIKELIHOOD OF THAT CHOICE)
311
P = P * POLD
POLD = P
313
IS P > X
YES
315
LOCATION = NEXT INTERSECTION ASSUMING THAT CHOICE MADE AT CURRENT INTERSECTION IS THE MOST LIKELY
NO
317
MOST LIKELY DESTINATION = LOCATION

FIG. 3B

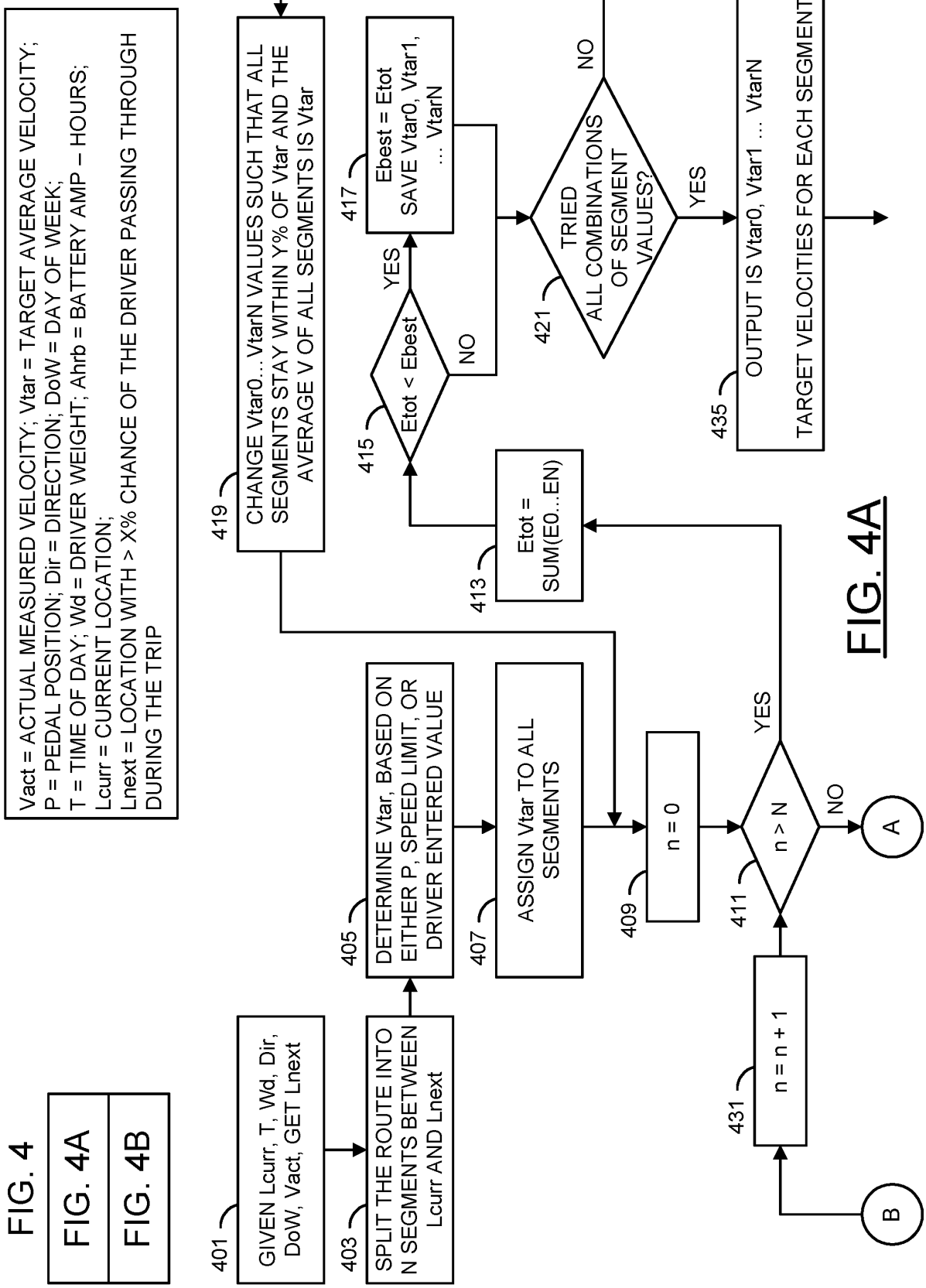


FIG. 4A

FIG. 4

FIG. 4A
FIG. 4B

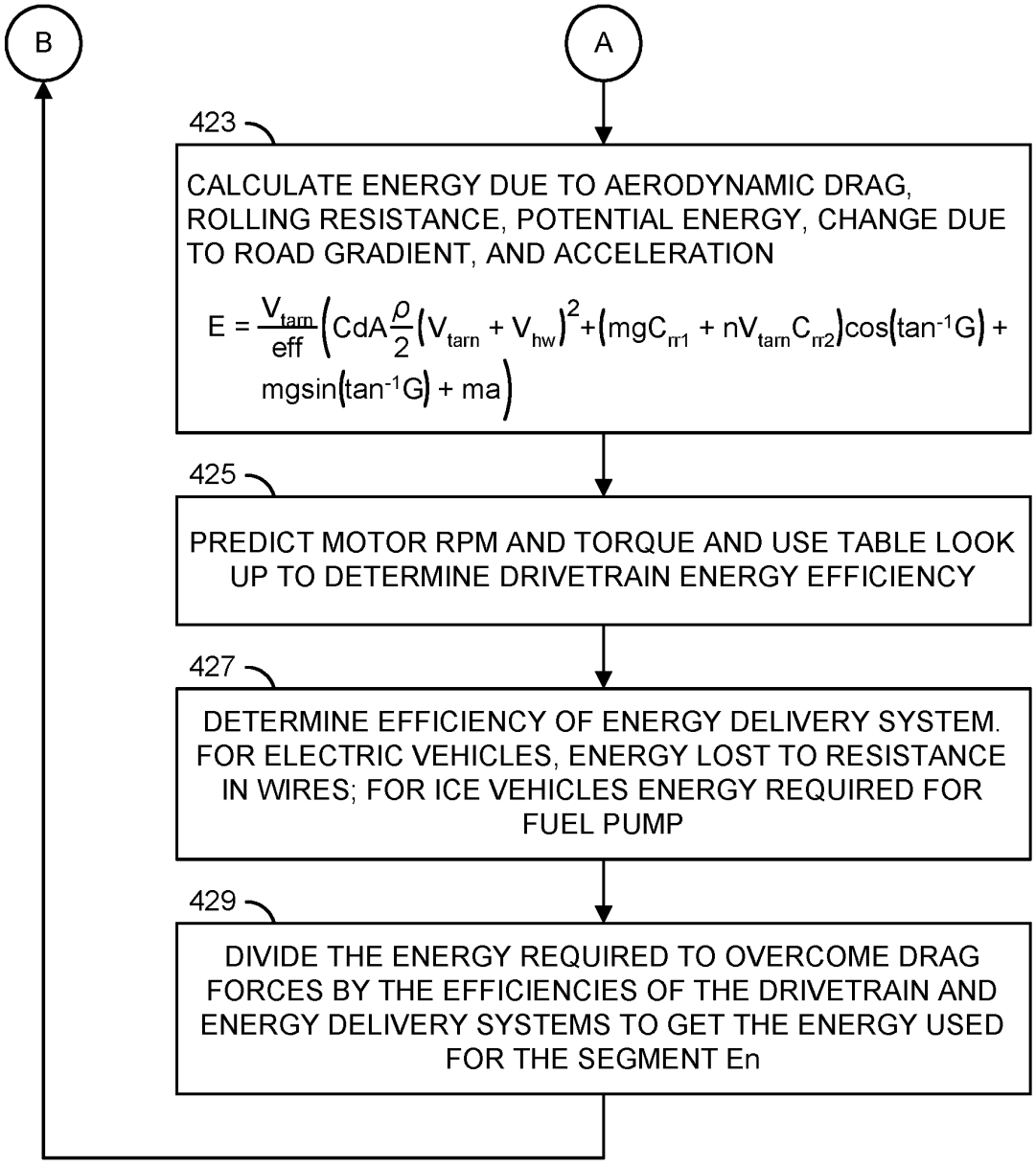

B
A
423
CALCULATE ENERGY DUE TO AERODYNAMIC DRAG, ROLLING RESISTANCE, POTENTIAL ENERGY, CHANGE DUE TO ROAD GRADIENT, AND ACCELERATION
$E = \frac{V_{tarn}}{eff}\left(CdA\frac{\rho}{2}\left(V_{tarn} + V_{hw}\right)^2 + \left(mgC_{rr1} + nV_{tarn}C_{rr2}\right)\cos\left(\tan^{-1}G\right) + mg\sin\left(\tan^{-1}G\right) + ma\right)$
425
PREDICT MOTOR RPM AND TORQUE AND USE TABLE LOOK UP TO DETERMINE DRIVETRAIN ENERGY EFFICIENCY
427
DETERMINE EFFICIENCY OF ENERGY DELIVERY SYSTEM. FOR ELECTRIC VEHICLES, ENERGY LOST TO RESISTANCE IN WIRES; FOR ICE VEHICLES ENERGY REQUIRED FOR FUEL PUMP
429
DIVIDE THE ENERGY REQUIRED TO OVERCOME DRAG FORCES BY THE EFFICIENCIES OF THE DRIVETRAIN AND ENERGY DELIVERY SYSTEMS TO GET THE ENERGY USED FOR THE SEGMENT En

FIG. 4B

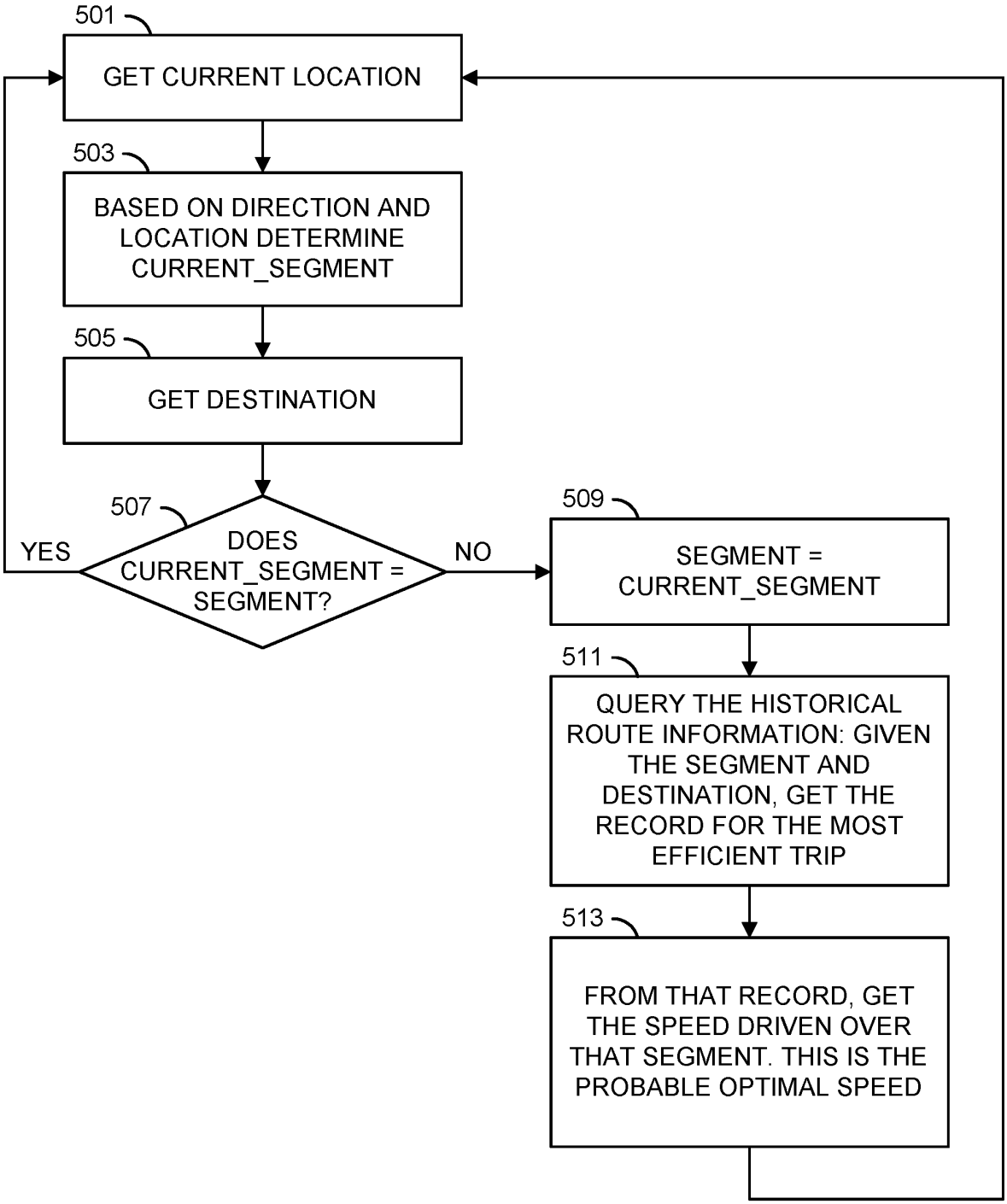

501
GET CURRENT LOCATION
503
BASED ON DIRECTION AND LOCATION DETERMINE CURRENT_SEGMENT
505
GET DESTINATION
507
DOES CURRENT_SEGMENT = SEGMENT?
YES
NO
509
SEGMENT = CURRENT_SEGMENT
511
QUERY THE HISTORICAL ROUTE INFORMATION: GIVEN THE SEGMENT AND DESTINATION, GET THE RECORD FOR THE MOST EFFICIENT TRIP
513
FROM THAT RECORD, GET THE SPEED DRIVEN OVER THAT SEGMENT. THIS IS THE PROBABLE OPTIMAL SPEED

FIG. 5

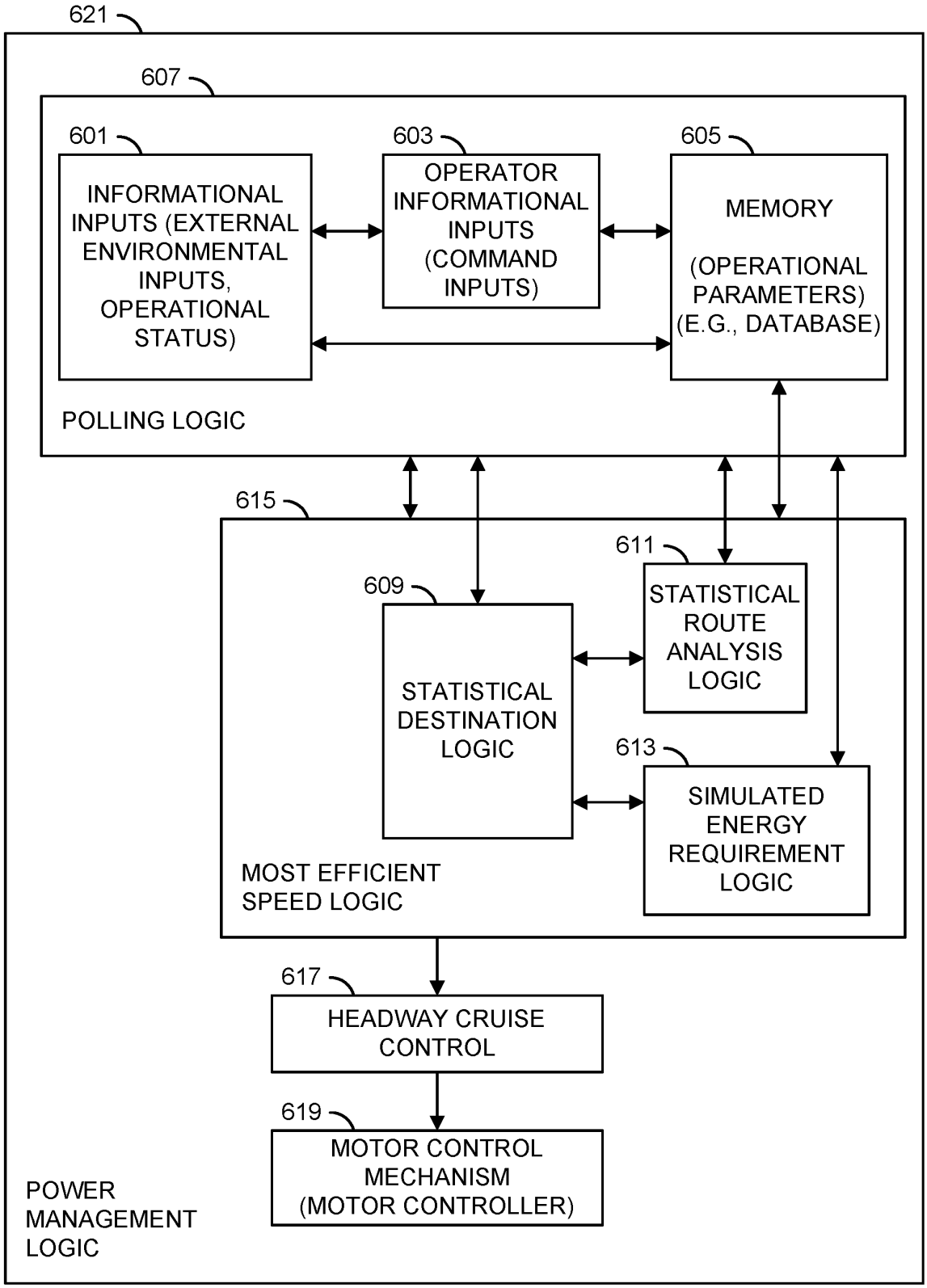

621
607
601
INFORMATIONAL INPUTS (EXTERNAL ENVIRONMENTAL INPUTS, OPERATIONAL STATUS)
603
OPERATOR INFORMATIONAL INPUTS (COMMAND INPUTS)
605
MEMORY
(OPERATIONAL PARAMETERS) (E.G., DATABASE)
POLLING LOGIC
615
611
609
STATISTICAL ROUTE ANALYSIS LOGIC
STATISTICAL DESTINATION LOGIC
613
SIMULATED ENERGY REQUIREMENT LOGIC
MOST EFFICIENT SPEED LOGIC
617
HEADWAY CRUISE CONTROL
619
MOTOR CONTROL MECHANISM (MOTOR CONTROLLER)
POWER MANAGEMENT LOGIC

FIG. 6

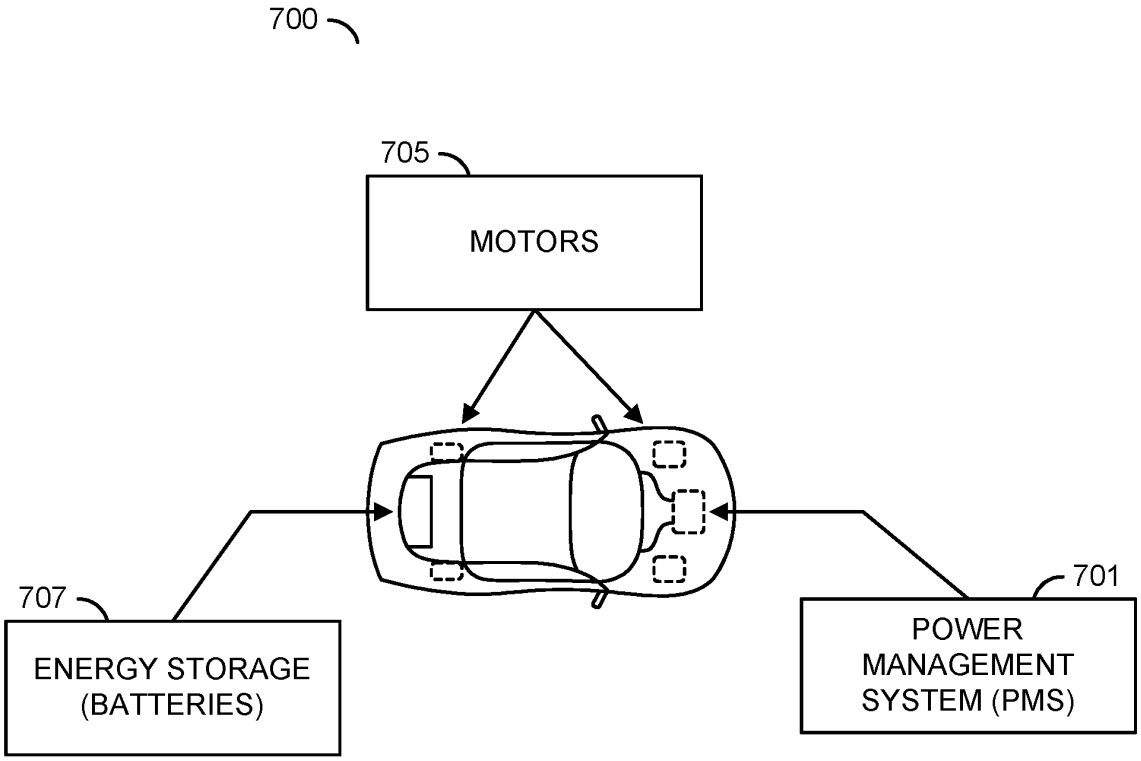

700
705
MOTORS
707
ENERGY STORAGE (BATTERIES)
701
POWER MANAGEMENT SYSTEM (PMS)

FIG. 7

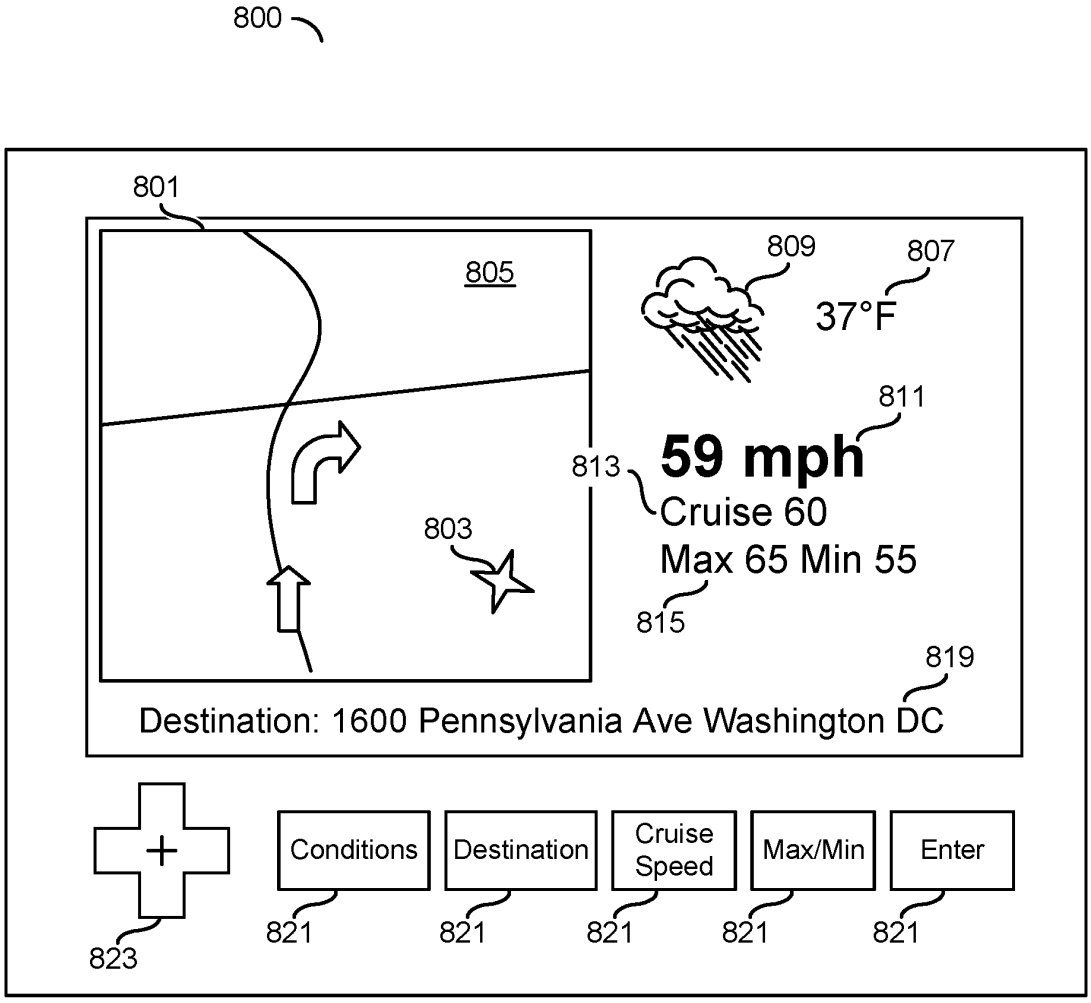

800
801
805
809
807
37°F
811
813
59 mph
Cruise 60
Max 65 Min 55
803
815
819
Destination: 1600 Pennsylvania Ave Washington DC
Conditions
Destination
Cruise Speed
Max/Min
Enter
821
821
821
821
821
823

FIG. 8

FIG. 9

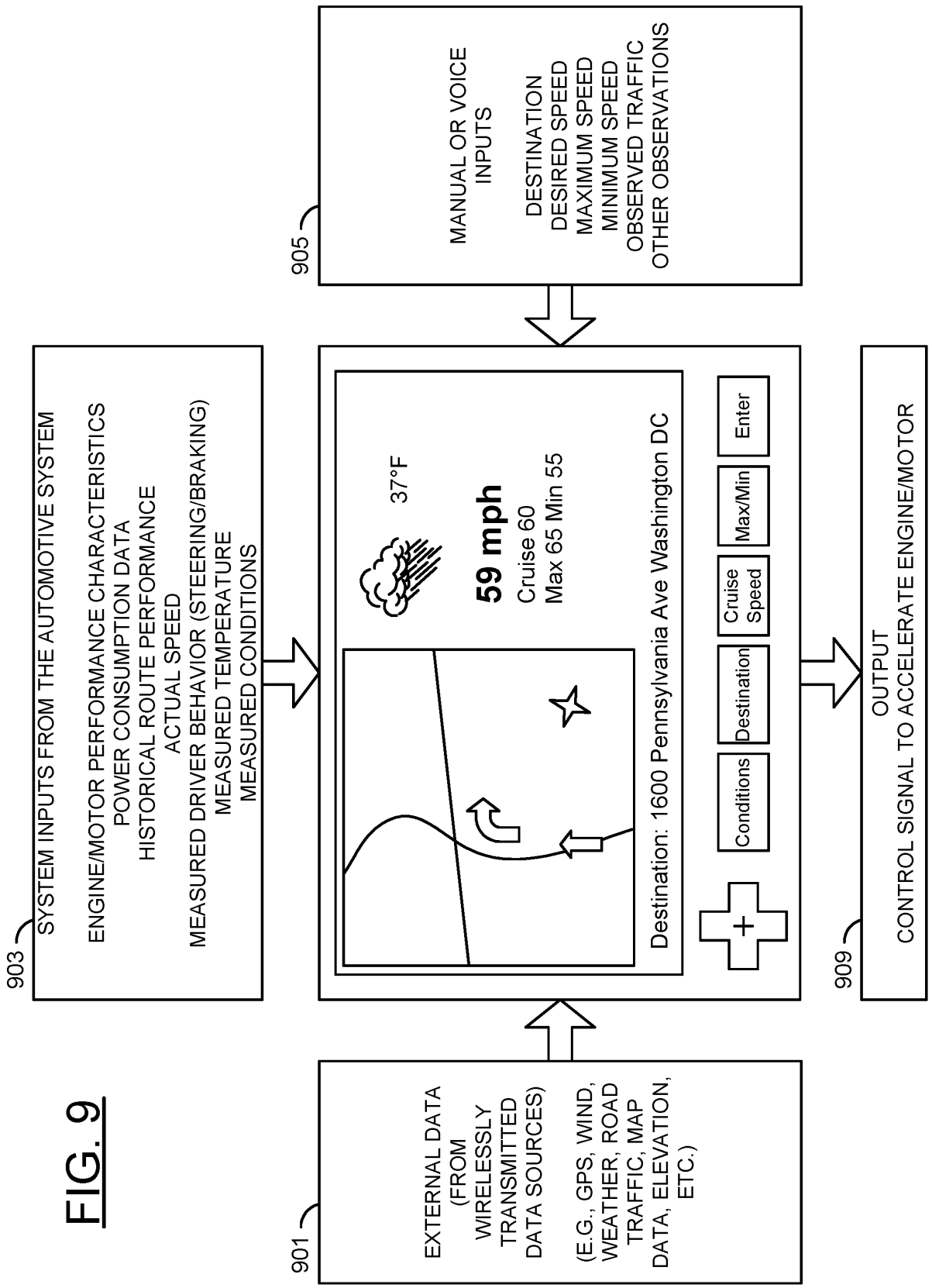

901
EXTERNAL DATA (FROM WIRELESSLY TRANSMITTED DATA SOURCES)
(E.G., GPS, WIND, WEATHER, ROAD TRAFFIC, MAP DATA, ELEVATION, ETC.)
903
SYSTEM INPUTS FROM THE AUTOMOTIVE SYSTEM
ENGINE/MOTOR PERFORMANCE CHARACTERISTICS
POWER CONSUMPTION DATA
HISTORICAL ROUTE PERFORMANCE
ACTUAL SPEED
MEASURED DRIVER BEHAVIOR (STEERING/BRAKING)
MEASURED TEMPERATURE
MEASURED CONDITIONS
905
MANUAL OR VOICE INPUTS
DESTINATION
DESIRED SPEED
MAXIMUM SPEED
MINIMUM SPEED
OBSERVED TRAFFIC
OTHER OBSERVATIONS
37°F
59 mph
Cruise 60
Max 65 Min 55
Destination: 1600 Pennsylvania Ave Washington DC
Conditions
Destination
Cruise Speed
Max/Min
Enter
909
OUTPUT
CONTROL SIGNAL TO ACCELERATE ENGINE/MOTOR

FIG. 10

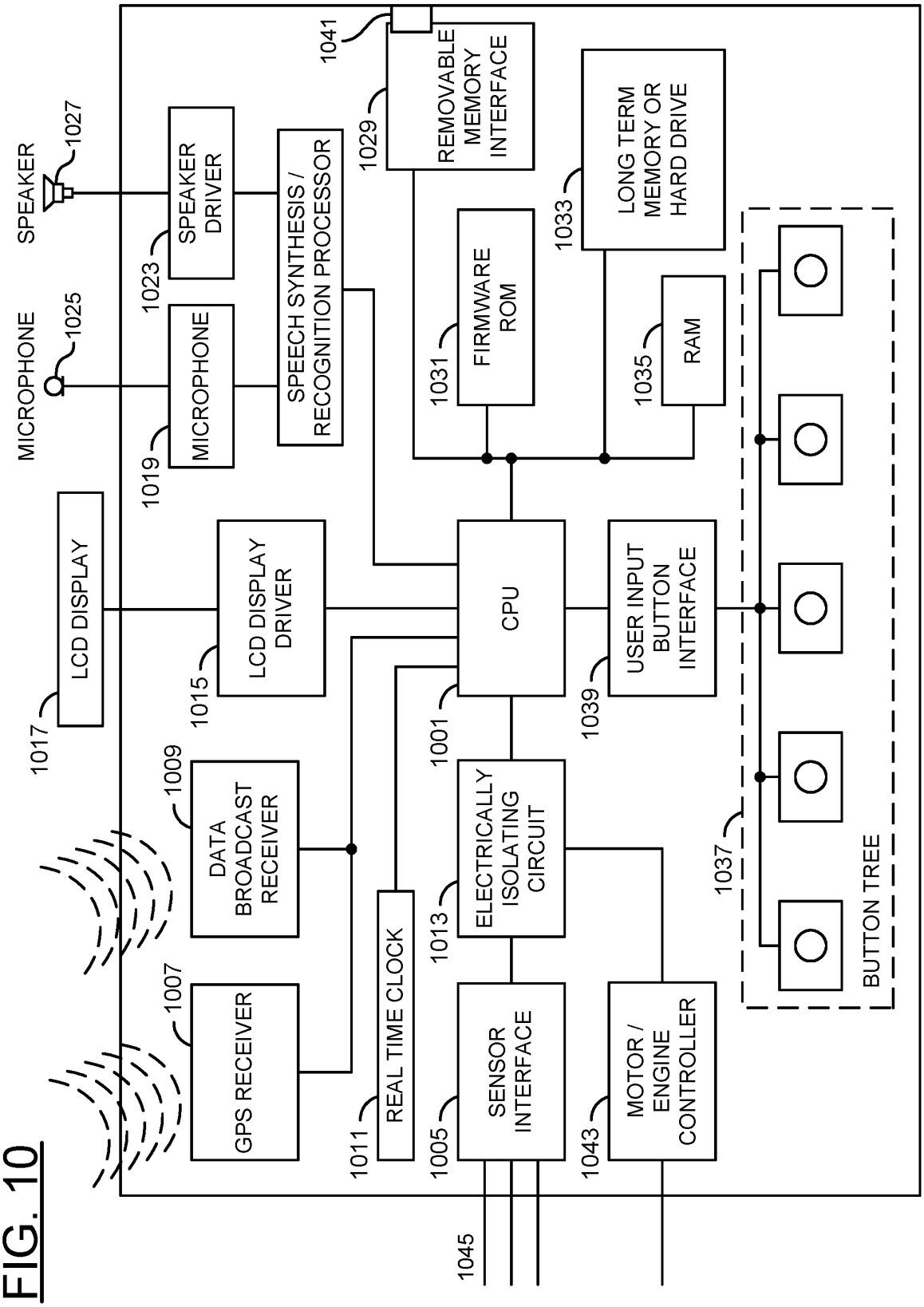
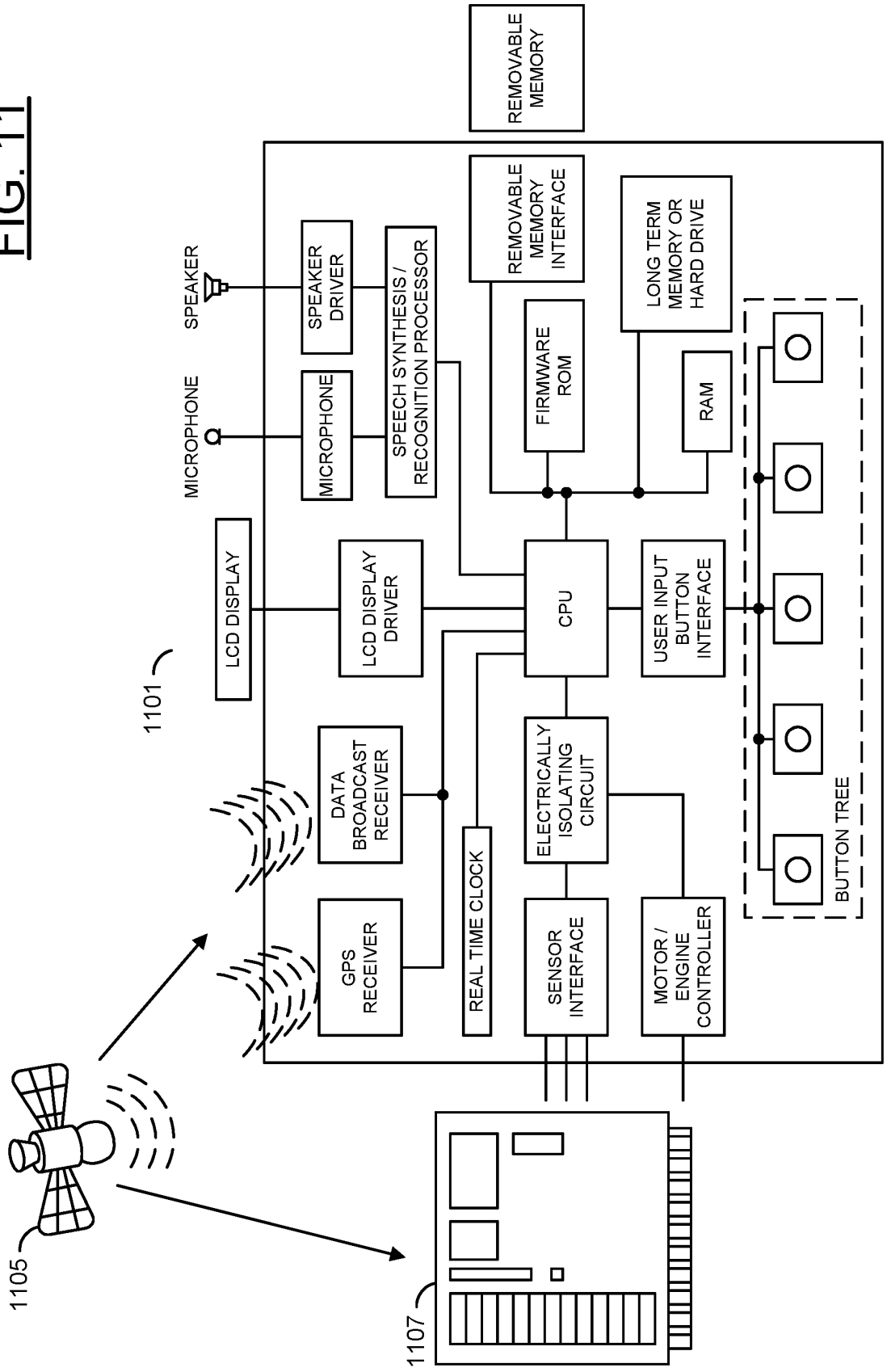

SPEAKER
1027
MICROPHONE
1025
1041
REMOVABLE MEMORY INTERFACE
1029
SPEAKER DRIVER
1023
SPEECH SYNTHESIS / RECOGNITION PROCESSOR
MICROPHONE
1019
LONG TERM MEMORY OR HARD DRIVE
1033
FIRMWARE ROM
1031
RAM
1035
LCD DISPLAY
1017
LCD DISPLAY DRIVER
1015
CPU
1001
USER INPUT BUTTON INTERFACE
1039
DATA BROADCAST RECEIVER
1009
GPS RECEIVER
1007
REAL TIME CLOCK
1011
ELECTRICALLY ISOLATING CIRCUIT
1013
SENSOR INTERFACE
1005
MOTOR / ENGINE CONTROLLER
1043
BUTTON TREE
1037
1045

FIG. 11


1105
1101
1107
SPEAKER
MICROPHONE
SPEAKER DRIVER
MICROPHONE
SPEECH SYNTHESIS / RECOGNITION PROCESSOR
REMOVABLE MEMORY
REMOVABLE MEMORY INTERFACE
LONG TERM MEMORY OR HARD DRIVE
FIRMWARE ROM
RAM
LCD DISPLAY
LCD DISPLAY DRIVER
CPU
USER INPUT BUTTON INTERFACE
BUTTON TREE
DATA BROADCAST RECEIVER
GPS RECEIVER
REAL TIME CLOCK
ELECTRICALLY ISOLATING CIRCUIT
SENSOR INTERFACE
MOTOR / ENGINE CONTROLLER

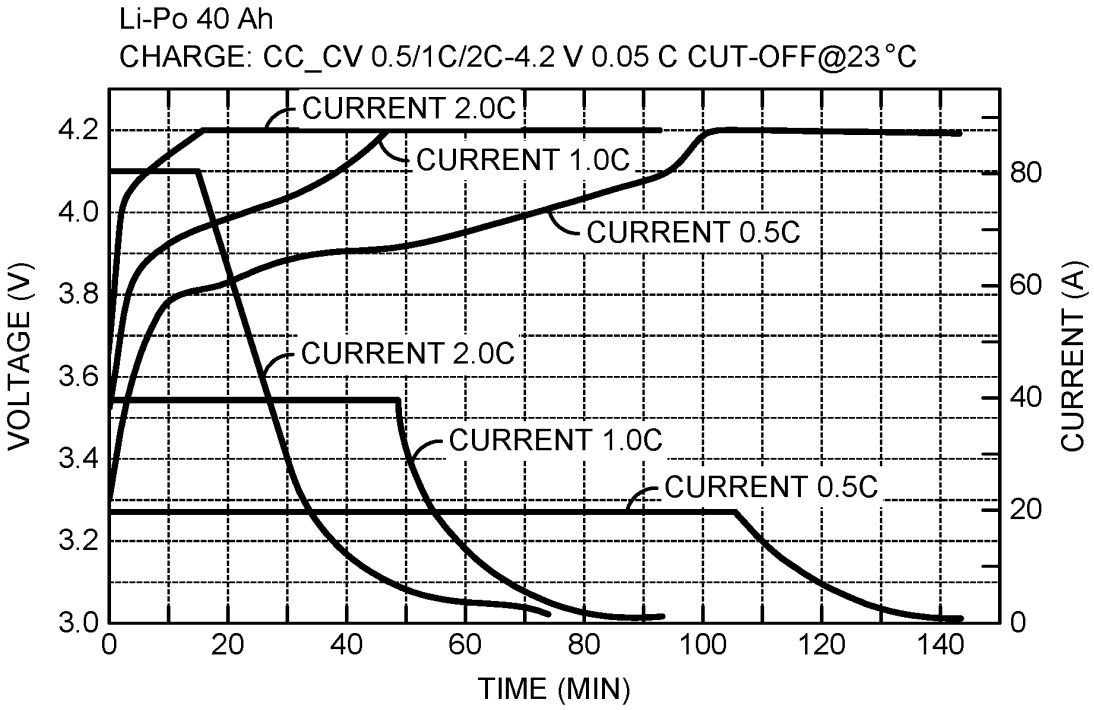


FIG. 12A

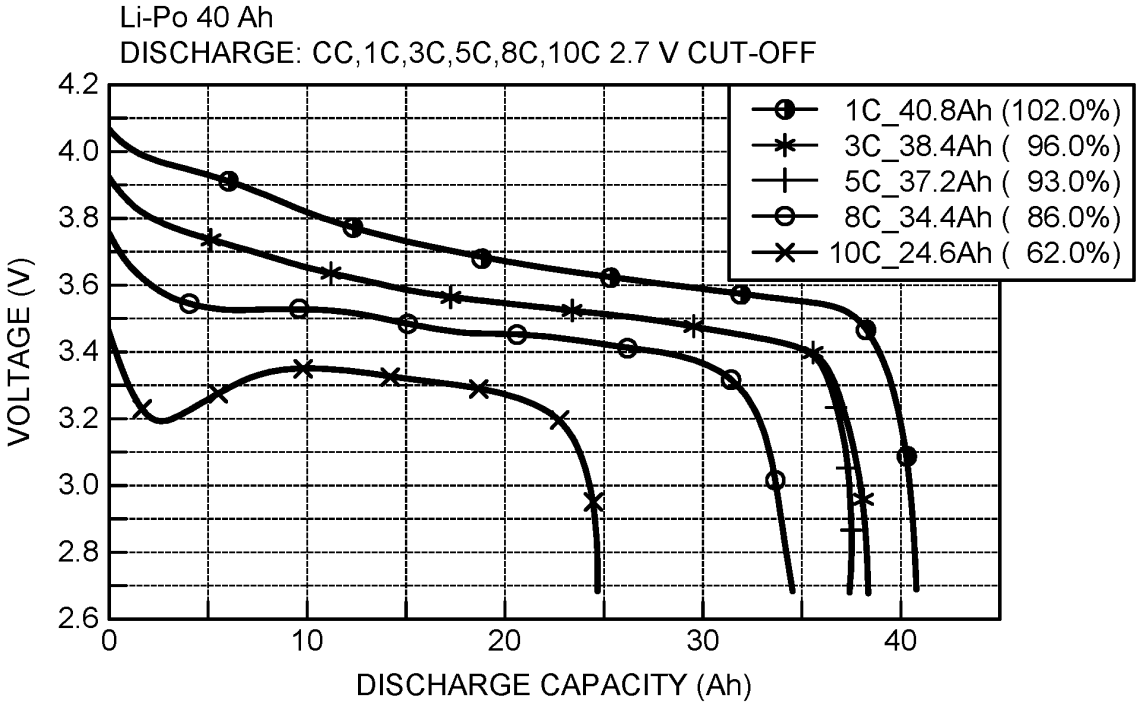


FIG. 12B

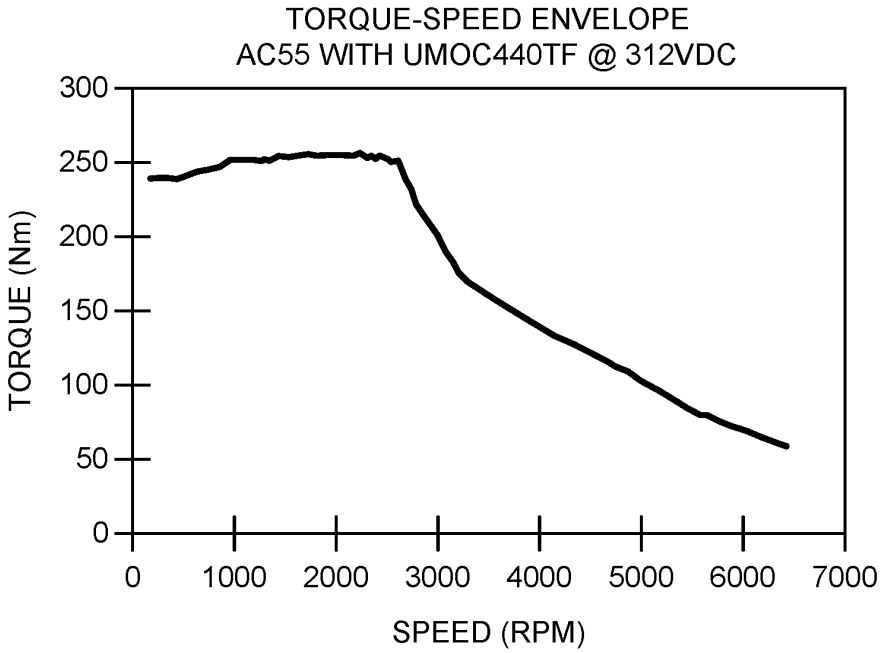


FIG. 13A

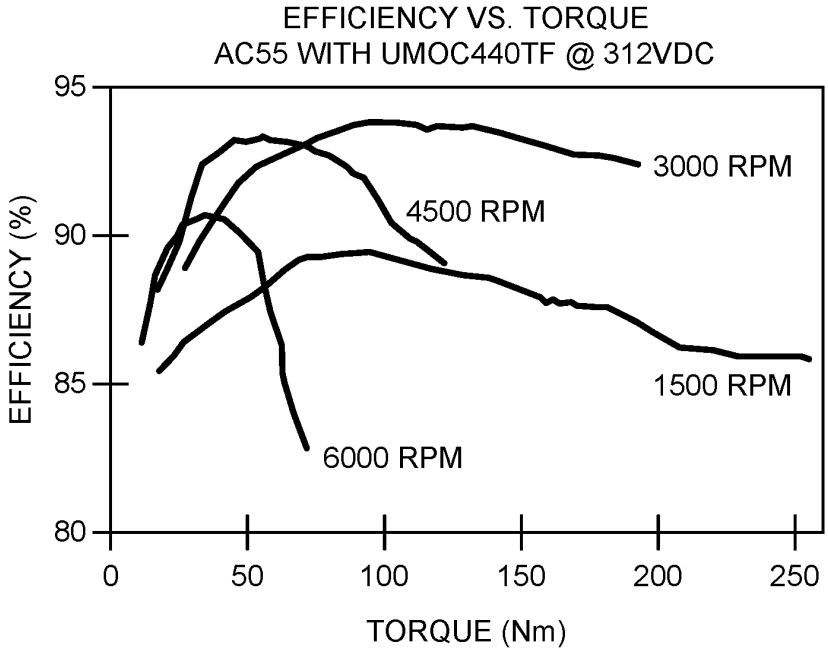


FIG. 13B