8557345

# THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

*January 03, 2025*

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**APPLICATION NUMBER:** ***14/253,371***
**FILING DATE:** ***April 15, 2014***
**PATENT NUMBER:** ***9123186***
**ISSUE DATE:** ***September 01, 2015***

Certified by

Acting Under Secretary of Commerce
for Intellectual Property
and Acting Director of the United States
Patent and Trademark Office

PTO/AIA/14 (12-13)
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| Application Data Sheet 37 CFR 1.76 | Attorney Docket Number | 6583-588 |
|---|---|---|
| | Application Number | |
| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | |

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

## 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.)

## Inventor Information:

**Inventor 1** Remove

**Legal Name**

| Prefix | Given Name | Middle Name | Family Name | Suffix |
|---|---|---|---|---|
| | Christopher | P. | Ricci | |

**Residence Information (Select One)** ◉ US Residency ○ Non US Residency ○ Active US Military Service

| City | Saratoga | State/Province | CA | Country of Residence i | US |
|---|---|---|---|---|---|

**Mailing Address of Inventor:**

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|---|---|---|---|
| Address 2 | | | |
| City | Saratoga | State/Province | CA |
| Postal Code | 95070 | Country i | US |

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

## Correspondence Information:

**Enter either Customer Number or complete the Correspondence Information section below.**
**For further information see 37 CFR 1.33(a).**

☐ **An Address is being provided for the correspondence Information of this application.**

| Customer Number | 111285 | | |
|---|---|---|---|
| Email Address | flexpatents@sheridanross.com | Add Email | Remove Email |

## Application Information:

| Title of the Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | | |
|---|---|---|---|
| Attorney Docket Number | 6583-588 | Small Entity Status Claimed | ☐ |
| Application Type | Nonprovisional | | |
| Subject Matter | Utility | | |
| Total Number of Drawing Sheets (if any) | 51 | Suggested Figure for Publication (if any) | |

## Filing By Reference :

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| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | |

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|---|---|---|
| | | |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

| Please Select One: | ◉ Customer Number | ○ US Patent Practitioner | ○ Limited Recognition (37 CFR 11.9) |
|---|---|---|---|
| Customer Number | 111285 | | |

## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the application number blank.

| Prior Application Status | Pending | | Remove |
|---|---|---|---|
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/811981 | 2013-04-15 |
| Prior Application Status | Pending | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/865954 | 2013-08-14 |
| Prior Application Status | Pending | | Remove |

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 6583-588 |
|---|---|---|
| | Application Number | |
| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | |

| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
|---|---|---|---|
| | Claims benefit of provisional | 61/870698 | 2013-08-27 |
| Prior Application Status | Pending | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/891217 | 2013-10-15 |
| Prior Application Status | Pending | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/904205 | 2013-11-14 |
| Prior Application Status | Pending | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/924572 | 2014-01-07 |
| Prior Application Status | Pending | | Remove |
| Application Number | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD) |
| | Claims benefit of provisional | 61/926749 | 2014-01-13 |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. | | | Add |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) [i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

| | | | Remove |
|---|---|---|---|
| Application Number | Country [i] | Filing Date (YYYY-MM-DD) | Access Code [i] (if applicable) |
| | | | |
| Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. | | | Add |

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## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) 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.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

## Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If 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 World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

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|---|---|---|
| | Application Number | |
| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | |

**Applicant 1** Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

| (●) Assignee | ( ) Legal Representative under 35 U.S.C. 117 | ( ) Joint Inventor |
|---|---|---|
| ( ) Person to whom the inventor is obligated to assign. | ( ) Person who shows sufficient proprietary interest | |

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. [X]

| Organization Name | Flextronics AP, LLC | | |
|---|---|---|---|
| **Mailing Address Information:** | | | |
| **Address 1** | 6201 America Center Drive | | |
| Address 2 | | | |
| **City** | San Jose | **State/Province** | CA |
| **Country** i | US | Postal Code | 95002 |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Applicant Data may be generated within this form by selecting the Add button. Add

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not subsitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

**Assignee 1**

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication . An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. [ ]

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| **Application Data Sheet 37 CFR 1.76** | Attorney Docket Number | 6583-588 |
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| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES | |

| Prefix | **Given Name** | Middle Name | **Family Name** | Suffix |
|---|---|---|---|---|
| | | | | |

**Mailing Address Information For Assignee including Non-Applicant Assignee:**

| | | | |
|---|---|---|---|
| **Address 1** | | | |
| Address 2 | | | |
| **City** | | **State/Province** | |
| **Country** i | | Postal Code | |
| Phone Number | | Fax Number | |
| Email Address | | | |

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

## Signature:

Remove

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

| **Signature** | /Douglas W. Swartz/ | | | Date (YYYY-MM-DD) | 2014-04-15 |
|---|---|---|---|---|---|
| First Name | Douglas W. | Last Name | Swartz | Registration Number | 37739 |

Additional Signature may be generated within this form by selecting the Add button. Add

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.**

# 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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

# REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES

## CROSS REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application claims the benefits of and priority, under 35 U.S.C. § 119(e), to U.S. Provisional Application Serial Nos. 61/811,981, filed on April 15, 2013, entitled "Functional Specification for a Next Generation Automobile"; 61/865,954, filed on August 14, 2013, entitled "Gesture Control of Vehicle Features"; 61/870,698, filed on August 27, 2013, entitled "Gesture Control and User Profiles Associated with Vehicle Features"; 61/891,217, filed on October 15, 2013, entitled "Gesture Control and User Profiles Associated with Vehicle Features"; 61/904,205, filed on November 14, 2013, entitled "Gesture Control and User Profiles Associated with Vehicle Features"; 61/924,572, filed on January 7, 2014, entitled "Gesture Control and User Profiles Associated with Vehicle Features"; and 61/926,749, filed on January 13, 2014, entitled "Method and System for Providing Infotainment in a Vehicle." The entire disclosures of the applications listed above are hereby incorporated by reference, in their entirety, for all that they teach and for all purposes.

**[0002]** This application is also related to U.S. Patent Application Nos. 13/420,236, filed on March 14, 2012, entitled, "Configurable Vehicle Console"; 13/420,240, filed on March 14, 2012, entitled "Removable, Configurable Vehicle Console"; 13/462,593, filed on May 2, 2012, entitled "Configurable Dash Display"; 13/462,596, filed on May 2, 2012, entitled "Configurable Heads-Up Dash Display"; 13/679,459, filed on November 16, 2012, entitled "Vehicle Comprising Multi-Operating System" (Attorney Docket No. 6583-228); 13/679,234, filed on November 16, 2012, entitled "Gesture Recognition for On-Board Display" (Attorney Docket No. 6583-229); 13/679,412, filed on November 16, 2012, entitled "Vehicle Application Store for Console" (Attorney Docket No. 6583-230); 13/679,857, filed on November 16, 2012, entitled "Sharing Applications/Media Between Car and Phone (Hydroid)" (Attorney Docket No. 6583-231); 13/679,878, filed on November 16, 2012, entitled "In-Cloud Connection for Car Multimedia" (Attorney Docket No. 6583-232); 13/679,875, filed on November 16, 2012, entitled "Music Streaming" (Attorney Docket No. 6583-233); 13/679,676, filed on November 16, 2012, entitled "Control of Device Features Based on Vehicle State" (Attorney Docket No. 6583-234); 13/678,673, filed on November 16, 2012, entitled "Insurance Tracking" (Attorney Docket No. 6583-235); 13/678,691, filed on November 16, 2012, entitled "Law Breaking/Behavior Sensor" (Attorney Docket No. 6583-236); 13/678,699, filed on

November 16, 2012, entitled "Etiquette Suggestion" (Attorney Docket No. 6583-237); 13/678,710, filed on November 16, 2012, entitled "Parking Space Finder Based on Parking Meter Data" (Attorney Docket No. 6583-238); 13/678,722, filed on November 16, 2012, entitled "Parking Meter Expired Alert" (Attorney Docket No. 6583-239); 13/678,726, filed on November 16, 2012, entitled "Object Sensing (Pedestrian Avoidance/Accident Avoidance)" (Attorney Docket No. 6583-240); 13/678,735, filed on November 16, 2012, entitled "Proximity Warning Relative to Other Cars" (Attorney Docket No. 6583-241); 13/678,745, filed on November 16, 2012, entitled "Street Side Sensors" (Attorney Docket No. 6583-242); 13/678,753, filed on November 16, 2012, entitled "Car Location" (Attorney Docket No. 6583-243); 13/679,441, filed on November 16, 2012, entitled "Universal Bus in the Car" (Attorney Docket No. 6583-244); 13/679,864, filed on November 16, 2012, entitled "Mobile Hot Spot/Router/Application Share Site or Network" (Attorney Docket No. 6583-245); 13/679,815, filed on November 16, 2012, entitled "Universal Console Chassis for the Car" (Attorney Docket No. 6583-246); 13/679,476, filed on November 16, 2012, entitled "Vehicle Middleware" (Attorney Docket No. 6583-247); 13/679,306, filed on November 16, 2012, entitled "Method and System for Vehicle Data Collection Regarding Traffic" (Attorney Docket No. 6583-248); 13/679,369, filed on November 16, 2012, entitled "Method and System for Vehicle Data Collection" (Attorney Docket No. 6583-249); 13/679,680, filed on November 16, 2012, entitled "Communications Based on Vehicle Diagnostics and Indications" (Attorney Docket No. 6583-250); 13/679,443, filed on November 16, 2012, entitled "Method and System for Maintaining and Reporting Vehicle Occupant Information" (Attorney Docket No. 6583-251); 13/678,762, filed on November 16, 2012, entitled "Behavioral Tracking and Vehicle Applications" (Attorney Docket No. 6583-252); 13/679,292, filed November 16, 2012, entitled "Branding of Electrically Propelled Vehicles Via the Generation of Specific Operating Output" (Attorney Docket No. 6583-258); 13/679,400, filed November 16, 2012, entitled "Vehicle Climate Control" (Attorney Docket No. 6583-313); 13/840,240, filed on March 15, 2013, entitled "Improvements to Controller Area Network Bus" (Attorney Docket No. 6583-314); 13/678,773, filed on November 16, 2012, entitled "Location Information Exchange Between Vehicle and Device" (Attorney Docket No. 6583-315); 13/679,887, filed on November 16, 2012, entitled "In Car Communication Between Devices" (Attorney Docket No. 6583-316); 13/679,842, filed on November 16, 2012, entitled "Configurable Hardware Unit for Car Systems" (Attorney Docket No. 6583-317); 13/679,204, filed on November 16, 2012, entitled "Feature Recognition for



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Configuring a Vehicle Console and Associated Devices" (Attorney Docket No. 6583-318); 13/679,350, filed on November 16, 2012, entitled "Configurable Vehicle Console" (Attorney Docket No. 6583-412); 13/679,358, filed on November 16, 2012, entitled "Configurable Dash Display" (Attorney Docket No. 6583-413); 13/679,363, filed on November 16, 2012, entitled "Configurable Heads-Up Dash Display" (Attorney Docket No. 6583-414); and 13/679,368, filed on November 16, 2012, entitled "Removable, Configurable Vehicle Console" (Attorney Docket No. 6583-415). The entire disclosures of the applications listed above are hereby incorporated by reference, in their entirety, for all that they teach and for all purposes.

## BACKGROUND

**[0003]** Whether using private, commercial, or public transport, the movement of people and/or cargo has become a major industry. In today's interconnected world, daily travel is essential to engaging in commerce. Commuting to and from work can account for a significant portion of a traveler's day. As a result, vehicle manufacturers have begun to focus on making this commute, and other journeys, more enjoyable.

**[0004]** Currently, vehicle manufacturers attempt to entice travelers to use a specific conveyance based on any number of features. Most of these features focus on vehicle safety or efficiency. From the addition of safety-restraints, air-bags, and warning systems to more efficient engines, motors, and designs, the vehicle industry has worked to appease the supposed needs of the traveler. Recently, however, vehicle manufactures have shifted their focus to user and passenger comfort as a primary concern. Making an individual more comfortable while traveling instills confidence and pleasure in using a given vehicle, increasing an individual's preference for a given manufacturer and/or vehicle type.

**[0005]** One way to instill comfort in a vehicle is to create an environment within the vehicle similar to that of an individual's home. Integrating features in a vehicle that are associated with comfort found in an individual's home can ease a traveler's transition from home to vehicle. Several manufacturers have added comfort features in vehicles such as the following: leather seats, adaptive and/or personal climate control systems, music and media players, ergonomic controls, and, in some cases, Internet connectivity. However, because these manufacturers have added features to a conveyance, they have built comfort around a vehicle and failed to build a vehicle around comfort.

## SUMMARY

**[0006]** There is a need for a vehicle ecosystem, which can integrate both physical and mental comforts, while seamlessly communicating with current electronic devices to result



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in a totally intuitive and immersive user experience. These and other needs are addressed by the various aspects, embodiments, and/or configurations of the present disclosure. Also, while the disclosure is presented in terms of exemplary and optional embodiments, it should be appreciated that individual aspects of the disclosure can be separately claimed.

**[0007]** A method can be provided by the present disclosure that includes the steps of:

**[0008]** providing, in a vehicle, first and second operating systems executing on a common microprocessor, wherein the first operating system comprises one or more applications performing a critical vehicle task, function, and/or operation and the second operating system comprises one or more applications performing an infotainment task, function, and/or operation;

**[0009]** collecting, by a computer control module, one or more metrics regarding an operation of the first and/or second operating system and/or computer and/or a network in communication with the computer;

**[0010]** determining, by the computer control module, whether the collected one or metrics are normal and/or abnormal; and

**[0011]** when the collected one or metrics is not normal or abnormal, shutting down the second operating system but not the first operating system.

**[0012]** In a vehicle, first and second operating systems can execute on a common microprocessor, the first operating system can comprise one or more applications performing a critical vehicle task, function, and/or operation and the second operating system can comprise one or more applications performing an infotainment task, function, and/or operation, and a tangible and non-transient computer readable medium in the vehicle can include microprocessor executable and readable instructions that, when executed by the microprocessor, can perform operations including:

**[0013]** collecting, by a computer control module, one or more metrics regarding an operation of the first and/or second operating system and/or a network in communication with the computer;

**[0014]** determining, by the computer control module, whether the collected one or metrics of one or more of the first and/or second operating system and/or a network in communication with the computer are normal and/or abnormal; and

**[0015]** applying one or more of the following rules:

**[0016]** when the collected one or metrics associated with the first operating system is not normal or abnormal, shutting down the first and second operating systems;

**[0017]** when the collected one or metrics associated with the second operating system is not normal or abnormal, shutting down the second, but not the first, operating system; and

**[0018]** when the collected one or metrics associated with the network is not normal or abnormal, shutting down the second, but not the first, operating system.

**[0019]** A vehicle can include:

**[0020]** a first computer having a first operating system executing one or more applications performing a critical vehicle task, function, and/or operation; and

**[0021]** a second computer having a different second operating system executing one or more applications performing at least one of an infotainment task, function, and/or operation and less critical task, function, and/or operation, wherein at least one of the following can be true:

**[0022]** (a) a computer control module collects one or more metrics regarding an operation of the first and/or second computers and/or a network in communication with the first and/or second computer, determines whether the collected one or metrics regarding an operation of the first and/or second computers and/or network are normal and/or abnormal, and apply one or more of the following rules:

**[0023]** when the collected one or metrics associated with the first operating system is not normal or abnormal, shutting down the first and second operating systems;

**[0024]** when the collected one or metrics associated with the second operating system is not normal or abnormal, shutting down the second, but not the first, operating system; and

**[0025]** when the collected one or metrics associated with the network is not normal or abnormal, shutting down the second, but not the first, operating system; and

**[0026]** (b) the first and second computers are configured to be incapable of communicating with each other.

**[0027]** Each member of the set of critical vehicle tasks, functions, and/or operations can be different from each member of the set of infotainment tasks, functions, and/or operations, whereby the union of the two sets is null.

**[0028]** The critical task, function or operation can be one or more of monitoring, controlling, and/or operating the ECU, TCU, door settings, window settings, and/or blind spot monitor, monitoring, controlling, and/or operating the safety equipment, monitoring and/or controlling certain critical sensors such as the power source controller and energy output sensor, engine temperature, oil pressure sensing, hydraulic pressure sensors, sensors for headlight and other lights, vehicle control system sensors, and/or steering/torque sensor, controlling the operation of the engine, head light control unit,

power steering, display panel, switch state control unit, power control unit, and/or brake control unit, and/or issuing alerts to a user and/or remote monitoring entity of potential problems with a vehicle operation.

**[0029]** The infotainment task, function or operation can be one or more of receiving, processing, and/or providing media and/or multimedia content.

**[0030]** The first operating system can be simulated by a first virtual machine and the second operating system by a second virtual machine and the computer control module can be in or configured as a hypervisor module.

**[0031]** The first and second operating systems can concurrently and independently run on a common kernel.

**[0032]** A first requirement applied to the first operating system to determine abnormal operation can be different from a second requirement applied to the second operating system to determine abnormal operation.

**[0033]** The present disclosure can include a method, vehicle, and/or tangible and non-transient computer readable medium comprising the steps, operations, and/or functions of:

**[0034]** (a) determining, by a microprocessor executable device discovery daemon, that a computational device is connected to or attempting to connect to a network and/or communication subsystem of a vehicle;

**[0035]** (b) in response, determining, by the device discovery daemon, whether the computational device is located within a predetermined area and/or zone of the vehicle; and

**[0036]** (c) applying, by the device discovery daemon, at least the following rules:

**[0037]** (C1) when the computational device is located within the predetermined area and/or zone of the vehicle, permitting the computational device to access or attempt to access the vehicle network and/or communication subsystem; and

**[0038]** (C2) when the computational device is not located within the predetermined area and/or zone of the vehicle, not permitting the computational device to access or attempt to access the vehicle network and/or communication subsystem.

**[0039]** A type of the computational device can determine a specific predetermined area and/or zone of the vehicle, from among a plurality of predetermined areas and/or zones, to be used in applying the rules.

**[0040]** The computational device can be one or more of a tablet computer, laptop, smart phone, and personal digital assistant.

**[0041]** The specific predetermined area and/or zone of the vehicle can be at least part of the passenger compartment.

**[0042]** The device discovery daemon can perform sub-steps of step (a) including:

**[0043]** receiving, by the device discovery daemon, information from an on board vehicle sensor that a new occupant has entered the vehicle;

**[0044]** in response to the receipt of the information, emitting, by the device discovery daemon, a ping to discover the computational device; and

**[0045]** when a responsive signal is received from the computational device, determining, by the device discovery daemon, that the computational device is attempting to connect to a network and/or communication subsystem of a vehicle.

**[0046]** The determining step/operation/function (b) can base the determination on whether the computational device is located within the predetermined area and/or zone of the vehicle on one or more of signal strength of a signal from the computational device as received by an access point of the vehicle, a received satellite-based position of the computational device, triangulation based on relative received signal strengths of a signal from the computational device as received by multiple access points of the vehicle, image processing of images of the predetermined area and/or zone, occupant presence and/or location information received by an on board vehicle sensor, whether the computational device is attempting to connect to the network and/or communication subsystem wirelessly or by hard wire connection, whether the computational device has moved relative to a selected access point during a defined time interval, whether the received signal strength of signaling from the computational device at a selected access point varies temporally, a type or service of the computational device, and input received from a user of the computational device.

**[0047]** When the computational device is determined to be located within the predetermined area and/or zone of the vehicle and is permitted to access or attempt to access the vehicle network and/or communication subsystem and wherein the device discovery daemon can determine a set of tasks, functions, and/or operations that can be performed and a set of tasks, functions, and/or operations that cannot be performed based on the determined location of the computational device.

**[0048]** The device discovery daemon can determine a level of confidence that the computational device is located within the predetermined area and/or zone and wherein the device discovery daemon determines that the computational device is located within

the predetermined area and/or zone when the level of confidence has at least a threshold value.

**[0049]** A method, vehicle, and/or computer executable instructions can be provided that perform at least the following steps, operations, and functions:

**[0050]** (a) determining, by a microprocessor executable media controller subsystem, that a user is driving a vehicle; and

**[0051]** (b) in response, the microprocessor executable media controller subsystem performing one or more of the following steps:

**[0052]** (i) removing a video channel but not an audio channel from media content to be displayed on a screen associated with the user;

**[0053]** (ii) applying screen magnification to content displayed on the screen associated with the user;

**[0054]** (iii) reconfiguring the screen and/or content to provide a large font and/or icon size for the displayed content compared to the displayed content when the user is not driving the vehicle;

**[0055]** (iv) removing unnecessary animations from the content to be displayed on the screen;

**[0056]** (v) removing background images from, while leaving at least one foreground image in, the content to be displayed on the screen;

**[0057]** (vi) compared to the displayed content when the user is not driving the vehicle, reconfiguring the screen and/or content to provide higher contrast to make the displayed content more visible to the user;

**[0058]** (vii) initiating a screen reader to audibly describe currently displayed content to the user;

**[0059]** (viii) compared to the period for notification dialog boxes to remain open on the screen when the user is not driving the vehicle, enabling a longer period for notification dialog boxes to remain open on the screen;

**[0060]** (ix) changing the color and/or transparency of window borders on the displayed content;

**[0061]** (x) changing the thickness of a focus rectangle around a currently selected object in a dialog box displayed on the screen;

**[0062]** (xi) changing the color, size and/or thickness of an on-screen mouse pointer displayed on the screen;

**[0063]** (xii) changing a keyboard setting of a keyboard displayed on the screen;

**[0064]** (xiii) formatting a web page, in the content to be displayed, differently from the web page format received from a web server;

**[0065]** (xiv) compared to the size of a mouse-selectable screen object when the user is not driving the vehicle, increasing a size of a mouse-selectable screen object to provide a larger target;

**[0066]** (xv) enabling mouse keys to move the mouse cursor on the screen;

**[0067]** (xvi) enabling one or more of sticky keys, toggle keys, and filter keys; and

**[0068]** (xvii) enabling the screen to receive input written by the user's finger as an inputted command or request.

**[0069]** The user can be determined to be driving the vehicle when the user is determined to be in a driver's seat of the vehicle.

**[0070]** The user can be determined to be driving the vehicle when the vehicle is at least one of in gear and in motion.

**[0071]** The method/vehicle/instructions can further perform the following steps, operations, and functions:

**[0072]** (c) determining, by the media controller subsystem, that the user is no longer driving the vehicle; and

**[0073]** (d) in response to step (c), the media controller subsystem performing one or more of the following steps:

**[0074]** (i) no longer removing a video channel from media content to be displayed;

**[0075]** (ii) no longer applying screen magnification to content to be displayed;

**[0076]** (iii) reconfiguring the display to provide a smaller font and/or icon size for the content to be displayed compared to the font and/or icon size used when the user is driving the vehicle;

**[0077]** (iv) no longer removing unnecessary animations from the content to be displayed;

**[0078]** (v) no longer removing background images from the content to be displayed;

**[0079]** (vi) reconfiguring the screen to provide lower contrast compared to the contrast used when the user is driving the vehicle;

**[0080]** (vii) disabling the screen reader;

**[0081]** (viii) compared to the period for notification dialog boxes to remain open on the screen when the user is driving the vehicle, enabling a shorter period for notification dialog boxes to remain open on the screen;

**[0082]** (ix) compared to the color and/or transparency of window borders on the displayed content when the user is driving the vehicle changing the color and/or transparency of window borders on the displayed content;

**[0083]** (x) compared to the thickness of a focus rectangle around a currently selected object in a dialog box displayed on the screen color and/or transparency of window borders on the displayed content when the user is driving the vehicle, changing the thickness of a focus rectangle around a currently selected object in a dialog box displayed on the screen;

**[0084]** (xi) compared to the color, size and/or thickness of an on-screen mouse pointer displayed on the screen when the user is driving the vehicle, changing the color, size and/or thickness of an on-screen mouse pointer displayed on the screen;

**[0085]** (xii) compared to the keyboard setting of a keyboard displayed on the screen when the user is driving the vehicle, changing a keyboard setting of a keyboard displayed on the screen;

**[0086]** (xiii) no longer formatting a web page, in the content to be displayed, differently from the web page format received from a web server;

**[0087]** (xiv) compared to the size of a mouse-selectable screen object when the user is driving the vehicle, decreasing a size of a mouse-selectable screen object to provide a larger target;

**[0088]** (xv) disabling mouse keys to move the mouse cursor on the screen;

**[0089]** (xvi) disabling the one or more of sticky keys, toggle keys, and filter keys; and

**[0090]** (xvii) disabling the screen to receive input written by the user's finger as an inputted command or request.

**[0091]** The user can be determined not to be driving the vehicle when the vehicle is at least one of not in gear, parked, and not in motion.

**[0092]** The user can be determined to be in a driver's seat of the vehicle when the user is located within a predetermined area and/or zone.

**[0093]** The determining step (a) can base the determination on whether the user is located within the predetermined area and/or zone of the vehicle on one or more of signal strength of a signal from a computational device associated with the user as received by an access point of the vehicle, a received satellite-based position of the computational device, triangulation based on relative received signal strengths of a signal from the computational device as received by multiple access points of the vehicle, image processing of images of

the predetermined area and/or zone, user presence and/or location information received by an on board vehicle sensor, and input received from a user of the computational device.

**[0094]** A media controller subsystem can include:

**[0095]** a microprocessor executable distributed network control server operable to access selected content on a public network external to a vehicle comprising the media controller subsystem, the distributed network control server having at least one of an assigned Internet Protocol address and global unicast address;

**[0096]** a microprocessor executable media server operable to receive requests for content from a vehicle occupant and provide requested content to a portable computational device associated with the vehicle occupant, the media server having a contactable electronic address on a local area network maintained by the vehicle;

**[0097]** a microprocessor readable memory to store content; and

**[0098]** a microprocessor executable virtual network console operable to provide the computational device with remote access to the media server.

**[0099]** The distributed network control server, media server, and virtual network console can be on a common media processing board mounted on the vehicle.

**[0100]** The portable computational device can be discrete from, remote from, and in wireless communication with the media processing board.

**[0101]** The virtual network console can operate in accordance with the Remote Frame Buffer protocol on top of the TCP/IP suite of protocols, thereby causing the remote computational device to appear to a computer mounted in the vehicle as if the remote computational device is part of the on board vehicle control system comprising the computer.

**[0102]** The vehicle occupant, through the remote computational device, can control one or more of the following media presentation features of a screen and sound system mounted on the vehicle: volume, contrast, resolution, and channel selection.

**[0103]** A method, vehicle, and instructions can perform at least the following steps, operations, and functions:

**[0104]** (a) determining, by a microprocessor executable media server, at least one of an identity of a vehicle occupant requesting media content, an identity of a portable computational device associated with the vehicle occupant, and a spatial location of the vehicle occupant and/or remote computational device;

**[0105]** (b) based on the at least one of the identity of the vehicle occupant requesting media content, the identity of a portable computational device associated with the vehicle

occupant, and the spatial location of the vehicle occupant and/or remote computational device, applying, by the microprocessor executable media server, at least one of a filter and restriction to the requested media content to form filtered and/or permitted media content to be provided to the portable computational device; and

**[0106]** (c) providing , by a microprocessor executable media server, the filtered and/or permitted media content to the portable computational device.

**[0107]** The portable computational device can be discrete from, remote from, and in wireless communication with the media processing board.

**[0108]** The filter and/or restriction can be applied to a media request of the vehicle occupant before and/or after the requested media content is accessed.

**[0109]** The filter and/or restriction can be one or more of an age-related content filter and/or restriction, a vehicle occupant seating location filter and/or restriction, and a privacy filter and/or restriction.

**[0110]** A method, vehicle, and tangible and non-transient computer readable medium can be provided to perform steps, operations, and functions, including:

**[0111]** (a) receiving a request from a vehicle occupant to perform a vehicle task, function and/or operation;

**[0112]** (b) determining that the vehicle occupant has been authenticated successfully;

**[0113]** (c) accessing an account for the vehicle occupant, the account defining rights and privileges of the user with respect to controlling a vehicle task, function and/or operation;

**[0114]** (d) determining at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle; and

**[0115]** (e) based upon the account corresponding to the vehicle occupant and the at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle, applying the following rules:

**[0116]** (i) when the account permits the vehicle occupant to perform the requested vehicle task, function and/or operation, performing or causing to be performed the vehicle task, function, and/or operation; and

**[0117]** (ii) when the account does not permit the vehicle occupant to perform the requested vehicle task, function and/or operation, not performing or causing to be performed the vehicle task, function, and/or operation.

**[0118]** In step, operation, or function (e), a microprocessor executable vehicle control system can apply the rules based on the account corresponding to the vehicle occupant and the area and/or zone occupied by the vehicle occupant. Then vehicle occupant can

perform a first set of vehicle tasks, functions and operations when in a first area and/or zone and a different set of vehicle tasks, functions, and operations when in a different second area and/or zone.

**[0119]** In step, operation, or function (e), the microprocessor executable vehicle control system can apply the rules based on the account corresponding to the vehicle occupant and the operating state of the vehicle. The vehicle occupant can perform a first set of vehicle tasks, functions and operations when the vehicle is in a first operating state and a different set of vehicle tasks, functions, and operations when the vehicle is in a second operating state.

**[0120]** When rule (i) applies, the vehicle occupant can control the requested vehicle task, function and/or operation using one or more of a cell phone, laptop, tablet computer, and personal digital assistant.

**[0121]** A different authentication procedure can be used for the vehicle occupant when requesting a first set of vehicle tasks, operations, and functions than when requesting a second set of vehicle tasks, operations, and functions.

**[0122]** The account can include rights and privileges for the vehicle occupant with respect to a vehicle task, function or operation, security and/or authentication requirements and/or credentials for the vehicle occupant, and personal settings of the vehicle occupant.

**[0123]** The personal settings of the vehicle occupant can include a plurality of a seat setting, climate control setting, lighting setting, configuration of an instrument cluster on a screen, rear view mirror setting, driving mode, media channel setting or preset, media delivery preference, music genre preference, scheduled program, playlist, synchronization with cloud-based data associated with the vehicle occupant, application-specific personalization and selections, and a display setting and configuration.

**[0124]** A method/vehicle/computer readable instructions can perform at least the following steps/operations/functions:

**[0125]** (a) detecting, by a microprocessor executable media controller subsystem, a change in state of a vehicle, a driver of the vehicle having a graphical user interface on board and/or in communication with a computer network controlled by computer on board the vehicle;

**[0126]** (b)_in response, reconfiguring, by the media controller subsystem, the graphical user interface by at least one of the following actions to reduce driver distraction and/or make content displayed by the graphical user interface more visible to the driver:



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**[0127]** apply screen magnification to at least part of the content displayed on the graphical user interface;

**[0128]** render at least part of the displayed content in a larger font and/or icon size;

**[0129]** initiate a screen reader to audibly provide and/or describe at least part of the displayed content to the driver;

**[0130]** initiate haptic feedback to provide and/or describe at least part of the displayed content to the driver;

**[0131]** disable unnecessary animation effects from at least a part of the displayed content;

**[0132]** remove a background image from while leaving a foreground image in at least part of the displayed content;

**[0133]** enable a longer period for notification dialog boxes to remain open in the displayed content;

**[0134]** enable a longer contact period of a digit of the driver to select a selectable object in the displayed content;

**[0135]** disable automatic arrangement of windows when a mouse cursor is moved to an edge of the displayed content;

**[0136]** enable activate a window in at least part of the displayed content by hovering over the window with a mouse cursor;

**[0137]** enable keyboard web page navigation in the displayed content;

**[0138]** enable a high contrast between text and a background color in at least part of the displayed content;

**[0139]** change a color and transparency of a border of a window in at least part of the displayed content;

**[0140]** change a thickness of a focus rectangle around a currently selected item in a dialog box in the displayed content;

**[0141]** change a color, size, and/or thickness of an on-screen mouse pointer in the displayed content;

**[0142]** change a keyboard setting displayed in the displayed content and/or in communication with the displayed content;

**[0143]** ignore a color, font style, font size, and/or format of a web page of the displayed content in accordance with a predetermined style sheet;

**[0144]** increase a size of a selectable object in at least part of the displayed content;

**[0145]** enable blind typing on the graphical user interface; and

**[0146]** remove one or more selectable objects from the displayed content.

**[0147]** A method/vehicle/computer readable instructions can perform at least the following steps/operations/functions:

**[0148]** (a) mapping, by a microprocessor executable media controller subsystem, a graphical user interface on board and/or in communication with a computer network controlled by computer on board the vehicle with a segmented control surface, whereby each segment corresponds to an item of content displayed on the graphical user interface;

**[0149]** (b) tracking, by a microprocessor executable media controller subsystem, a position of a body part of a user on the control surface relative to the control surface segments;

**[0150]** (c) determining, by a microprocessor executable media controller subsystem, that the body part of the user is located on a first segment; and

**[0151]** (d) in response, at least one of providing displayed content corresponding to the first segment and selecting a selectable object corresponding to the first segment.

**[0152]** The control surface can be electrically, magnetically, and electromagnetically nonresponsive to contact of the user's body part.

**[0153]** The control surface can be optically nonresponsive to contact of the user's body part.

**[0154]** The control surface can be part of an arm rest and/or dashboard and wherein the graphical user interface is virtual and not displayed to the user.

**[0155]** The control surface can be part of an arm rest and/or dashboard and wherein the graphical user interface is displayed to the user on a screen on board the vehicle.

**[0156]** A method/vehicle/computer readable instructions can perform at least the following steps/operations/functions:

**[0157]** (a) determining, by a vehicle control system, that a vehicle occupant has an impairment; and

**[0158]** (b) in response, altering a communication interface of the vehicle to accommodate the impairment.

**[0159]** The impairment can be one or more of a vision impairment, hearing impairment, dexterity impairment, mobility impairment, language impairment, and communication impairment.

**[0160]** The communication interface can be a screen on board the vehicle.

**[0161]** The location of the vehicle occupant and the screen corresponding to the determined occupant location can be determined.

**[0162]** The alteration can be one or more of:

**[0163]** apply screen magnification to at least part of the content displayed on the screen;

**[0164]** render at least part of the displayed content in a larger font and/or icon size;

**[0165]** initiate a screen reader to audibly provide and/or describe at least part of the displayed content to the occupant;

**[0166]** initiate haptic feedback to provide and/or describe at least part of the displayed content to the occupant;

**[0167]** disable unnecessary animation effects from at least a part of the displayed content;

**[0168]** remove a background image from while leaving a foreground image in at least part of the displayed content;

**[0169]** enable a longer period for notification dialog boxes to remain open in the displayed content;

**[0170]** enable a longer contact period of a digit of the occupant to select a selectable object in the displayed content;

**[0171]** disable automatic arrangement of windows when a mouse cursor is moved to an edge of the displayed content;

**[0172]** enable activate a window in at least part of the displayed content by hovering over the window with a mouse cursor;

**[0173]** enable keyboard web page navigation in the displayed content;

**[0174]** enable a high contrast between text and a background color in at least part of the displayed content;

**[0175]** change a color and transparency of a border of a window in at least part of the displayed content;

**[0176]** change a thickness of a focus rectangle around a currently selected item in a dialog box in the displayed content;

**[0177]** change a color, size, and/or thickness of an on-screen mouse pointer in the displayed content;

**[0178]** change a keyboard setting displayed in the displayed content and/or in communication with the displayed content;

**[0179]** ignore a color, font style, font size, and/or format of a web page of the displayed content in accordance with a predetermined style sheet;

**[0180]** increase a size of a selectable object in at least part of the displayed content;

**[0181]** enable blind typing on the graphical user interface;

**[0182]** enable text and/or a visual alternative to an audio channel associated with the displayed content;

**[0183]** increase a volume setting of the audio channel;

**[0184]** change a sound provided by the audio channel;

**[0185]** enable sign language interpretation;

**[0186]** enable a text phone application;

**[0187]** change a setting of a mouse associated with the displayed content; and

**[0188]** remove one or more selectable objects from the displayed content.

**[0189]** A method/vehicle/computer readable instructions can perform at least the following steps/operations/functions:

**[0190]** (a) sensing, by a vehicle control system, a sound from a source external to a vehicle;

**[0191]** (b) identifying, by the vehicle control system, a type and/or source of the sound;

**[0192]** (c) based on the identifying step, notifying a driver of the vehicle of the type and/or source of the sound.

**[0193]** The notification can be one or more of a visual notification, an audible notification, and a haptic notification.

**[0194]** The notification can be an audible notification.

**[0195]** The audible notification can be one or more of a portion of the frequency range of the received sound, a frequency shifted portion of the received sound, and a phase shifted portion of the sound.

**[0196]** A method/vehicle/computer readable instructions can perform at least the following step/operation/function:

**[0197]** altering, by a vehicle control system, an interface of a vehicle based on one or more of a user impairment, user medical condition, user age, user physical condition, user driving characteristic and driving history.

**[0198]** The interface can be one or more of a steering wheel, pedal, a graphical user interface, and a setting and/or configuration of an automated vehicle response system.

**[0199]** The automated vehicle response system can be a collision avoidance system.

**[0200]** A method/vehicle/computer readable instructions can perform at least the following step/operation/function:

**[0201]** maintaining a persona of a vehicle occupant; and

**[0202]** based on the persona of the vehicle occupant and vehicle-related information, perform an action assisting the vehicle occupant.

**[0203]** the vehicle-related information comprises at least one of a current and/or future vehicle location and path of vehicle travel.

**[0204]** The action performed can depend on a seating position of the vehicle occupant.

**[0205]** The persona can include one or more of bioinformatics, medical information, driving history, personal information, private information, travel information, and Internet browsing history and/or browsed content.

**[0206]** The vehicle related information can include one or more of vehicle context, state, external surroundings, location, past, current, and/or intended path of travel, waypoint, and destination.

**[0207]** The action can be one or more of making an appointment, making a reservation, purchasing an item on line, adding a waypoint or destination to path of travel on a navigation system of the vehicle, adding an entry into the occupant's electronic calendar, changing a destination or path of travel on the navigation system, warning the occupant, notifying the occupant, and sending a message to a person at a waypoint or destination of the vehicle regarding an arrival time.

**[0208]** The steps/ functions/operations can determine relevant information other than the persona of the vehicle occupant and the vehicle-related information.

**[0209]** The relevant information can include one or more of a persona of a selected person not currently in the vehicle, a message from a friend or family member of the vehicle occupant, a current activity of the friend and/or family member, a location, hours of operation, and/or descriptive information about a point and/or location of interest near the vehicle and/or the vehicle's path of travel, a location, hours of operation, and/or descriptive information about a vehicle service facility near the vehicle and/or the vehicle's path of travel, a location, hours of operation, and/or descriptive information about a hotel and/or motel near the vehicle and/or the vehicle's path of travel, a current location of the friend or family member near the vehicle and/or the vehicle's path of travel, and a road condition along a path of travel of the vehicle.

**[0210]** The vehicle can obtain the persona from one or more of a different vehicle driven by the occupant and a home computer.

**[0211]** The vehicle can synchronize with the different vehicle and/or home computer when the vehicle is parked in proximity thereto and an ignition of the vehicle is turned off.

**[0212]** The maintaining of the persona can include collecting information from one or more vehicle sensors and/or from a remote information source.

**[0213]** A type of information collected can depend on a seating position of the occupant.

**[0214]** The type of information collected can depend on one or more of an identity of the occupant, an age of the occupant, and an association of the occupant with the vehicle.

**[0215]** The persona can be defined in a format (e.g., grammar, syntax, and/or semantics) that can be processed by vehicles of different manufacturers.

**[0216]** A vehicle backplane assembly can include at least the following components:

**[0217]** A plurality of blade processors in a vehicle that includes a first set of blade processors installed prior to vehicle sale and not modifiable and/or replaceable by the vehicle owner and a second set of blade processors installable after vehicle sale and is modifiable and/or replaceable by the vehicle owner. Each blade processor includes a microprocessor, a memory, and a network interface and each of the blade processors performing a different set of functions.

**[0218]** The restricted access by the customer to the first set of blade processors can be done through restrictions on software rights and privileges (e.g., read only rights and privileges to machine code with no right or privilege to modify same) and physical access to the first set of blade processors (e.g., through a locked housing containing one or more components of the blade processors).

**[0219]** The assembly can include a third set of blade processors that interfaces with the first and second set of blade processors to provide input to and/or receive output from a corresponding one of the first and second blade processors.

**[0220]** A satellite receiving system can be a member of the third set of blade processors and a navigation system a member of one of the first and second set of blade processors.

**[0221]** Each of the first and second sets of blade processors can include a corresponding Universal Serial Bus ("USB") hub, the USB hub comprising a plurality of ports to permit devices to connect to the USB hub.

**[0222]** The first set of blades can include a master blade processor operable to inventory hardware and/or software in communication with the backplane assembly, assign blade processors to applications attempting to execute, and/or determine a health state of a selected the blade processor.

**[0223]** A vehicle can include a plurality of blade processors, each blade processor performing a function that is at least one of a vehicle task, function, or operation and an infotainment task, function, or operation.

**[0224]** The blade processors can have a backplane.

**[0225]** The backplane can have a first communication zone defining a trusted network within the vehicle to connect with trusted computational devices and/or module provided

or certified by the vehicle manufacturer but not untrusted computational devices and/or modules provided by vehicle occupants. Whether or not a computational device and/or module is certified by a manufacturer can be determined using known license check procedures, such as a unique identifier, a unique credential (e.g., password or encrypted or unencrypted key), and the like. When the check is completed satisfactorily (e.g., the unique identifier or a unique credential (e.g., password or encrypted or unencrypted key) provided by the device and/or module matches a stored identifier in the memory of the vehicle control system (or master blade processor)), the computational device and/or module is deemed to be certified by the manufacturer. When the check is not completed satisfactorily, the computational device and/or module is not deemed to be certified by the manufacturer.

**[0226]** The backplane can have a second communication zone defining an untrusted network to connect with the untrusted computational devices.

**[0227]** The backplane can have a third communication zone providing power and data transmission to the plurality of blade processors.

**[0228]** The first and second communication zones can be connected logically on opposing sides of a firewall blade processor.

**[0229]** A master blade processor can enable a connection to a computational device connected to the first communication zone upon verification that the connected computational device is certified by a vehicle manufacturer.

**[0230]** The first and second communication zones can be configured as separate Ethernet switches. The first and second communication zones are typically not in signal communication with one another.

**[0231]** A firewall can have a dedicated slot that bridges the first and second communication zones and uses the third communication zone for power connections.

**[0232]** An output of each of the plurality of blade processors can be an IP message framed into an Ethernet packet.

**[0233]** A sensor and/or controller of the vehicle can communicate by a Car Area Network ("CAN") protocol. An Ethernet bus controller can terminate a CAN bus to the sensor and/or controller and a CAN Ethernet controller subsystem can translate an Ethernet message from a blade processor to a CAN protocol-based message.

**[0234]** The plurality of blade processors can be configured as a crate having the backplane connector and on-backplane Ethernet interfaces enabling the blade processors to communicate with one another using Ethernet messages.

**[0235]** A vehicle can include a plurality of blade processors, each blade processor performing a function that is at least one of a vehicle task, function, or operation and an infotainment task, function, or operation. The plurality of blade processors can include a master blade processor operable to assign a component and/or module requiring a blade processor for execution to a selected blade processor.

**[0236]** The master blade processor can inventory hardware and software capabilities of components and/or modules in communication with the master blade processor to provide an application resource table comprising component and/or module identity, functional description, and/or computational resource requirements and/or capabilities needed for execution of the component and/or module.

**[0237]** A blade processor can be assigned to execute the component and/or module when the blade processor satisfies the corresponding computational resource requirements and/or capabilities.

**[0238]** The master blade processor can assign a network address to each blade processor and communication device in communication with the master blade processor.

**[0239]** The master blade processor can assign a component and/or module to a selected blade processor when the selected blade processor is available or, though unavailable, is executing a component and/or module having a lower priority than the component and/or module to be assigned to the selected blade processor.

**[0240]** The present disclosure can provide a number of advantages depending on the particular aspect, embodiment, and/or configuration. For example, operating multiple operating systems on a common on board computer platform for vehicle control and infotainment tasks, functions and operations can provide a high level of vehicle security and block successfully intrusive attacks. The network security configurations can enable both infotainment and critical vehicle tasks, functions, and operations to performed automatically and concurrently in a vehicle without increasing driver danger from computer-targeted attacks by an outside source. Using a common computer to run safely both the first and second operating systems can not only reduce vehicle manufacturing costs but also provide a simpler computational architecture. The device discovery daemon, by locating the portable device seeking access to the vehicle network, can not only provide higher levels of security from intrusive attacks via a computational device external to the vehicle but also protect the privacy and resources of the vehicle network. The application of accessibility technologies to the driver's screen can successfully reduce driver distractions while enabling the driver to perform permissible computational tasks.



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The availability of accessibility technologies in the vehicle can not only comply with prevailing legal requirements but also enhance passenger enjoyment. The use of network control and media servers and virtual network console functionality on a common processing board can provide a simple yet effective way to stream media to devices within the vehicle network. The use of media filters and restrictions based on one or more of the identity of the vehicle occupant requesting media content, the identity of a portable computational device associated with the vehicle occupant, and the spatial location of the vehicle occupant and/or remote computational device can enable compliance with prevailing laws regarding driver distractions while providing the vehicle owner with the ability to control media access by one or more selected vehicle occupants. The use of user accounts to control passenger access to vehicle tasks, functions, and operations can prevent a non-driving passenger, for instance, from controlling a critical vehicle task, function or operation and confusing or frustrating the driver. The inactive control surface can enable a vehicle occupant to perform tasks, functions and operations without viewing his or her screen. This provides yet another convenient method for driver control of vehicle and non-vehicle tasks, functions, and operations without distraction while driving the vehicle. The blade processor architecture can take advantage of the pervasiveness of TCP/IP and the large volume of components and/or modules made for IP-based distributed systems, such as the Ethernet. The architecture can be a modular distributed system that can be upgraded and/or extended over time, without changing the basic processing architecture. Because the various subsystems can communicate with one another by protocol-based messages, there is not requirement that all software be written in any specific language or execute on any specific operating system. This can allow developers to use the most appropriate run time environment for the subsystem being developed. For instance, when a real time operating system ("RTOS") is required because of the timing constraints of the run time environment (i.e., real time control of a function), a subsystem can be developed using RTOS, without constraining the runtime environment of less demanding systems (e.g., a console subsystem).

**[0241]** These and other advantages will be apparent from the disclosure.

**[0242]** The phrases "at least one," "one or more," and "and/or" are open-ended expressions that are both conjunctive and disjunctive in operation. For example, each of the expressions "at least one of A, B and C," "at least one of A, B, or C," "one or more of A, B, and C," "one or more of A, B, or C" and "A, B, and/or C" means A alone, B alone, C alone, A and B together, A and C together, B and C together, or A, B and C together.



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**[0243]** The term "a" or "an" entity refers to one or more of that entity. As such, the terms "a" (or "an"), "one or more," and "at least one" can be used interchangeably herein. It is also to be noted that the terms "comprising," "including," and "having" can be used interchangeably.

**[0244]** "Accessible technology" refers to any computer technology that users can adjust and/or employ to accommodate his or her vision, dexterity, hearing, cognitive, language, learning, and/or speech needs. Accessibility technology can be in the form of accessibility features or settings built into software programs and specialty hardware devices or software programs.

**[0245]** "Assistive technology" refers to any technology that users can adjust and/or employ to accommodate his or her vision, dexterity, hearing, cognitive, language, learning, and/or speech needs. Examples of assistive technology include accessible technology, adjuncts, peripherals, plug-ins, and add-ins.

**[0246]** The term "disability" refers to the consequence of an impairment that may be physical, cognitive, intellectual, mental, sensory, emotional, developmental, or some combination of these. By way of illustration, Section 503 defines "disability" as an impairment that substantially limits a major life activity, even if it were not to limit any other major life activity, or an impairment that is episodically active or in remission and would substantially limit a major life activity when active.

**[0247]** The term "automatic" and variations thereof, as used herein, refer to any process or operation done without material human input when the process or operation is performed. However, a process or operation can be automatic, even though performance of the process or operation uses material or immaterial human input, if the input is received before the performance of the process or operation. Human input is deemed to be material if such input influences how the process or operation will be performed. Human input that consents to the performance of the process or operation is not deemed to be "material."

**[0248]** The term "automotive navigation system" can refer to a satellite navigation system designed for use in vehicles. It typically uses a GPS navigation device to acquire position data to locate the user on a road in the unit's map database. Using the road database, the unit can give directions to other locations along roads also in its database. Dead reckoning using distance data from sensors attached to the drivetrain, a gyroscope and an accelerometer can be used for greater reliability, as GPS signal loss and/or multipath can occur due to urban canyons or tunnels.

**[0249]** The term "bus" and variations thereof, as used herein, can refer to a subsystem that transfers information and/or data between various components. A bus generally refers to the collection communication hardware interface, interconnects, bus architecture, standard, and/or protocol defining the communication scheme for a communication system and/or communication network. A bus may also refer to a part of a communication hardware that interfaces the communication hardware with the interconnects that connect to other components of the corresponding communication network. The bus may be for a wired network, such as a physical bus, or wireless network, such as part of an antenna or hardware that couples the communication hardware with the antenna. A bus architecture supports a defined format in which information and/or data is arranged when sent and received through a communication network. A protocol may define the format and rules of communication of a bus architecture.

**[0250]** The terms "communication device," "smartphone," and "mobile device," and variations thereof, as used herein, can be used interchangeably and may include any type of device capable of communicating with one or more of another device and/or across a communications network, via a communications protocol, and the like. Exemplary communication devices may include but are not limited to smartphones, handheld computers, laptops, netbooks, notebook computers, subnotebooks, tablet computers, scanners, portable gaming devices, phones, pagers, GPS modules, portable music players, and other Internet-enabled and/or network-connected devices.

**[0251]** A "communication modality" can refer to any protocol- or standard defined or specific communication session or interaction, such as Voice-Over-Internet-Protocol ("VoIP), cellular communications (e.g., IS-95, 1G, 2G, 3G, 3.5G, 4G, 4G/IMT-Advanced standards, 3GPP, WIMAX™, GSM, CDMA, CDMA2000, EDGE, 1xEVDO, iDEN, GPRS, HSPDA, TDMA, UMA, UMTS, ITU-R, and 5G), Bluetooth™, text or instant messaging (e.g., AIM, Blauk, eBuddy, Gadu-Gadu, IBM Lotus Sametime, ICQ, iMessage, IMVU, Lync, MXit, Paltalk, Skype, Tencent QQ, Windows Live Messenger™ or MSN Messenger™, Wireclub, Xfire, and Yahoo! Messenger™), email, Twitter (e.g., tweeting), Digital Service Protocol (DSP), and the like.

**[0252]** The term "communication system" or "communication network" and variations thereof, as used herein, can refer to a collection of communication components capable of one or more of transmission, relay, interconnect, control, or otherwise manipulate information or data from at least one transmitter to at least one receiver. As such, the communication may include a range of systems supporting point-to-point or broadcasting

of the information or data. A communication system may refer to the collection individual communication hardware as well as the interconnects associated with and connecting the individual communication hardware. Communication hardware may refer to dedicated communication hardware or may refer a processor coupled with a communication means (i.e., an antenna) and running software capable of using the communication means to send and/or receive a signal within the communication system. Interconnect refers some type of wired or wireless communication link that connects various components, such as communication hardware, within a communication system. A communication network may refer to a specific setup of a communication system with the collection of individual communication hardware and interconnects having some definable network topography. A communication network may include wired and/or wireless network having a pre-set to an ad hoc network structure.

**[0253]** The term "computer-readable medium," as used herein refers to any tangible storage and/or transmission medium that participates in providing instructions to a processor for execution. Such a medium may take many forms, including but not limited to, non-volatile media, volatile media, and transmission media. Non-volatile media includes, for example, non-volatile random access memory (NVRAM), or magnetic or optical disks. Volatile media includes dynamic memory, such as main memory. Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, or any other magnetic medium, magneto-optical medium, a compact disc read only memory (CD-ROM), any other optical medium, punch cards, paper tape, any other physical medium with patterns of holes, a random access memory (RAM), a programmable read only memory (PROM), and erasable programmable read only memory EPROM, a FLASH-EPROM, a solid state medium like a memory card, any other memory chip or cartridge, a carrier wave as described hereinafter, or any other medium from which a computer can read. A digital file attachment to an e-mail or other self-contained information archive or set of archives is considered a distribution medium equivalent to a tangible storage medium. When the computer-readable media is configured as a database, it is to be understood that the database may be any type of database, such as relational, hierarchical, object-oriented, and/or the like. Accordingly, the disclosure is considered to include a tangible storage medium or distribution medium and prior art-recognized equivalents and successor media, in which the software implementations of the present disclosure are stored. It should be noted that any computer readable medium that is not a signal transmission may be considered non-transitory.

**[0254]** The terms dash and dashboard and variations thereof, as used herein, may be used interchangeably and can be any panel and/or area of a vehicle disposed adjacent to an operator, user, and/or passenger. Dashboards may include, but are not limited to, one or more control panel(s), instrument housing(s), head unit(s), indicator(s), gauge(s), meter(s), light(s), audio equipment, computer(s), screen(s), display(s), HUD unit(s), and graphical user interface(s).

**[0255]** The term "module" as used herein refers to any known or later developed hardware, software, firmware, artificial intelligence, fuzzy logic, or combination of hardware and software that is capable of performing the functionality associated with that element.

**[0256]** The term "desktop" refers to a metaphor used to portray systems. A desktop is generally considered a "surface" that may include pictures, called icons, widgets, folders, etc. that can activate and/or show applications, windows, cabinets, files, folders, documents, and other graphical items. The icons are generally selectable to initiate a task through user interface interaction to allow a user to execute applications and/or conduct other operations.

**[0257]** The term "display" refers to a portion of a physical screen used to display the output of a computer to a user.

**[0258]** The term "displayed image" refers to an image produced on the display. A typical displayed image is a window or desktop. The displayed image may occupy all or a portion of the display.

**[0259]** The term "display orientation" refers to the way in which a rectangular display is oriented for viewing. The two most common types of display orientations are portrait and landscape. In landscape mode, the display is oriented such that the width of the display is greater than the height of the display (such as a 4:3 ratio, which is 4 units wide and 3 units tall, or a 16:9 ratio, which is 16 units wide and 9 units tall). Stated differently, the longer dimension of the display is oriented substantially horizontal in landscape mode while the shorter dimension of the display is oriented substantially vertical. In the portrait mode, by contrast, the display is oriented such that the width of the display is less than the height of the display. Stated differently, the shorter dimension of the display is oriented substantially horizontal in the portrait mode while the longer dimension of the display is oriented substantially vertical. A multi-screen display can have one composite display that encompasses all the screens. The composite display can have different display characteristics based on the various orientations of the device.

**[0260]** The term "electronic address" can refer to any contactable address, including a telephone number, instant message handle, e-mail address, Uniform Resource Locator ("URL"), Global Universal Identifier ("GUID"), Universal Resource Identifier ("URI"), Address of Record ("AOR"), electronic alias in a database, etc., combinations thereof.

**[0261]** The term "gesture" refers to a user action that expresses an intended idea, action, meaning, result, and/or outcome. The user action can include manipulating a device (e.g., opening or closing a device, changing a device orientation, moving a trackball or wheel, etc.), movement of a body part in relation to the device, movement of an implement or tool in relation to the device, audio inputs, etc. A gesture may be made on a device (such as on the screen) or with the device to interact with the device.

**[0262]** The term "gesture capture" refers to a sense or otherwise a detection of an instance and/or type of user gesture. The gesture capture can be received by sensors in three-dimensional space. Further, the gesture capture can occur in one or more areas of a screen, for example, on a touch-sensitive display or a gesture capture region. A gesture region can be on the display, where it may be referred to as a touch sensitive display, or off the display, where it may be referred to as a gesture capture area.

**[0263]** The terms "infotainment" and "infotainment system" may be used interchangeably and can refer to the hardware/software products, data, content, information, and/or systems, which can be built into or added to vehicles to enhance driver and/or passenger experience. Infotainment may provide media and/or multimedia content. An example is information-based media content or programming that also includes entertainment content.

**[0264]** A "multi-screen application" refers to an application that is capable of producing one or more windows that may simultaneously occupy one or more screens. A multi-screen application commonly can operate in single-screen mode in which one or more windows of the application are displayed only on one screen or in multi-screen mode in which one or more windows are displayed simultaneously on multiple screens.

**[0265]** A "single-screen application" refers to an application that is capable of producing one or more windows that may occupy only a single screen at a time.

**[0266]** The terms "online community," "e-community," or "virtual community" can mean a group of people that interact via a computer network, for social, professional, educational, and/or other purposes. The interaction can use a variety of media formats, including wikis, blogs, chat rooms, Internet forums, instant messaging, email, and other forms of electronic media. Many media formats may be used in social software separately

and/or in combination, including text-based chat rooms and forums that use voice, video text or avatars.

**[0267]** The term "satellite positioning system receiver" can refer to a wireless receiver or transceiver to receive and/or send location signals from and/or to a satellite positioning system (SPS), such as the Global Positioning System ("GPS") (US), GLONASS (Russia), Galileo positioning system (EU), Compass navigation system (China), and Regional Navigational Satellite System (India).

**[0268]** The term "social network service" may include a service provider that builds online communities of people, who share interests and/or activities, or who are interested in exploring the interests and/or activities of others. Social network services can be network-based and may provide a variety of ways for users to interact, such as e-mail and instant messaging services.

**[0269]** The term "social network" can refer to a network-based social network.

**[0270]** The term "screen," "touch screen," "touchscreen," or "touch-sensitive display" refers to a physical structure that enables the user to interact with the computer by touching areas on the screen and provides information to a user through a display. The touch screen may sense user contact in a number of different ways, such as by a change in an electrical parameter (e.g., resistance or capacitance), acoustic wave variations, infrared radiation proximity detection, light variation detection, and the like. In a resistive touch screen, for example, normally separated conductive and resistive metallic layers in the screen pass an electrical current. When a user touches the screen, the two layers make contact in the contacted location, whereby a change in electrical field is noted and the coordinates of the contacted location calculated. In a capacitive touch screen, a capacitive layer stores electrical charge, which is discharged to the user upon contact with the touch screen, causing a decrease in the charge of the capacitive layer. The decrease is measured, and the contacted location coordinates determined. In a surface acoustic wave touch screen, an acoustic wave is transmitted through the screen, and the acoustic wave is disturbed by user contact. A receiving transducer detects the user contact instance and determines the contacted location coordinates.

**[0271]** The term "window" refers to a, typically rectangular, displayed image on at least part of a display that contains or provides content different from the rest of the screen. The window may obscure the desktop. The dimensions and orientation of the window may be configurable either by another module or by a user. When the window is

expanded, the window can occupy substantially all of the display space on a screen or screens.

**[0272]** The terms "determine," "calculate," and "compute," and variations thereof, as used herein, are used interchangeably and include any type of methodology, process, mathematical operation, or technique.

**[0273]** It shall be understood that the term "means," as used herein, shall be given its broadest possible interpretation in accordance with 35 U.S.C., Section 112, Paragraph 6 or other applicable law. Accordingly, a claim incorporating the term "means" shall cover all structures, materials, or acts set forth herein, and all of the equivalents thereof. Further, the structures, materials or acts and the equivalents thereof shall include all those described in the summary of the invention, brief description of the drawings, detailed description, abstract, and claims themselves.

**[0274]** The terms "vehicle," "car," "automobile," and variations thereof may be used interchangeably herein and can refer to a device or structure for transporting animate and/or inanimate or tangible objects (e.g., persons and/or things), such as a self-propelled conveyance. A vehicle as used herein can include any conveyance or model of a conveyance, where the conveyance was originally designed for the purpose of moving one or more tangible objects, such as people, animals, cargo, and the like. The term "vehicle" does not require that a conveyance moves or is capable of movement. Typical vehicles may include but are in no way limited to cars, trucks, motorcycles, busses, automobiles, trains, railed conveyances, boats, ships, marine conveyances, submarine conveyances, airplanes, space craft, flying machines, human-powered conveyances, and the like.

**[0275]** The term "profile," as used herein, can refer to any data structure, data store, and/or database that includes one or more items of information associated with a vehicle, a vehicle system, a device (e.g., a mobile device, laptop, mobile phone, etc.), or a person.

**[0276]** The term "in communication with," as used herein, refers to any coupling, connection, or interaction using electrical signals to exchange information or data, using any system, hardware, software, protocol, or format, regardless of whether the exchange occurs wirelessly or over a wired connection.

**[0277]** The preceding is a simplified summary of the disclosure to provide an understanding of some aspects of the disclosure. This summary is neither an extensive nor exhaustive overview of the disclosure and its various aspects, embodiments, and/or configurations. It is intended neither to identify key or critical elements of the disclosure nor to delineate the scope of the disclosure but to present selected concepts of the

disclosure in a simplified form as an introduction to the more detailed description presented below. As will be appreciated, other aspects, embodiments, and/or configurations of the disclosure are possible utilizing, alone or in combination, one or more of the features set forth above or described in detail below.

**[0278]** BRIEF DESCRIPTION OF THE DRAWINGS

**[0279]** Fig. 1 depicts an embodiment of a vehicle operating environment;

**[0280]** Fig. 2 is a block diagram of an embodiment of a vehicle system;

**[0281]** Fig. 3 is a block diagram of an embodiment of a vehicle control system environment;

**[0282]** Fig. 4 is a block diagram of an embodiment of a vehicle communications subsystem;

**[0283]** Fig. 5A is a first block diagram of an embodiment of a vehicle interior environment separated into areas and/or zones;

**[0284]** Fig. 5B is a second block diagram of an embodiment of a vehicle interior environment separated into areas and/or zones;

**[0285]** Fig. 5C is a third block diagram of an embodiment of a vehicle interior environment separated into areas and/or zones;

**[0286]** Fig. 6A depicts an embodiment of a sensor configuration for a vehicle;

**[0287]** Fig. 6B depicts an embodiment of a sensor configuration for a zone of a vehicle;

**[0288]** Fig. 7A is a block diagram of an embodiment of interior sensors for a vehicle;

**[0289]** Fig. 7B is a block diagram of an embodiment of exterior sensors for a vehicle;

**[0290]** Fig. 8A is a block diagram of an embodiment of a media subsystem for a vehicle;

**[0291]** Fig. 8B is a block diagram of an embodiment of a user and device interaction subsystem for a vehicle;

**[0292]** Fig. 8C is a block diagram of an embodiment of a Navigation subsystem for a vehicle;

**[0293]** Fig. 9 is a block diagram of an embodiment of a communications subsystem for a vehicle;

**[0294]** Fig. 10 is a block diagram of an embodiment of a software architecture for the vehicle control system;

**[0295]** Fig. 11A is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0296]** Fig. 11B is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0297]** Fig. 11C is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0298]** Fig. 11D is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0299]** Fig. 11E is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0300]** Fig. 11F is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0301]** Fig. 11G is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0302]** Fig. 11H is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0303]** Fig. 11I is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0304]** Fig. 11J is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0305]** Fig. 11K is a graphical representation of an embodiment of a gesture that a user may perform to provide input to a vehicle control system;

**[0306]** Fig. 12A is a diagram of an embodiment of a data structure for storing information about a user of a vehicle;

**[0307]** Fig. 12B is a diagram of an embodiment of a data structure for storing information about a device associated with or in a vehicle;

**[0308]** Fig. 12C is a diagram of an embodiment of a data structure for storing information about a system of a vehicle;

**[0309]** Fig. 12D is a diagram of an embodiment of a data structure for storing information about a vehicle;

**[0310]** Fig. 13 is a flow or process diagram of a method for storing one or more settings associated with a user;

**[0311]** Fig. 14 is a flow or process diagram of a method for establishing one or more settings associated with a user;

**[0312]** Fig. 15 is a flow or process diagram of a method for storing one or more settings associated with a user;

**[0313]** Fig. 16 is a flow or process diagram of a method for storing one or more gestures associated with a user;

**[0314]** Fig. 17 is a flow or process diagram of a method for reacting to a gesture performed by a user;

**[0315]** Fig. 18 is a flow or process diagram of a method for storing health data associated with a user;

**[0316]** Fig. 19 is a flow or process diagram of a method for reacting to a gesture performed by a user;

**[0317]** Fig. 20 depicts a flow diagram according to an embodiment;

**[0318]** Fig. 21 depicts an on board media system according to an embodiment;

**[0319]** Fig. 22 depicts a flow diagram according to an embodiment;

**[0320]** Fig. 23 depicts a flow diagram according to an embodiment;

**[0321]** Fig. 24 depicts a computational system according to an embodiment;

**[0322]** Fig. 25 depicts a computational system according to an embodiment;

**[0323]** Fig. 26 depicts a flow diagram according to an embodiment;

**[0324]** Fig. 27 depicts a flow diagram according to an embodiment;

**[0325]** Fig. 28 depicts a screen shot according to an embodiment; and

**[0326]** Fig. 29 depicts a screen shot according to an embodiment;

**[0327]** Fig. 30 depicts a screen shot according to an embodiment;

**[0328]** Fig. 31 depicts a flow diagram according to an embodiment;

**[0329]** Fig. 32 depicts a flow diagram according to an embodiment;

**[0330]** Fig. 33 depicts a segmented control surface according to an embodiment;

**[0331]** Fig. 34 depicts a mapped display according to an embodiment;

**[0332]** Fig. 35 depicts a flow diagram according to an embodiment;

**[0333]** Fig. 36 depicts a flow diagram according to an embodiment;

**[0334]** Figs. 37A-B depict a flow diagram according to an embodiment;

**[0335]** Fig. 38 depicts a flow diagram according to an embodiment; and

**[0336]** Fig. 39 depicts a flow diagram according to an embodiment.

**[0337]** In the appended figures, similar components and/or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label by a letter that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference letter or label.

**[0338]** DETAILED DESCRIPTION

**[0339]** Presented herein are embodiments of systems, devices, processes, data structures, user interfaces, etc. The embodiments may relate to an automobile and/or an automobile environment. The automobile environment can include systems associated with the automobile and devices or other systems in communication with the automobile and/or automobile systems. Furthermore, the systems can relate to communications systems and/or devices and may be capable of communicating with other devices and/or to an individual or group of individuals. Further, the systems can receive user input in unique ways. The overall design and functionality of the systems provide for an enhanced user experience making the automobile more useful and more efficient. As described herein, the automobile systems may be electrical, mechanical, electro-mechanical, software-based, and/or combinations thereof.

**[0340]** A vehicle environment 100 that may contain a vehicle ecosystem is shown in Fig. 1. The vehicle environment 100 can contain areas associated with a vehicle or conveyance 104. The vehicle 104 is shown as a car but can be any type of conveyance. The environment 100 can include at least three zones. A first zone 108 may be inside a vehicle 104. The zone 108 includes any interior space, trunk space, engine compartment, or other associated space within or associated with the vehicle 104. The interior zone 108 can be defined by one or more techniques, for example, geo-fencing.

**[0341]** A second zone 112 may be delineated by line 120. The zone 112 is created by a range of one or more sensors associated with the vehicle 104. Thus, the area 112 is exemplary of the range of those sensors and what can be detected by those sensors associated with the vehicle 104. Although sensor range is shown as a fixed and continuous oval, the sensor range may be dynamic and/or discontinuous. For example, a ranging sensor (e.g., radar, lidar, ladar, etc.) may provide a variable range depending on output power, signal characteristics, or environmental conditions (e.g., rain, fog, clear, etc.). The rest of the environment includes all space beyond the range of the sensors and is represented by space 116. Thus, the environment 100 may have an area 116 that includes all areas beyond the sensor range 112. The area 116 may include locations of travel that the vehicle 104 may proceed to in the future.

**[0342]** An embodiment of a vehicle system 200 is shown in Fig. 2. The vehicle system 200 may comprise hardware and/or software that conduct various operations for or with the vehicle 104. The operations can include, but are not limited to, providing information to the user 216, receiving input from the user 216, and controlling the functions or operation of the vehicle 104, etc. The vehicle system 200 can include a vehicle control

system 204. The vehicle control system 204 can be any type of computing system operable to conduct the operations as described herein. An example of a vehicle control system may be as described in conjunction with Fig. 3.

**[0343]** The vehicle control system 204 may interact with a memory or storage system 208 that stores system data. System data 208 may be any type of data needed for the vehicle control system 204 to control effectively the vehicle 104. The system data 208 can represent any type of database or other storage system. Thus, the system data 208 can be a flat file data system, an object-oriented data system, or some other data system that may interface with the vehicle control system 204.

**[0344]** The vehicle control system 204 may communicate with a device or user interface 212, 248. The user interface 212, 248 may be operable to receive user input either through touch input, on one or more user interface buttons, via voice command, via one or more image sensors, or through a graphical user interface that may include a gesture capture region, as described in conjunction with the other figures provided herein. Further, the symbol 212, 248 can represent a device that is located or associated with the vehicle 104. The device 212, 248 can be a mobile device, including, but not limited to, a mobile telephone, a mobile computer, or other type of computing system or device that is either permanently located in or temporarily associated with, but not necessarily connected to, the vehicle 104. Thus, the vehicle control system 204 can interface with the device 212, 248 and leverage the device's computing capability to provide one or more of the features or functions as described herein.

**[0345]** The device or user interface 212, 248 can receive input or provide information to a user 216. The user 216 may thus interact with the vehicle control system 204 through the interface or device 212, 248. Further, the device 212, 248 may include or have access to device data 220 and/or profile data 252. The device data 220 can be any type of data that is used in conjunction with the device 212, 248 including, but not limited to, multimedia data, preferences data, device identification information, or other types of data. The profile data 252 can be any type of data associated with at least one user 216 including, but in no way limited to, bioinformatics, medical information, driving history, personal information (e.g., home physical address, business physical address, contact addresses, likes, dislikes, hobbies, size, weight, occupation, business contacts – including physical and/or electronic addresses, personal contacts – including physical and/or electronic addresses, family members, and personal information related thereto, etc.), other user characteristics, advertising information, user settings and feature preferences, travel

information, associated vehicle preferences, communication preferences, historical information (e.g., including historical, current, and/or future travel destinations), Internet browsing history, or other types of data. In any event, the data may be stored as device data 220 and/or profile data 252 in a storage system similar to that described in conjunction with Figs. 12A through 12D.

**[0346]** As an example, the profile data 252 may include one or more user profiles. User profiles may be generated based on data gathered from one or more of vehicle preferences (e.g., seat settings, HVAC settings, dash configurations, and the like), recorded settings, geographic location information (e.g., provided by a satellite positioning system (e.g., GPS), Wi-Fi hotspot, cell tower data, etc.), mobile device information (such as mobile device electronic addresses, Internet browsing history and content, application store selections, user settings and enabled and disabled features, and the like), private information (such as user information from a social network, user presence information, user business account, and the like), secure data, biometric information, audio information from on board microphones, video information from on board cameras, Internet browsing history and browsed content using an on board computer and/or the local area network enabled by the vehicle 104, geographic location information (e.g., a vendor storefront, roadway name, city name, etc.), and the like.

**[0347]** The profile data 252 may include one or more user accounts. User accounts may include access and permissions to one or more settings and/or feature preferences associated with the vehicle 104, communications, infotainment, content, etc. In one example, a user account may allow access to certain settings for a particular user, while another user account may deny access to the settings for another user, and vice versa. The access controlled by the user account may be based on at least one of a user account priority, role, permission, age, family status, a group priority (e.g., the user account priority of one or more users, etc.), a group age (e.g., the average age of users in the group, a minimum age of the users in the group, a maximum age of the users in the group, and/or combinations thereof, etc.).

**[0348]** For example, a user 216 may be allowed to purchase applications (e.g., software, etc.) for the vehicle 104 and/or a device associated with the vehicle 104 based on information associated with the user account. This user account information may include a preferred payment method, permissions, and/or other account information. As provided herein, the user account information may be part of the user profile and/or other data stored in the profile data 252.

**[0349]** As another example, an adult user (e.g., a user with an age of 18 years old and/or over, etc.) may be located in an area of a vehicle 104, such as a rear passenger area. Continuing this example a child user (e.g., a user with an age of 17 years old and/or less, etc.) may be located in the same, or close, area. In this example, the user account information in the profile data 252 associated with both the adult user and the child user may be used by the vehicle 104 in determining whether content is appropriate for the area given the age of the child user. For instance, a graphic movie containing violence (e.g., a movie associated with a mature rating, such as a Motion Picture Association of America (MPAA) rating of "R," "NC-17," etc.) may be suitable to present to a display device associated with the adult user but may not be acceptable to present to the display device if a 12-year old child user may see and/or hear the content of the movie.

**[0350]** The vehicle control system 204 may also communicate with or through a communication network 224. The communication network 224 can represent any type of wireless and/or wired communication system that may be included within the vehicle 104 or operable to communicate outside the vehicle 104. Thus, the communication network 224 can include a local area communication capability and a wide area communication capability. For example, the communication network 224 can include a Bluetooth® wireless system, an 802.11x (e.g., 802.11G/ 802.11N /802.11AC, or the like, wireless system), a CAN bus, an Ethernet network within the vehicle 104, or other types of communication networks that may function with or be associated with the vehicle 104. Further, the communication network 224 can also include wide area communication capabilities, including one or more of, but not limited to, a cellular communication capability, satellite telephone communication capability, a wireless wide area network communication capability, or other types of communication capabilities that allow for the vehicle control system 204 to communicate outside the vehicle 104.

**[0351]** The vehicle control system 204 may communicate through the communication network 224 to a server 228 that may be located in a facility that is not within physical proximity to the vehicle 104. Thus, the server 228 may represent a cloud computing system or cloud storage that allows the vehicle control system 204 to either gain access to further computing capabilities or to storage at a location outside of the vehicle 104. The server 228 can include a computer processor and memory and be similar to any computing system as understood to one skilled in the art.

**[0352]** Further, the server 228 may be associated with stored data 232. The stored data 232 may be stored in any system or by any method, as described in conjunction with

system data 208, device data 220, and/or profile data 252. The stored data 232 can include information that may be associated with one or more users 216 or associated with one or more vehicles 104. The stored data 232, being stored in a cloud or in a distant facility, may be exchanged among vehicles 104 or may be used by a user 216 in different locations or with different vehicles 104. Additionally or alternatively, the server may be associated with profile data 252 as provided herein. It is anticipated that the profile data 252 may be accessed across the communication network 224 by one or more components of the system 200. Similar to the stored data 232, the profile data 252, being stored in a cloud or in a distant facility, may be exchanged among vehicles 104 or may be used by a user 216 in different locations or with different vehicles 104.

**[0353]** The vehicle control system 204 may also communicate with one or more sensors 236, 242, which are either associated with the vehicle 104 or communicate with the vehicle 104. Vehicle sensors 242 may include one or more sensors for providing information to the vehicle control system 204 that determine or provide information about the environment 100 in which the vehicle 104 is operating. Embodiments of these sensors may be as described in conjunction with Figs. 6A-7B. Non-vehicle sensor 236 can be any type of sensor that is not currently associated with the vehicle 104. For example, non-vehicle sensor 236 can be sensors in a traffic system operated by a third party that provides data to the vehicle control system 204. Further, the non-vehicle sensor(s) 236 can be other types of sensors which provide information about the distant environment 116 or other information about the vehicle 104 or the environment 100. These non-vehicle sensors 236 may be operated by third parties but provide information to the vehicle control system 204. Examples of information provided by the sensors 236 and that may be used by the vehicle control system 204 may include weather tracking data, traffic data, user health tracking data, vehicle maintenance data, or other types of data, which may provide environmental or other data to the vehicle control system 204. The vehicle control system 204 may also perform signal processing of signals received from one or more sensors 236, 242. Such signal processing may include estimation of a measured parameter from a single sensor, such as multiple measurements of a range state parameter from the vehicle 104 to an obstacle, and/or the estimation, blending, or fusion of a measured state parameter from multiple sensors such as multiple radar sensors or a combination of a ladar/lidar range sensor and a radar sensor. Signal processing of such sensor signal measurements may comprise stochastic signal processing, adaptive signal processing, and/or other signal processing techniques known to those skilled in the art.

**[0354]** The various sensors 236, 242 may include one or more sensor memory 244. Embodiments of the sensor memory 244 may be configured to store data collected by the sensors 236, 242. For example, a temperature sensor may collect temperature data associated with a vehicle 104, user 216, and/or environment, over time. The temperature data may be collected incrementally, in response to a condition, or at specific time periods. In this example, as the temperature data is collected, it may be stored in the sensor memory 244. In some cases, the data may be stored along with an identification of the sensor and a collection time associated with the data. Among other things, this stored data may include multiple data points and may be used to track changes in sensor measurements over time. As can be appreciated, the sensor memory 244 can represent any type of database or other storage system.

**[0355]** The diagnostic communications module 256 may be configured to receive and transmit diagnostic signals and information associated with the vehicle 104. Examples of diagnostics signals and information may include, but is in no way limited to, vehicle system warnings, sensor data, vehicle component status, service information, component health, maintenance alerts, recall notifications, predictive analysis, and the like. Embodiments of the diagnostic communications module 256 may handle warning/error signals in a predetermined manner. The signals, for instance, can be presented to one or more of a third party, occupant, vehicle control system 204, and a service provider (e.g., manufacturer, repair facility, etc.).

**[0356]** Optionally, the diagnostic communications module 256 may be utilized by a third party (i.e., a party other than the user 216, etc.) in communicating vehicle diagnostic information. For instance, a manufacturer may send a signal to a vehicle 104 to determine a status associated with one or more components associated with the vehicle 104. In response to receiving the signal, the diagnostic communications module 256 may communicate with the vehicle control system 204 to initiate a diagnostic status check. Once the diagnostic status check is performed, the information may be sent via the diagnostic communications module 256 to the manufacturer. This example may be especially useful in determining whether a component recall should be issued based on the status check responses returned from a certain number of vehicles.

**[0357]** Wired/wireless transceiver/communications ports 260 may be included. The wired/wireless transceiver/communications ports 260 may be included to support communications over wired networks or links, for example with other communication devices, server devices, and/or peripheral devices. Examples of wired/wireless

transceiver/communications ports 260 include Ethernet ports, Universal Serial Bus (USB) ports, Institute of Electrical and Electronics Engineers (IEEE) 1594, or other interface ports.

**[0358]** An embodiment of a vehicle control environment 300 including a vehicle control system 204 may be as shown in Fig. 3. Beyond the vehicle control system 204, the vehicle control environment 300 can include one or more of, but is not limited to, a power source and/or power control module 316, a data storage module 320, user interface(s)/input interface(s) 324, vehicle subsystems 328, user interaction subsystems 332, Global Positioning System (GPS)/Navigation subsystems 336, sensor(s) and/or sensor subsystems 340, communication subsystems 344, media subsystems 348, and/or device interaction subsystems 352. The subsystems, modules, components, etc. 316-352 may include hardware, software, firmware, computer readable media, displays, input devices, output devices, etc. or combinations thereof. The system, subsystems, modules, components, etc. 204, 316-352 may communicate over a network or bus 356. This communication bus 356 may be bidirectional and perform data communications using any known or future-developed standard or protocol. An example of the communication bus 356 may be as described in conjunction with Fig. 4.

**[0359]** The vehicle control system 204 can include a processor 304, memory 308, and/or an input/output (I/O) module 312. Thus, the vehicle control system 204 may be a computer system, which can comprise hardware elements that may be electrically coupled. The hardware elements may include one or more central processing units (CPUs) 304; one or more components of the I/O module 312 including input devices (e.g., a mouse, a keyboard, etc.) and/or one or more output devices (e.g., a display device, a printer, etc.).

**[0360]** The processor 304 may comprise a general purpose programmable processor or controller for executing application programming or instructions. The processor 304 may, optionally, include multiple processor cores, and/or implement multiple virtual processors. Additionally or alternatively, the processor 304 may include multiple physical processors. As a particular example, the processor 304 may comprise a specially configured application specific integrated circuit (ASIC) or other integrated circuit, a digital signal processor, a controller, a hardwired electronic or logic circuit, a programmable logic device or gate array, a special purpose computer, or the like. The processor 304 generally functions to run programming code or instructions implementing various functions of the vehicle control system 204.

**[0361]** The input/output module 312 and associated ports may be included to support communications over wired or wireless networks or links, for example with other communication devices, server devices, and/or peripheral devices. Examples of an input/output module 312 include an Ethernet port, a Universal Serial Bus (USB) port, Institute of Electrical and Electronics Engineers (IEEE) 1594, or other interface.

**[0362]** The vehicle control system 204 may also include one or more storage devices 308. By way of example, storage devices 308 may be disk drives, optical storage devices, solid-state storage devices such as a random access memory ("RAM") and/or a read-only memory ("ROM"), which can be programmable, flash-updateable and/or the like. The vehicle control system 204 may additionally include a computer-readable storage media reader; a communications system (e.g., a modem, a network card (wireless or wired), an infra-red communication device, etc.); and working memory 308, which may include RAM and ROM devices as described above. The vehicle control system 204 may also include a processing acceleration unit, which can include a digital signal processor (DSP), a special-purpose processor, and/or the like.

**[0363]** The computer-readable storage media reader can further be connected to a computer-readable storage medium, together (and, optionally, in combination with storage device(s)) comprehensively representing remote, local, fixed, and/or removable storage devices plus storage media for temporarily and/or more permanently containing computer-readable information. The communications system may permit data to be exchanged with an external or internal network and/or any other computer or device described herein. Moreover, as disclosed herein, the term "storage medium" may represent one or more devices for storing data, including read only memory (ROM), random access memory (RAM), magnetic RAM, core memory, magnetic disk storage mediums, optical storage mediums, flash memory devices, and/or other machine readable mediums for storing information.

**[0364]** The vehicle control system 204 may also comprise software elements including an operating system and/or other code, as described in conjunction with Fig. 10. It should be appreciated that alternates to the vehicle control system 204 may have numerous variations from that described herein. For example, customized hardware might also be used and/or particular elements might be implemented in hardware, software (including portable software, such as applets), or both. Further, connection to other computing devices such as network input/output devices may be employed.

**[0365]** The power source and/or power control module 316 can include any type of power source, including, but not limited to, batteries, alternating current sources (from connections to a building power system or power line), solar cell arrays, etc. One or more components or modules may also be included to control the power source or change the characteristics of the provided power signal. Such modules can include one or more of, but is not limited to, power regulators, power filters, alternating current (AC) to direct current (DC) converters, DC to AC converters, receptacles, wiring, other converters, etc. The power source and/or power control module 316 functions to provide the vehicle control system 204 and any other system with power.

**[0366]** The data storage 320 can include any module for storing, retrieving, and/or managing data in one or more data stores and/or databases. The database or data stores may reside on a storage medium local to (and/or resident in) the vehicle control system 204 or in the vehicle 104. Alternatively, some of the data storage capability may be remote from the vehicle control system 204 or automobile, and in communication (e.g., via a network) to the vehicle control system 204. The database or data stores may reside in a storage-area network ("SAN") familiar to those skilled in the art. Similarly, any necessary files for performing the functions attributed to the vehicle control system 204 may be stored locally on the respective vehicle control system 204 and/or remotely, as appropriate. The databases or data stores may be a relational database, and the data storage module 320 may be adapted to store, update, and retrieve data in response to specifically-formatted commands. The data storage module 320 may also perform data management functions for any flat file, object oriented, or other type of database or data store.

**[0367]** A first data store that may be part of the vehicle control environment 300 is a profile data store 252 for storing data about user profiles and data associated with the users. A system data store 208 can include data used by the vehicle control system 204 and/or one or more of the components 324-352 to facilitate the functionality described herein. The data stores 208 and/or 252 may be as described in conjunction with Figs. 1 and/or 12A-12D.

**[0368]** The user interface/input interfaces 324 may be as described herein for providing information or data and/or for receiving input or data from a user. Vehicle systems 328 can include any of the mechanical, electrical, electromechanical, computer, or other systems associated with the function of the vehicle 100. For example, vehicle systems 328 can include one or more of, but is not limited to, the steering system, the braking system,

the engine and engine control systems, the electrical system, the suspension, the drive train, the cruise control system, the radio, the heating, ventilation, air conditioning (HVAC) system, the windows and/or doors, etc. These systems are well known in the art and will not be described further.

**[0369]** Examples of the other systems and subsystems 324-352 may be as described further herein. For example, the user interface(s)/input interface(s) 324 may be as described in Figs. 2 and 8B; the vehicle subsystems 328 may be as described in Figs. 6a *et. seq.*; the user interaction subsystem 332 may be as described in conjunction with the user/device interaction subsystem 817 of Fig. 8B; the Navigation subsystem 336 may be as described in Figs. 6A and 8C; the sensor(s)/sensor subsystem 340 may be as described in Figs. 7A and 7B; the communication subsystem 344 may be as described in Figs. 2, 4, 5B, 5C, and 9; the media subsystem 348 may be as described in Fig. 8A; and, the device interaction subsystem 352 may be as described in Fig. 2 and in conjunction with the user/device interaction subsystem 817 of Fig. 8B.

**[0370]** Fig. 4 illustrates an optional communications channel architecture 400 and associated communications components. Fig. 4 illustrates some of the optional components that can be interconnected via the communication channels/zones 404. Communication channels/zones 404 can carry information on one or more of a wired and/or wireless communications link with, in the illustrated example, there being three communications channels/zones, 408, 412, and 416.

**[0371]** This optional environment 400 can also include an IP router 420, an operator cluster 424, one or more storage devices 428, one or more blades, such as master blade 432, and computational blades 436 and 440. Additionally, the communications channels/zones 404 can interconnect one or more displays, such as, remote display 1 444, remote display N 448, and console display 452. The communications channels/zones 404 also interconnect an access point 456, a Bluetooth® access point/USB hub 460, a Femtocell 464, a storage controller 468, that is connected to one or more of USB devices 472, DVDs 476, or other storage devices 480. To assist with managing communications within the communication channel, the environment 400 optionally includes a firewall 484 which will be discussed hereinafter in greater detail. Other components that could also share the communications channel/zones 404 include GPS 488, media controller 492, which is connected to one or more media sources 496, and one or more subsystems, such as subsystem switches 498.

**[0372]** Optionally, the communications channels/zones 404 can be viewed as an I/O network or bus where the communications channels are carried on the same physical media. Optionally, the communication channels 404 can be split amongst one or more physical media and/or combined with one or more wireless communications protocols. Optionally, the communications channels 404 can be based on wireless protocols with no physical media interconnecting the various elements described herein.

**[0373]** The environment 400 shown in Fig. 4 can include a collection of blade processors that are housed in a "crate." The crate can have a PC-style backplane connector 408 and a backplane Ethernet 408 that allows the various blades to communicate with one another using, for example, an Ethernet.

**[0374]** Various other functional elements illustrated in Fig. 4 can be integrated into this crate architecture with, as discussed hereinafter, various zones utilized for security. Optionally, as illustrated in Fig. 4, the backplane 404/408 can have two separate Ethernet zones that may or may not be on the same communications channel. Optionally, the zones exist on a single communications channel on the I/O network/bus 408. Optionally, the zones are actually on different communications channels, e.g., 412, 416; however, the implementation is not restricted to any particular type of configuration. Rather, as illustrated in Fig. 4, there can be a red zone 417 and a green zone 413, and the I/O backplane on the network/bus 408 that enables standard I/O operations. This backplane or I/O network/bus 408 also optionally can provide power distribution to the various modules and blades illustrated in Fig. 4. The red and green Ethernet zones, 417 and 413 respectively, can be implemented as Ethernet switches, with one on each side of the firewall 484. Two Ethernets (untrusted and trusted) are not connected in accordance with an optional embodiment. Optionally, the connector geometry for the firewall can be different for the Ethernet zones than for the blades that are a part of the system.

**[0375]** The red zone 417 only needs to go from the modular connector to the input side of the backplane connector of the firewall 484. While Fig. 4 indicates that there are five external red zone connectors to the firewall 484, provisions can be made for any number of ports with the connections being made at the access point 456, the Bluetooth® access point (combo controller) 460, Femtocell 464, storage controller 468, and/or firewall 484. Optionally, the external port connections can be made through a manufacturer configurable modular connector panel, and one or more of the red zone Ethernet ports could be available through a customer supplied crate which allows, for example, wired Ethernet connections from a bring-your-own-device (BYOD) to the firewall 484.

**[0376]** The green zone 413 goes from the output side of the firewall 484 and generally defines the trusted Ethernet. The Ethernet on the backplane 408 essentially implements an Ethernet switch for the entire system, defining the Ethernet backbone of the vehicle 104. All other modules, e.g., blades, etc., can connect to a standard backplane bus and the trusted Ethernet. Some number of switch ports can be reserved to connect to an output modular connector panel to distribute the Ethernet throughout the vehicle 104, e.g., connecting such elements as the console display 452, remote displays 444, 448, GPS 488, etc. Optionally, only trusted components, either provided or approved by the manufacturer after testing, can be attached to the green zone 413, which is by definition in the trusted Ethernet environment.

**[0377]** Optionally, the environment 400, shown in Fig. 4, utilizes IPv6 over Ethernet connections wherever possible. Using, for example, the Broadcom single-twisted pair Ethernet technology, wiring harnesses are simplified and data transmission speeds are maximized. However, while the Broadcom single-twisted pair Ethernet technology can be used, in general, systems and methods can work comparably well with any type of well-known Ethernet technology or other comparable communications technology.

**[0378]** As illustrated in Fig. 4 the I/O network/bus 408 is a split-bus concept that contains three independent bus structures:

**[0379]** The red zone 417 - the untrusted Ethernet environment. This zone 417 may be used to connect network devices and customer provided devices to the vehicle information system with these devices being on the untrusted side of the firewall 484.

**[0380]** The green zone 413 - the trusted Ethernet environment, this zone 413 can be used to connect manufacturer certified devices such as GPS units, remote displays, subsystem switches, and the like, to the vehicle network 404. Manufacturer certified devices can be implemented by vendors that allow the vehicle software system to validate whether or not a device is certified to operate with the vehicle 100. Optionally, only certified devices are allowed to connect to the trusted side of the network.

**[0381]** The I/O bus 409 - the I/O bus may be used to provide power and data transmission to bus-based devices such as the vehicle solid state drive, the media controller blade 492, the computational blades 436, 440, and the like.

**[0382]** As an example, the split-bus structure can have the following minimum configuration:

**[0383]** Two slots for the red zone Ethernet;

**[0384]** One slot for built-in LTE/WiMax access 420 from the car to other network resources such as the cloud/Internet;

**[0385]** One slot for user devices or bring-your-own device access, this slot can implement, for example, WiFi, Bluetooth®, and/or USB connectivity 456, which can be provided in, for example, the customer crate;

**[0386]** One slot for combined red zone and green zone Ethernet, this slot can be reserved for the firewall controller;

**[0387]** Two slots for computational blades. Here the two computation blades are illustratively as shown the optional master blade and the multimedia blade or controller 492 which can be provided as standard equipment; and

**[0388]** The expansion controller that allows the I/O bus to be extended and provides additional Ethernet switch ports for one or more of the red or green zones, which may require that the basic green zone Ethernet switch implementation will support additional ports beyond the initial three that are needed for the basic exemplary system.

**[0389]** It should be possible to build 8 or 16 or more Ethernet switches that allow for the expansion with existing component(s) in a straight-forward manner.

**[0390]** The red zone 417 can be implemented as an 8-port Ethernet switch that has three actual bus ports within the crate with the remaining five ports being available on the customer crate. The crate implements red zone slots for the firewall controller 484, the combo controller which includes WiFi, Bluetooth®, USB hub (456, 460) and the IP router 420.

**[0391]** The firewall controller 484 can have a dedicated slot that bridges the red zone 417, green zone 413, and uses the I/O bus for power connections. In accordance with an optional low cost implementation, the firewall 484 can be implemented by a dummy module that simply bridges the red zone 417 and the green zone 413 without necessarily providing any firewall functionality. The combo controller 460 that includes the WiFi, Bluetooth®, and USB hub can be provided for consumer device connections. This controller can also implement the IPv6 (un-routable) protocol to insure that all information is packetized for transmission via IP over the Ethernet in the I/O network/bus 408.

**[0392]** The combo controller 460 with the USB hub can have ports in the customer crate. The combo controller 460 can implement USB discovery functions and packetizes the information for transmission via IP over Ethernet. The combo controller 460 can also facilitate installation of the correct USB driver for the discovered device, such as a BYOD from the user. The combo controller 460 and USB hub can then map the USB address to a

"local" IPv6 address for interaction with one or more of the computational blades which is generally going to be the media controller 492.

**[0393]** The IP router 420 can implement Internet access through a manufacturer provided service. This service can allow, for example, a manufacturer to offer value-added services to be integrated into the vehicle information systems. The existence of the manufacturer provided Internet access can also allow the "e-Call" function and other vehicle data recorder functions to be implemented. IP router 420 also allows, for example, WiMax, 4G LTE, and other connections to the Internet through a service provider that can be, for example, contracted by the manufacturer. Internally, the IP router 420 can allow cellular handset connections to the Internet through a Femtocell 464 that is part of the IP router implementation. The IP router 420, with the Femtocell 464, can also allow a cone of silence functionality to be implemented. The IP router 420 can be an optional component for a vehicle provided by, for example, the manufacturer, a dealer, or installed by a user. In the absence of the IP router 420, it is possible to connect a consumer handheld device to the I/O network/bus 408 using, for example, either WiFi or Bluetooth® 456, 460. While functionality may be somewhat reduced when using a handheld device instead of a built-in Ethernet connection, systems and methods of this invention can also work utilizing this consumer handheld device which then connects to the Internet via, for example, WiMax, 4G, 4G LTE, or the like.

**[0394]** Figs. 5A-5C show configurations of a vehicle 104. In general, a vehicle 104 may provide functionality based at least partially on one or more areas, zones, and distances, associated with the vehicle 104. Non-limiting examples of this functionality are provided herein below.

**[0395]** An arrangement or configuration for sensors within a vehicle 104 is as shown in Fig. 5A. The sensor arrangement 500 can include one or more areas 508 within the vehicle. An area can be a larger part of the environment inside or outside of the vehicle 104. Thus, area one 508A may include the area within the trunk space or engine space of the vehicle 104 and/or the front passenger compartment. Area two 508B may include a portion of the interior space 108 (e.g., a passenger compartment, etc.) of the vehicle 104. The area N, 508N, may include the trunk space or rear compartment area, when included within the vehicle 104. The interior space 108 may also be divided into other areas. Thus, one area may be associated with the front passenger's and driver's seats, a second area may be associated with the middle passengers' seats, and a third area may be associated

with a rear passenger's seat. Each area 508 may include one or more sensors that are positioned or operate to provide environmental information about that area 508.

**[0396]** Each area 508 may be further separated into one or more zones 512 within the area 508. For example, area 1 508A may be separated into zone A 512A, and zone B 512B. Each zone 512 may be associated with a particular portion of the interior occupied by a passenger. For example, zone A 512A may be associated with a driver. Zone B 512B, may be associated with a front passenger. Each zone 512 may include one or more sensors that are positioned or configured to collect information about the environment or ecosystem associated with that zone or person.

**[0397]** A passenger area 508B may include more than two zones as described in conjunction with area 508A. For example, area 508B may include three zones, 512C, 512D, and 512E. These three separate zones 512C, 512D, and 512E may be associated with three passenger seats typically found in the rear passenger area of a vehicle 104. An area 508N and may include a single zone 512N as there may be no separate passenger areas but may include a single trunk area within the vehicle 104. The number of zones 512 is unlimited within the areas as the areas are also unlimited inside the vehicle 104. Further, it should be noted that there may be one or areas 508 or zones 512 that may be located outside the vehicle 104 that may have a specific set of sensors associated therewith.

**[0398]** Optionally, each area/access point 508, 456, 516, 520, and/or zone 512, associated with a vehicle 104, may comprise one or more sensors to determine a presence of a user 216 and/or device 212, 248 in and/or adjacent to each area 508, 456, 516, 520, and/or zone 512. The sensors may include vehicle sensors 242 and/or non-vehicle sensors 236 as described herein. It is anticipated that the sensors may be configured to communicate with a vehicle control system 204 and/or the diagnostic communications module 256. Additionally or alternatively, the sensors may communicate with a device 212, 248. The communication of sensors with the vehicle 104 may initiate and/or terminate the control of device 212, 248 features. For example, a vehicle operator may be located in a second outside area 520 associated with a vehicle 104. As the operator approaches the first outside area 516, associated with the vehicle 104, the vehicle control system 204 may determine to control features associated with one or more device 212, 248 and diagnostic communications module 256.

**[0399]** Optionally, the location of the device 212, 248 relative to the vehicle 104 may determine vehicle functionality and/or features to be provided and/or restricted to a user

216. By way of example, a device 212, 248 associated with a user 216 may be located at a second outside area 520 from the vehicle 104. In this case, and based at least partially on the distance of the device 212, 248 from the vehicle 104 (e.g., provided by detecting the device 212, 248 at or beyond the second outside area 520) the vehicle 104 may lock one or more features (e.g., ignition access, vehicle access, communications ability, etc.) associated with the vehicle 104. Optionally, the vehicle 104 may provide an alert based on the distance of the device 212, 248 from the vehicle 104. Continuing the example above, once the device 212, 248 reaches the first outside area 516 of the vehicle 104 at least one of the vehicle features may be unlocked. For instance, by reaching the first outside area 516, the vehicle 104 may unlock a door of the vehicle 104. In some cases, when the device is detected to be inside the vehicle 104, the various sensors 236, 242 may determine that the user 216 is in an area 508 and/or zone 512. As is further described herein, features of the vehicle 104, device 212, 248, and/or other components may be controlled based on rules stored in a memory.

**[0400]** Fig. 5B illustrates optional internal vehicle communications between one or more of the vehicle and one or more devices or between devices. Various communications can occur utilizing one or more Bluetooth®, NFC, WiFi, mobile hot spot, point-to-point communications, point-to-multipoint other point communications, an ad hoc network, or in general any known communications protocol over any known communications media or media-types.

**[0401]** Optionally, various types of internal vehicle communications can be facilitated using an access point 456 that utilizes one or more of Bluetooth®, NFC, WiFi, wireless Ethernet, mobile hot spot technology, or the like. Upon being connected with, and optionally authenticated to the access point 456, the connected device is able to communicate with one or more of the vehicle and one or more other devices that are connected to the access point 456. The type of connection to the access point 456 can be based on, for example, the zone 512, in which the device is located.

**[0402]** The user may identify their zone 512 in conjunction with an authentication procedure to the access point 456. For example, a driver in zone A 512A, upon authenticating to the access point 456, can cause the access point 456 to send a query to the device asking the device user in which zone 512 they are located. As discussed hereinafter, the zone 512 the user device is located in may have an impact on the type of communications, available bandwidth, the types of other devices or vehicle systems or subsystems the device could communicate with, and the like. As a brief introduction,

internal communications with zone A 512A may be given preferential treatment over those communications originating from area 2 508B, which could have in itself, preferential treatment over communications originating within area N 508N.

**[0403]** Moreover, the device in zone A 512A can include profile information that governs the other devices that are allowed to connect to the access point 456 and what those devices have access to, how they can communicate, how much bandwidth they are allocated, and the like. While, optionally, the device associated with zone A 512A will be considered the "master" controller of the profile that governs the internal vehicle communications, it should be appreciated that this was arbitrarily chosen since it is assumed that there will always be a driver in a car that is present in zone A 512A. However, it should be appreciated the driver in zone A 512A, for example, may not have a communications device in which case a device associated with one of the other areas or zones, such as zone B 512B, area 2 508B, or area N 508N could also be associated with or control this master profile.

**[0404]** Optionally, various devices located within the various zones 512 can connect using, for example, ports provided by access point 456 or Bluetooth® access point/USB hub 460 as illustrated in Fig 4. Similarly, the device(s) could connect utilizing the Femtocell 464 and optionally be directly connected via, for example, a standard Ethernet port.

**[0405]** As discussed, each one of the areas, area 1 508A, area 2 508B, and area N 508N, can each have associated therewith a profile that governs, for example, how many and what types of devices can connect from that area 508, bandwidth allocated to that area 508, the types of media or content available to device(s) within that area 508, the interconnection of devices within that area 508 or between areas 508, or, in general, can control any aspect of communication of an associated device with any one or more other associated devices/vehicle systems within the vehicle 104.

**[0406]** Optionally, area 2 508B devices can be provided with full access to multimedia and infotainment available within the vehicle 104, however, devices in area 2 508B may be restricted from any access to vehicle functions. Only devices in area 1 508A may be able to access vehicle control functions such as when "parents" are located in area 1 508A and the children are located in area 2 508B. Optionally, devices found in zone E 512E of area 2 508B may be able to access limited vehicle control functionality such as climate control within area 2. Similarly, devices in area N 508N may be able to control climate features within zone N 512N.

**[0407]** As will be appreciated, profiles can be established that allow management of communications within each of the areas 508, and further optionally within each of the zones 512. The profile can be granular in nature controlling not only what type of devices can connect within each zone 512, but how those devices can communicate with other devices and/or the vehicle and types of information that can be communicated.

**[0408]** To assist with identifying a location of a device within a zone 512, a number of different techniques can be utilized. One optional technique involves one or more of the vehicle sensors detecting the presence of an individual within one of the zones 512. Upon detection of an individual in a zone 512, communications subsystems 344 and the access point 456 can cooperate to not only associate the device within the zone 512 with the access point 456 but to also determine the location of the device within an area, and optionally within a zone 512. Once the device is established within a zone 512, a profile associated with the vehicle 104 can store information identifying that device and/or a person and optionally associating it with a particular zone 512 as a default. As discussed, there can be a master profile optionally associated with the device in zone A 512A, this master profile can govern communications with the communications subsystems 340 and where communications within vehicle 104 are to occur.

**[0409]** Some optional profiles are illustrated below where the Master Profile governs other device connectivity:

**[0410]** Master Profile:

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| All Communications | Allow Access to Infotainment | No Access | Master Profile acts as Firewall and Router |
| All Vehicle Controls | Allow Area 2 Climate Control | | |

Secondary Profile (e.g., device in Zone B 512B, Area 1 508A)

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| All Communications | Allow Access to Infotainment | Allow Access to Infotainment | Master Profile acts as Firewall and Router |
| All Vehicle Controls | Allow Area 2 Climate Control | Allow Area 2 Climate Control | |

Secondary Profile, Option 2

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| All Communications | Allow Access to Infotainment, Internet | Allow Access to Infotainment | |
| All Vehicle Controls Except Driver-centric Controls | Allow Area 2 Climate Control | Allow Area 2 Climate Control | |

**[0411]** Some optional profiles are illustrated below where the Area/Zone governs device connectivity:

Area 2 508B Profile:

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| No Communications with Area 1 Devices | Allow Access to Infotainment, Allow Access to Other Area 2 or Zone N Devices, Internet | | |
| No Vehicle Controls | Allow Area 2 Climate Control | | |

Area N 508N Profile:

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| Communications with Area 1, Zone B Device | | Allow Access to Infotainment, Allow Access to Other Area N or Zone N Devices | |
| No Vehicle Controls | | Allow Area N Climate Control | |

Area 2 508B Profile:

| Area 1 508A | Area 2 508B | Area N 508N | Other |
|---|---|---|---|
| Media Sharing with Area 1, Zone B and Vehicle | Allow Access to Infotainment, Allow Access to Other Area 2 or Zone N Devices, Internet and Femtocell | | |
| No Vehicle Controls | | | |

**[0412]** Optionally, a user's device, such as a SmartPhone, can store in, for example a profile, with which zone 512 the user's device is associated. Then, assuming the user sits in the same zone 512 and area 508 as previously, the user's device can re-establish the same communications protocols with the access point 456 as were previously established.

**[0413]** In addition or in the alternative, the areas 508 and zones 512 can have associated therewith restrictions as to which one or more other user's devices with which users' devices can connect. For example, a first user's device can connect with any other user device in area 2 508B or area N 508N, however is restricted from connecting with a user device in area 1 508A, zone A 512A. However, the first user device may be able to communicate with another user's device that is located in area 1 508A, zone B 512B. These communications can include any type of standard communications such as sharing content, exchanging messages, forwarding or sharing multimedia or infotainment, or in general can include any communications that would ordinarily be available between two devices and/or the vehicle and vehicle systems. As discussed, there may be restrictions on the type of communications that can be sent to the device in area 1 508A, zone A 512A. For example, the user's device in area 1 508A, zone A 512A may be restricted from receiving one or more of text messages, multimedia, infotainment, or in general anything that can be envisioned as a potential distraction to the driver. Moreover, it should be appreciated that the communications between the various devices and the various zones 512 need not necessarily occur with the assistance of access point 456, but the communications could also occur directly between the device(s).

**[0414]** Fig. 5C outlines optional internal vehicle communications between one or more of the vehicle and one or more devices. More specifically, Fig. 5C illustrates an example of vehicle communications where the vehicle 104 is equipped with the necessary transceivers to provide a mobile hot spot functionality to any user device(s) therein, such as user devices 248A and 248N.

**[0415]** Optionally, and as discussed above, one or more user devices can connect to the access point 456. This access point 456 is equipped to handle communications routing to not only the communication network/buses 224 for intra-vehicle communications, but optionally can also communicate with, for example, the Internet or the cloud, in cooperation with transceiver 260. Optionally included is a firewall 484 that has the capability of not only blocking certain types of content, such as a malicious content, but can also operate to exclude certain type of communications from emanating from the vehicle 104 and transceiver 260. As will be appreciated, various profiles could be

established in the firewall 484 that controls not only the type of communications that can be received at the vehicle 104, but the type of communications that can be sent from the vehicle 104.

**[0416]** The transceiver 260 can be any type of well-known wireless transceiver that communicates using a known communications protocol such as WiMax, 4G, 4G LTE, 3G, or the like. The user devices can communicate via, for example, WiFi link 248 with the access point 456, with the transceiver 260 providing Internet connectivity to the various user devices. As will be appreciated, there may need to be an account associated with transceiver 260 with a wireless carrier to provide data and/or voice connectivity to enable the user devices to communicate with the Internet. Typically, the account is established on a month-to-month basis with an associated fee but could also be performed based on the amount of data to be transmitted, received, or in any other manner.

**[0417]** Moreover, one or more of the user's devices and access point 456 can maintain profile information that governs how the user's devices are able to communicate with other devices, and optionally the Internet. Optionally, a profile can exist that only allows the user's devices to communicate with other user's devices and/or the vehicle, multimedia and/or the vehicle infotainment system, and may not be allowed access to the Internet via transceiver 260. The profile can stipulate that the user's device could connect to the Internet via transceiver 260 for a specified period of time and/or up to a certain amount of data usage. The user's device can have full access to the Internet via transceiver 260 with no limit on time or data usage which would reduce the data usage of the user's device since it is connected via WiFi to the access point 456, but however, would increase the data usage by transceiver 260, and therefore, shift the billing for that data usage to the transceiver 260 instead of the user's device. Still further, and as previously discussed, the various profiles may stipulate which user's device has priority for use of the bandwidth provided by the transceiver 260. For example, a user's device located area 1 508A, zone A 512A may be given preferential routing treatment of data above that of a user's device in zone N 512N. In this manner, for example, a driver would be given priority for Internet access above that of the passengers. This could become important, for example, when the driver is trying to obtain traffic or direction information or, for example, when the vehicle is performing a download to update various software features.

**[0418]** As will be appreciated, the optional firewall 484 can cooperate with the access point 456 and the various profiles that area 508 associated with the various devices within

the vehicle 104 and can fully implement communications restrictions, control bandwidth limits, Internet accessibility, malicious software blocking, and the like. Moreover, the optional firewall 484 can be accessed by an administrator with one or more of these configuration settings edited through an administrator's control panel. For example, in a scenario where parents are always in area 1 508A, it may be appropriate to give all of the user's devices in area 1 508A full access to the Internet utilizing transceiver 260, however, while restricting access and/or bandwidth to any other user devices within the vehicle 104. As the user's device and profile would be known by the firewall 484, upon the user's device being associated with the access point 456, the firewall 484 and transceiver 260 can be configured to allow communications in accordance with the stored profile.

**[0419]** A set of sensors or vehicle components 600 associated with the vehicle 104 may be as shown in Fig. 6A. The vehicle 104 can include, among many other components common to vehicles, wheels 607, a power source 609 (such as an engine, motor, or energy storage system (e.g., battery or capacitive energy storage system)), a manual or automatic transmission 612, a manual or automatic transmission gear controller 616, a power controller 620 (such as a throttle), a vehicle control system 204, the display device 212, a braking system 636, a steering wheel 640, a power source activation/deactivation switch 644 (e.g., an ignition), an occupant seating system 648, a wireless signal receiver 653 to receive wireless signals from signal sources such as roadside beacons and other electronic roadside devices, and a satellite positioning system receiver 657 (e.g., a Global Positioning System ("GPS") (US), GLONASS (Russia), Galileo positioning system (EU), Compass navigation system (China), and Regional Navigational Satellite System (India) receiver), driverless systems (e.g., cruise control systems, automatic steering systems, automatic braking systems, etc.).

**[0420]** The vehicle 104 can include a number of sensors in wireless or wired communication with the vehicle control system 204 and/or display device 212, 248 to collect sensed information regarding the vehicle state, configuration, and/or operation. Exemplary sensors may include one or more of, but are not limited to, wheel state sensor 660 to sense one or more of vehicle speed, acceleration, deceleration, wheel rotation, wheel speed (e.g., wheel revolutions-per-minute), wheel slip, and the like, a power source energy output sensor 664 to sense a power output of the power source 609 by measuring one or more of current engine speed (e.g., revolutions-per-minute), energy input and/or output (e.g., voltage, current, fuel consumption, and torque) (e.g., turbine speed sensor, input speed sensor, crankshaft position sensor, manifold absolute pressure sensor, mass

flow sensor, and the like), and the like, a switch state sensor 668 to determine a current activation or deactivation state of the power source activation/deactivation switch 644, a transmission setting sensor 670 to determine a current setting of the transmission (e.g., gear selection or setting), a gear controller sensor 672 to determine a current setting of the gear controller 616, a power controller sensor 674 to determine a current setting of the power controller 620, a brake sensor 676 to determine a current state (braking or non-braking) of the braking system 636, a seating system sensor 678 to determine a seat setting and current weight of seated occupant, if any) in a selected seat of the seating system 648, exterior and interior sound receivers 690 and 692 (e.g., a microphone, sonar, and other type of acoustic-to-electric transducer or sensor) to receive and convert sound waves into an equivalent analog or digital signal. Examples of other sensors (not shown) that may be employed include safety system state sensors to determine a current state of a vehicular safety system (e.g., air bag setting (deployed or undeployed) and/or seat belt setting (engaged or not engaged)), light setting sensor (e.g., current headlight, emergency light, brake light, parking light, fog light, interior or passenger compartment light, and/or tail light state (on or off)), brake control (e.g., pedal) setting sensor, accelerator pedal setting or angle sensor, clutch pedal setting sensor, emergency brake pedal setting sensor, door setting (e.g., open, closed, locked or unlocked) sensor, engine temperature sensor, passenger compartment or cabin temperature sensor, window setting (open or closed) sensor, one or more interior-facing or exterior-facing cameras or other imaging sensors (which commonly convert an optical image into an electronic signal but may include other devices for detection objects such as an electromagnetic radiation emitter/receiver that emits electromagnetic radiation and receives electromagnetic waves reflected by the object) to sense objects, such as other vehicles and pedestrians and optionally determine the distance, trajectory and speed of such objects, in the vicinity or path of the vehicle, odometer reading sensor, trip mileage reading sensor, wind speed sensor, radar transmitter/receiver output, brake wear sensor, steering/torque sensor, oxygen sensor, ambient lighting sensor, vision system sensor, ranging sensor, parking sensor, heating, venting, and air conditioning (HVAC) sensor, water sensor, air-fuel ratio meter, blind spot monitor, hall effect sensor, microphone, radio frequency (RF) sensor, infrared (IR) sensor, vehicle control system sensors, wireless network sensor (e.g., Wi-Fi and/or Bluetooth® sensor), cellular data sensor, and other sensors either future-developed or known to those of skill in the vehicle art.

**[0421]** In the depicted vehicle embodiment, the various sensors can be in communication with the display device 212, 248 and vehicle control system 204 via signal carrier network 224. As noted, the signal carrier network 224 can be a network of signal conductors, a wireless network (e.g., a radio frequency, microwave, or infrared communication system using a communications protocol, such as Wi-Fi), or a combination thereof. The vehicle control system 204 may also provide signal processing of one or more sensors, sensor fusion of similar and/or dissimilar sensors, signal smoothing in the case of erroneous "wild point" signals, and/or sensor fault detection. For example, ranging measurements provided by one or more RF sensors may be combined with ranging measurements from one or more IR sensors to determine one fused estimate of vehicle range to an obstacle target.

**[0422]** The control system 204 may receive and read sensor signals, such as wheel and engine speed signals, as a digital input comprising, for example, a pulse width modulated (PWM) signal. The processor 304 can be configured, for example, to read each of the signals into a port configured as a counter or configured to generate an interrupt on receipt of a pulse, such that the processor 304 can determine, for example, the engine speed in revolutions per minute (RPM) and the speed of the vehicle in miles per hour (MPH) and/or kilometers per hour (KPH). One skilled in the art will recognize that the two signals can be received from existing sensors in a vehicle comprising a tachometer and a speedometer, respectively. Alternatively, the current engine speed and vehicle speed can be received in a communication packet as numeric values from a conventional dashboard subsystem comprising a tachometer and a speedometer. The transmission speed sensor signal can be similarly received as a digital input comprising a signal coupled to a counter or interrupt signal of the processor 304 or received as a value in a communication packet on a network or port interface from an existing subsystem of the vehicle 104. The ignition sensor signal can be configured as a digital input, wherein a HIGH value represents that the ignition is on and a LOW value represents that the ignition is OFF. Three bits of the port interface can be configured as a digital input to receive the gear shift position signal, representing eight possible gear shift positions. Alternatively, the gear shift position signal can be received in a communication packet as a numeric value on the port interface. The throttle position signal can be received as an analog input value, typically in the range 0-5 volts. Alternatively, the throttle position signal can be received in a communication packet as a numeric value on the port interface. The output of other sensors can be processed in a similar fashion.

**[0423]** Other sensors may be included and positioned in the interior space 108 of the vehicle 104. Generally, these interior sensors obtain data about the health of the driver and/or passenger(s), data about the safety of the driver and/or passenger(s), and/or data about the comfort of the driver and/or passenger(s). The health data sensors can include sensors in the steering wheel that can measure various health telemetry for the person (e.g., heart rate, temperature, blood pressure, blood presence, blood composition, etc.). Sensors in the seats may also provide for health telemetry (e.g., presence of liquid, weight, weight shifts, etc.). Infrared sensors could detect a person's temperature; optical sensors can determine a person's position and whether the person has become unconscious. Other health sensors are possible and included herein.

**[0424]** Safety sensors can measure whether the person is acting safely. Optical sensors can determine a person's position and focus. If the person stops looking at the road ahead, the optical sensor can detect the lack of focus. Sensors in the seats may detect if a person is leaning forward or may be injured by a seat belt in a collision. Other sensors can detect that the driver has at least one hand on a steering wheel. Other safety sensors are possible and contemplated as if included herein.

**[0425]** Comfort sensors can collect information about a person's comfort. Temperature sensors may detect a temperature of the interior cabin. Moisture sensors can determine a relative humidity. Audio sensors can detect loud sounds or other distractions. Audio sensors may also receive input from a person through voice data. Other comfort sensors are possible and contemplated as if included herein.

**[0426]** Fig. 6B shows an interior sensor configuration for one or more zones 512 of a vehicle 104 optionally. Optionally, the areas 508 and/or zones 512 of a vehicle 104 may include sensors that are configured to collect information associated with the interior 108 of a vehicle 104. In particular, the various sensors may collect environmental information, user information, and safety information, to name a few. Embodiments of these sensors may be as described in conjunction with Figs. 7A-8B.

**[0427]** Optionally, the sensors may include one or more of optical, or image, sensors 622A-B (e.g., cameras, etc.), motion sensors 624A-B (e.g., utilizing RF, IR, and/or other sound/image sensing, etc.), steering wheel user sensors 642 (e.g., heart rate, temperature, blood pressure, sweat, health, etc.), seat sensors 677 (e.g., weight, load cell, moisture, electrical, force transducer, etc.), safety restraint sensors 679 (e.g., seatbelt, airbag, load cell, force transducer, etc.), interior sound receivers 692A-B, environmental sensors 694 (e.g., temperature, humidity, air, oxygen, etc.), and the like.

**[0428]** The image sensors 622A-B may be used alone or in combination to identify objects, users 216, and/or other features, inside the vehicle 104. Optionally, a first image sensor 622A may be located in a different position within a vehicle 104 from a second image sensor 622B. When used in combination, the image sensors 622A-B may combine captured images to form, among other things, stereo and/or three-dimensional (3D) images. The stereo images can be recorded and/or used to determine depth associated with objects and/or users 216 in a vehicle 104. Optionally, the image sensors 622A-B used in combination may determine the complex geometry associated with identifying characteristics of a user 216. For instance, the image sensors 622A-B may be used to determine dimensions between various features of a user's face (e.g., the depth/distance from a user's nose to a user's cheeks, a linear distance between the center of a user's eyes, and more). These dimensions may be used to verify, record, and even modify characteristics that serve to identify a user 216. As can be appreciated, utilizing stereo images can allow for a user 216 to provide complex gestures in a 3D space of the vehicle 104. These gestures may be interpreted via one or more of the subsystems as disclosed herein. Optionally, the image sensors 622A-B may be used to determine movement associated with objects and/or users 216 within the vehicle 104. It should be appreciated that the number of image sensors used in a vehicle 104 may be increased to provide greater dimensional accuracy and/or views of a detected image in the vehicle 104.

**[0429]** The vehicle 104 may include one or more motion sensors 624A-B. These motion sensors 624A-B may detect motion and/or movement of objects inside the vehicle 104. Optionally, the motion sensors 624A-B may be used alone or in combination to detect movement. For example, a user 216 may be operating a vehicle 104 (e.g., while driving, etc.) when a passenger in the rear of the vehicle 104 unbuckles a safety belt and proceeds to move about the vehicle 104. In this example, the movement of the passenger could be detected by the motion sensors 624A-B. Optionally, the user 216 could be alerted of this movement by one or more of the devices 212, 248 in the vehicle 104. In another example, a passenger may attempt to reach for one of the vehicle control features (e.g., the steering wheel 640, the console, icons displayed on the head unit and/or device 212, 248, etc.). In this case, the movement (i.e., reaching) of the passenger may be detected by the motion sensors 624A-B. Optionally, the path, trajectory, anticipated path, and/or some other direction of movement/motion may be determined using the motion sensors 624A-B. In response to detecting the movement and/or the direction associated with the movement, the passenger may be prevented from interfacing with and/or accessing at least some of

the vehicle control features (e.g., the features represented by icons may be hidden from a user interface, the features may be locked from use by the passenger, combinations thereof, etc.). As can be appreciated, the user 216 may be alerted of the movement/motion such that the user 216 can act to prevent the passenger from interfering with the vehicle 104 controls. Optionally, the number of motion sensors in a vehicle 104, or areas of a vehicle 104, may be increased to increase an accuracy associated with motion detected in the vehicle 104.

**[0430]** The interior sound receivers 692A-B may include, but are not limited to, microphones and other types of acoustic-to-electric transducers or sensors. Optionally, the interior sound receivers 692A-B may be configured to receive and convert sound waves into an equivalent analog or digital signal. The interior sound receivers 692A-B may serve to determine one or more locations associated with various sounds in the vehicle 104. The location of the sounds may be determined based on a comparison of volume levels, intensity, and the like, between sounds detected by two or more interior sound receivers 692A-B. For instance, a first interior sound receiver 692A may be located in a first area of the vehicle 104 and a second interior sound receiver 692B may be located in a second area of the vehicle 104. If a sound is detected at a first volume level by the first interior sound receiver 692A and a second, higher, volume level by the second interior sound receiver 692B in the second area of the vehicle 104, the sound may be determined to be closer to the second area of the vehicle 104. As can be appreciated, the number of sound receivers used in a vehicle 104 may be increased (e.g., more than two, etc.) to increase measurement accuracy surrounding sound detection and location, or source, of the sound (e.g., via triangulation, etc.).

**[0431]** Seat sensors 677 may be included in the vehicle 104. The seat sensors 677 may be associated with each seat and/or zone 512 in the vehicle 104. Optionally, the seat sensors 677 may provide health telemetry and/or identification via one or more of load cells, force transducers, weight sensors, moisture detection sensor, electrical conductivity/resistance sensor, and the like. For example, the seat sensors 677 may determine that a user 216 weighs 180 lbs. This value may be compared to user data stored in memory to determine whether a match exists between the detected weight and a user 216 associated with the vehicle 104. In another example, if the seat sensors 677 detect that a user 216 is fidgeting, or moving, in a seemingly uncontrollable manner, the system may determine that the user 216 has suffered a nervous and/or muscular system issue (e.g., seizure, etc.). The vehicle control system 204 may then cause the vehicle 104 to slow

down and in addition or alternatively the automobile controller 8104 (described below) can safely take control of the vehicle 104 and bring the vehicle 104 to a stop in a safe location (e.g., out of traffic, off a freeway, etc).

**[0432]** Health telemetry and other data may be collected via the steering wheel user sensors 642. Optionally, the steering wheel user sensors 642 may collect heart rate, temperature, blood pressure, and the like, associated with a user 216 via at least one contact disposed on or about the steering wheel 640.

**[0433]** The safety restraint sensors 679 may be employed to determine a state associated with one or more safety restraint devices in a vehicle 104. The state associated with one or more safety restraint devices may serve to indicate a force observed at the safety restraint device, a state of activity (e.g., retracted, extended, various ranges of extension and/or retraction, deployment, buckled, unbuckled, etc.), damage to the safety restraint device, and more.

**[0434]** Environmental sensors 694, including one or more of temperature, humidity, air, oxygen, carbon monoxide, smoke, and other environmental condition sensors may be used in a vehicle 104. These environmental sensors 694 may be used to collect data relating to the safety, comfort, and/or condition of the interior space 108 of the vehicle 104. Among other things, the data collected by the environmental sensors 694 may be used by the vehicle control system 204 to alter functions of a vehicle. The environment may correspond to an interior space 108 of a vehicle 104 and/or specific areas 508 and/or zones 512 of the vehicle 104. It should be appreciate that an environment may correspond to a user 216. For example, a low oxygen environment may be detected by the environmental sensors 694 and associated with a user 216 who is operating the vehicle 104 in a particular zone 512. In response to detecting the low oxygen environment, at least one of the subsystems of the vehicle 104, as provided herein, may alter the environment, especially in the particular zone 512, to increase the amount of oxygen in the zone 512. Additionally or alternatively, the environmental sensors 694 may be used to report conditions associated with a vehicle (e.g., fire detected, low oxygen, low humidity, high carbon monoxide, etc.). The conditions may be reported to a user 216 and/or a third party via at least one communications module as provided herein.

**[0435]** Among other things, the sensors as disclosed herein may communicate with each other, with devices 212, 248, and/or with the vehicle control system 204 via the signal carrier network 224. Additionally or alternatively, the sensors disclosed herein may serve to provide data relevant to more than one category of sensor information including, but not

limited to, combinations of environmental information, user information, and safety information to name a few.

**[0436]** Figs. 7A-7B show block diagrams of various sensors that may be associated with a vehicle 104. Although depicted as interior and exterior sensors, it should be appreciated that any of the one or more of the sensors shown may be used in both the interior space 108 and the exterior space of the vehicle 104. Moreover, sensors having the same symbol or name may include the same, or substantially the same, functionality as those sensors described elsewhere in the present disclosure. Further, although the various sensors are depicted in conjunction with specific groups (e.g., environmental 708, 708E, user interface 712, safety 716, 716E, etc.) the sensors should not be limited to the groups in which they appear. In other words, the sensors may be associated with other groups or combinations of groups and/or disassociated from one or more of the groups shown. The sensors as disclosed herein may communicate with each other, the devices 212, 248, and/or the vehicle control system 204 via one or more communications channel(s) 356.

**[0437]** Fig. 7A is a block diagram of an embodiment of interior sensors 340 for a vehicle 104 is provided. The interior sensors 340 may be arranged into one or more groups, based at least partially on the function of the interior sensors 340. The interior space 108 of a vehicle 104 may include an environmental group 708, a user interface group 712, and a safety group 716. Additionally or alternatively, there may be sensors associated with various devices inside the vehicle (e.g., devices 212, 248, smart phones, tablets, mobile computers, etc.)

**[0438]** The environmental group 708 may comprise sensors configured to collect data relating to the internal environment of a vehicle 104. It is anticipated that the environment of the vehicle 104 may be subdivided into areas 508 and zones 512 in an interior space 108 of a vehicle 104. In this case, each area 508 and/or zone 512 may include one or more of the environmental sensors. Examples of environmental sensors associated with the environmental group 708 may include, but are not limited to, oxygen/air sensors 724, temperature sensors 728, humidity sensors 732, light/photo sensors 736, and more. The oxygen/air sensors 724 may be configured to detect a quality of the air in the interior space 108 of the vehicle 104 (e.g., ratios and/or types of gasses comprising the air inside the vehicle 104, dangerous gas levels, safe gas levels, etc.). Temperature sensors 728 may be configured to detect temperature readings of one or more objects, users 216, and/or areas 508 of a vehicle 104. Humidity sensors 732 may detect an amount of water vapor present in the air inside the vehicle 104. The light/photo sensors 736 can detect an amount of light

present in the vehicle 104. Further, the light/photo sensors 736 may be configured to detect various levels of light intensity associated with light in the vehicle 104.

**[0439]** The user interface group 712 may comprise sensors configured to collect data relating to one or more users 216 in a vehicle 104. As can be appreciated, the user interface group 712 may include sensors that are configured to collect data from users 216 in one or more areas 508 and zones 512 of the vehicle 104. For example, each area 508 and/or zone 512 of the vehicle 104 may include one or more of the sensors in the user interface group 712. Examples of user interface sensors associated with the user interface group 712 may include, but are not limited to, infrared sensors 740, motion sensors 744, weight sensors 748, wireless network sensors 752, biometric sensors 756, camera (or image) sensors 760, audio sensors 764, and more.

**[0440]** Infrared sensors 740 may be used to measure IR light irradiating from at least one surface, user 216, or other object in the vehicle 104. Among other things, the Infrared sensors 740 may be used to measure temperatures, form images (especially in low light conditions), identify users 216, and even detect motion in the vehicle 104.

**[0441]** The motion sensors 744 may be similar to the motion detectors 624A-B, as described in conjunction with Fig. 6B. Weight sensors 748 may be employed to collect data relating to objects and/or users 216 in various areas 508 of the vehicle 104. In some cases, the weight sensors 748 may be included in the seats and/or floor of a vehicle 104.

**[0442]** Optionally, the vehicle 104 may include a wireless network sensor 752. This sensor 752 may be configured to detect one or more wireless network(s) inside the vehicle 104. Examples of wireless networks may include, but are not limited to, wireless communications utilizing Bluetooth®, Wi-Fi™, ZigBee, IEEE 802.11, and other wireless technology standards. For example, a mobile hotspot may be detected inside the vehicle 104 via the wireless network sensor 752. In this case, the vehicle 104 may determine to utilize and/or share the mobile hotspot detected via/with one or more other devices 212, 248 and/or components associated with the vehicle 104.

**[0443]** Biometric sensors 756 may be employed to identify and/or record characteristics associated with a user 216. It is anticipated that biometric sensors 756 can include at least one of image sensors, IR sensors, fingerprint readers, weight sensors, load cells, force transducers, heart rate monitors, blood pressure monitors, and the like as provided herein.

**[0444]** The camera sensors 760 may be similar to image sensors 622A-B, as described in conjunction with Fig. 6B. Optionally, the camera sensors may record still images, video, and/or combinations thereof. The audio sensors 764 may be similar to the interior sound

receivers 692A-B, as described in conjunction with Figs. 6A-6B. The audio sensors may be configured to receive audio input from a user 216 of the vehicle 104. The audio input from a user 216 may correspond to voice commands, conversations detected in the vehicle 104, phone calls made in the vehicle 104, and/or other audible expressions made in the vehicle 104.

**[0445]** The safety group 716 may comprise sensors configured to collect data relating to the safety of a user 216 and/or one or more components of a vehicle 104. The vehicle 104 may be subdivided into areas 508 and/or zones 512 in an interior space 108 of a vehicle 104 where each area 508 and/or zone 512 may include one or more of the safety sensors provided herein. Examples of safety sensors associated with the safety group 716 may include, but are not limited to, force sensors 768, mechanical motion sensors 772, orientation sensors 776, restraint sensors 780, and more.

**[0446]** The force sensors 768 may include one or more sensors inside the vehicle 104 configured to detect a force observed in the vehicle 104. One example of a force sensor 768 may include a force transducer that converts measured forces (e.g., force, weight, pressure, etc.) into output signals.

**[0447]** Mechanical motion sensors 772 may correspond to encoders, accelerometers, damped masses, and the like. Optionally, the mechanical motion sensors 772 may be adapted to measure the force of gravity (i.e., G-force) as observed inside the vehicle 104. Measuring the G-force observed inside a vehicle 104 can provide valuable information related to a vehicle's acceleration, deceleration, collisions, and/or forces that may have been suffered by one or more users 216 in the vehicle 104. As can be appreciated, the mechanical motion sensors 772 can be located in an interior space 108 or an exterior of the vehicle 104.

**[0448]** Orientation sensors 776 can include accelerometers, gyroscopes, magnetic sensors, and the like that are configured to detect an orientation associated with the vehicle 104. Similar to the mechanical motion sensors 772, the orientation sensors 776 can be located in an interior space 108 or an exterior of the vehicle 104.

**[0449]** The restraint sensors 780 may be similar to the safety restraint sensors 679 as described in conjunction with Figs. 6A-6B. These sensors 780 may correspond to sensors associated with one or more restraint devices and/or systems in a vehicle 104. Seatbelts and airbags are examples of restraint devices and/or systems. As can be appreciated, the restraint devices and/or systems may be associated with one or more sensors that are configured to detect a state of the device/system. The state may include extension,

engagement, retraction, disengagement, deployment, and/or other electrical or mechanical conditions associated with the device/system.

**[0450]** The associated device sensors 720 can include any sensors that are associated with a device 212, 248 in the vehicle 104. As previously stated, typical devices 212, 248 may include smart phones, tablets, laptops, mobile computers, and the like. It is anticipated that the various sensors associated with these devices 212, 248 can be employed by the vehicle control system 204. For example, a typical smart phone can include, an image sensor, an IR sensor, audio sensor, gyroscope, accelerometer, wireless network sensor, fingerprint reader, and more. It is an aspect of the present disclosure that one or more of these associated device sensors 720 may be used by one or more subsystems of the vehicle system 200.

**[0451]** In Fig. 7B, a block diagram of an embodiment of exterior sensors 340 for a vehicle 104 is shown. The exterior sensors may include sensors that are identical, or substantially similar, to those previously disclosed in conjunction with the interior sensors of Fig. 7A. Optionally, the exterior sensors 340 may be configured to collect data relating to one or more conditions, objects, users 216, and other events that are external to the interior space 108 of the vehicle 104. For instance, the oxygen/air sensors 724 may measure a quality and/or composition of the air outside of a vehicle 104. As another example, the motion sensors 744 may detect motion outside of a vehicle 104.

**[0452]** The external environmental group 708E may comprise sensors configured to collect data relating to the external environment of a vehicle 104. In addition to including one or more of the sensors previously described, the external environmental group 708E may include additional sensors, such as, vehicle sensors 750, biological sensors, and wireless signal sensors 758. Vehicle sensors 750 can detect vehicles that are in an environment surrounding the vehicle 104. For example, the vehicle sensors 750 may detect vehicles in a first outside area 516, a second outside area 520, and/or combinations of the first and second outside areas 516, 520. Optionally, the vehicle sensors 750 may include one or more of RF sensors, IR sensors, image sensors, and the like to detect vehicles, people, hazards, etc. that are in an environment exterior to the vehicle 104. Additionally or alternatively, the vehicle sensors 750 can provide distance/directional information relating to a distance (e.g., distance from the vehicle 104 to the detected object) and/or a direction (e.g., direction of travel, etc.) associated with the detected object.

**[0453]** The biological sensors 754 may determine whether one or more biological entities (e.g., an animal, a person, a user 216, etc.) is in an external environment of the

vehicle 104. Additionally or alternatively, the biological sensors 754 may provide distance information relating to a distance of the biological entity from the vehicle 104. Biological sensors 754 may include at least one of RF sensors, IR sensors, image sensors and the like that are configured to detect biological entities. For example, an IR sensor may be used to determine that an object, or biological entity, has a specific temperature, temperature pattern, or heat signature. Continuing this example, a comparison of the determined heat signature may be compared to known heat signatures associated with recognized biological entities (e.g., based on shape, locations of temperature, and combinations thereof, etc.) to determine whether the heat signature is associated with a biological entity or an inanimate, or non-biological, object.

**[0454]** The wireless signal sensors 758 may include one or more sensors configured to receive wireless signals from signal sources such as Wi-Fi™ hotspots, cell towers, roadside beacons, other electronic roadside devices, and satellite positioning systems. Optionally, the wireless signal sensors 758 may detect wireless signals from one or more of a mobile phone, mobile computer, keyless entry device, RFID device, near field communications (NFC) device, and the like.

**[0455]** The external safety group 716E may comprise sensors configured to collect data relating to the safety of a user 216 and/or one or more components of a vehicle 104. Examples of safety sensors associated with the external safety group 716E may include, but are not limited to, force sensors 768, mechanical motion sensors 772, orientation sensors 776, vehicle body sensors 782, and more. Optionally, the exterior safety sensors 716E may be configured to collect data relating to one or more conditions, objects, vehicle components, and other events that are external to the vehicle 104. For instance, the force sensors 768 in the external safety group 716E may detect and/or record force information associated with the outside of a vehicle 104. For instance, if an object strikes the exterior of the vehicle 104, the force sensors 768 from the exterior safety group 716E may determine a magnitude, location, and/or time associated with the strike.

**[0456]** The vehicle 104 may include a number of vehicle body sensors 782. The vehicle body sensors 782 may be configured to measure characteristics associated with the body (e.g., body panels, components, chassis, windows, etc.) of a vehicle 104. For example, two vehicle body sensors 782, including a first body sensor and a second body sensor, may be located at some distance apart. Continuing this example, the first body sensor may be configured to send an electrical signal across the body of the vehicle 104 to the second body sensor, or vice versa. Upon receiving the electrical signal from the first body sensor,

the second body sensor may record a detected current, voltage, resistance, and/or combinations thereof associated with the received electrical signal. Values (e.g., current, voltage, resistance, etc.) for the sent and received electrical signal may be stored in a memory. These values can be compared to determine whether subsequent electrical signals sent and received between vehicle body sensors 782 deviate from the stored values. When the subsequent signal values deviate from the stored values, the difference may serve to indicate damage and/or loss of a body component. Additionally or alternatively, the deviation may indicate a problem with the vehicle body sensors 782. The vehicle body sensors 782 may communicate with each other, a vehicle control system 204, and/or systems of the vehicle system 200 via a communications channel 356. Although described using electrical signals, it should be appreciated that alternative embodiments of the vehicle body sensors 782 may use sound waves and/or light to perform a similar function.

**[0457]** Fig. 8A is a block diagram of an embodiment of a media controller subsystem 348 for a vehicle 104. The media controller subsystem 348 may include, but is not limited to, a media controller 804, a media processor 808, a match engine 812, an audio processor 816, a speech synthesis module 820, a network transceiver 824, a signal processing module 828, memory 832, and a language database 836. Optionally, the media controller subsystem 348 may be configured as a dedicated blade that implements the media-related functionality of the system 200. Additionally or alternatively, the media controller subsystem 348 can provide voice input, voice output, library functions for multimedia, and display control for various areas 508 and/or zones 512 of the vehicle 104.

**[0458]** Optionally, the media controller subsystem 348 may include a local IP address (e.g., IPv4, IPv6, combinations thereof, etc.) and even a routable, global unicast address. The routable, global unicast address may allow for direct addressing of the media controller subsystem 348 for streaming data from Internet resources (e.g., cloud storage, user accounts, etc.). It is anticipated, that the media controller subsystem 348 can provide multimedia via at least one Internet connection, or wireless network communications module, associated with the vehicle 104. Moreover, the media controller subsystem 348 may be configured to service multiple independent clients simultaneously.

**[0459]** The media processor 808 may comprise a general purpose programmable processor or controller for executing application programming or instructions related to the media subsystem 348. The media processor 808 may include multiple processor cores, and/or implement multiple virtual processors. Optionally, the media processor 808 may

include multiple physical processors. By way of example, the media processor 808 may comprise a specially configured application specific integrated circuit (ASIC) or other integrated circuit, a digital signal processor, a controller, a hardwired electronic or logic circuit, a programmable logic device or gate array, a special purpose computer, or the like. The media processor 808 generally functions to run programming code or instructions implementing various functions of the media controller 804.

**[0460]** The match engine 812 can receive input from one or more components of the vehicle system 800 and perform matching functions. Optionally, the match engine 812 may receive audio input provided via a microphone 886 of the system 800. The audio input may be provided to the media controller subsystem 348 where the audio input can be decoded and matched, via the match engine 812, to one or more functions available to the vehicle 104. Similar matching operations may be performed by the match engine 812 relating to video input received via one or more image sensors, cameras 878, and the like.

**[0461]** The media controller subsystem 348 may include a speech synthesis module 820 configured to provide audio output to one or more speakers 880, or audio output devices, associated with the vehicle 104. Optionally, the speech synthesis module 820 may be configured to provide audio output based at least partially on the matching functions performed by the match engine 812.

**[0462]** As can be appreciated, the coding/decoding, the analysis of audio input/output, and/or other operations associated with the match engine 812 and speech synthesis module 820, may be performed by the media processor 808 and/or a dedicated audio processor 816. The audio processor 816 may comprise a general purpose programmable processor or controller for executing application programming or instructions related to audio processing. Further, the audio processor 816 may be similar to the media processor 808 described herein.

**[0463]** The network transceiver 824 can include any device configured to transmit and receive analog and/or digital signals. Optionally, the media controller subsystem 348 may utilize a network transceiver 824 in one or more communication networks associated with the vehicle 104 to receive and transmit signals via the communications channel 356. Additionally or alternatively, the network transceiver 824 may accept requests from one or more devices 212, 248 to access the media controller subsystem 348. One example of the communication network is a local-area network (LAN). As can be appreciated, the functionality associated with the network transceiver 824 may be built into at least one

other component of the vehicle 104 (e.g., a network interface card, communications module, etc.).

**[0464]** The signal processing module 828 may be configured to alter audio/multimedia signals received from one or more input sources (e.g., microphones 886, etc.) via the communications channel 356. Among other things, the signal processing module 828 may alter the signals received electrically, mathematically, combinations thereof, and the like.

**[0465]** The media controller 804 may also include memory 832 for use in connection with the execution of application programming or instructions by the media processor 808, and for the temporary or long term storage of program instructions and/or data. As examples, the memory 832 may comprise RAM, DRAM, SDRAM, or other solid state memory.

**[0466]** The language database 836 may include the data and/or libraries for one or more languages, as are used to provide the language functionality as provided herein. In one case, the language database 836 may be loaded on the media controller 804 at the point of manufacture. Optionally, the language database 836 can be modified, updated, and/or otherwise changed to alter the data stored therein. For instance, additional languages may be supported by adding the language data to the language database 836. In some cases, this addition of languages can be performed via accessing administrative functions on the media controller 804 and loading the new language modules via wired (e.g., USB, etc.) or wireless communication. In some cases, the administrative functions may be available via a vehicle console device 248, a user device 212, 248, and/or other mobile computing device that is authorized to access administrative functions (e.g., based at least partially on the device's address, identification, etc.).

**[0467]** One or more video controllers 840 may be provided for controlling the video operation of the devices 212, 248, 882 associated with the vehicle. Optionally, the video controller 840 may include a display controller for controlling the operation of touch sensitive screens, including input (touch sensing) and output (display) functions. Video data may include data received in a stream and unpacked by a processor and loaded into a display buffer. In this example, the processor and video controller 840 can optimize the display based on the characteristics of a screen of a display device 212, 248, 882. The functions of a touch screen controller may be incorporated into other components, such as a media processor 808 or display subsystem.

**[0468]** The audio controller 844 can provide control of the audio entertainment system (e.g., radio, subscription music service, multimedia entertainment, etc.), and other audio

associated with the vehicle 104 (e.g., navigation systems, vehicle comfort systems, convenience systems, etc.). Optionally, the audio controller 844 may be configured to translate digital signals to analog signals and vice versa. As can be appreciated, the audio controller 844 may include device drivers that allow the audio controller 844 to communicate with other components of the system 800 (e.g., processors 816, 808, audio I/O 874, and the like).

**[0469]** The system 800 may include a profile identification module 848 to determine whether a user profile is associated with the vehicle 104. Among other things, the profile identification module 848 may receive requests from a user 216, or device 212, 228, 248, to access a profile stored in a profile database 856 or profile data 252. Additionally or alternatively, the profile identification module 848 may request profile information from a user 216 and/or a device 212, 228, 248, to access a profile stored in a profile database 856 or profile data 252. In any event, the profile identification module 848 may be configured to create, modify, retrieve, and/or store user profiles in the profile database 856 and/or profile data 252. The profile identification module 848 may include rules for profile identification, profile information retrieval, creation, modification, and/or control of components in the system 800.

**[0470]** By way of example, a user 216 may enter the vehicle 104 with a smart phone or other device 212. In response to determining that a user 216 is inside the vehicle 104, the profile identification module 848 may determine that a user profile is associated with the user's smart phone 212. As another example, the system 800 may receive information about a user 216 (e.g., from a camera 878, microphone 886, etc.), and, in response to receiving the user information, the profile identification module 848 may refer to the profile database 856 to determine whether the user information matches a user profile stored in the database 856. It is anticipated that the profile identification module 848 may communicate with the other components of the system to load one or more preferences, settings, and/or conditions based on the user profile. Further, the profile identification module 848 may be configured to control components of the system 800 based on user profile information.

**[0471]** Optionally, data storage 852 may be provided. Like the memory 832, the data storage 852 may comprise a solid state memory device or devices. Alternatively or in addition, the data storage 852 may comprise a hard disk drive or other random access memory. Similar to the data storage 852, the profile database 856 may comprise a solid state memory device or devices.

**[0472]** An input/output module 860 and associated ports may be included to support communications over wired networks or links, for example with other communication devices, server devices, and/or peripheral devices. Examples of an input/output module 860 include an Ethernet port, a Universal Serial Bus (USB) port, CAN Bus, Institute of Electrical and Electronics Engineers (IEEE) 1594, or other interface. Users may bring their own devices (e.g., Bring Your Own Device (BYOD), device 212, etc.) into the vehicle 104 for use with the various systems disclosed. Although most BYOD devices can connect to the vehicle systems (e.g., the media controller subsystem 348, etc.) via wireless communications protocols (e.g., Wi-Fi™, Bluetooth®, etc.) many devices may require a direct connection via USB, or similar. In any event, the input/output module 860 can provide the necessary connection of one or more devices to the vehicle systems described herein.

**[0473]** A video input/output interface 864 can be included to receive and transmit video signals between the various components in the system 800. Optionally, the video input/output interface 864 can operate with compressed and uncompressed video signals. The video input/output interface 864 can support high data rates associated with image capture devices. Additionally or alternatively, the video input/output interface 864 may convert analog video signals to digital signals.

**[0474]** The infotainment system 870 may include information media content and/or entertainment content, informational devices, entertainment devices, and the associated programming therefor. Optionally, the infotainment system 870 may be configured to handle the control of one or more components of the system 800 including, but in no way limited to, radio, streaming audio/video devices, audio devices 880, 882, 886, video devices 878, 882, travel devices (e.g., GPS, navigational systems, etc.), wireless communication devices, network devices, and the like. Further, the infotainment system 870 can provide the functionality associated with other infotainment features as provided herein.

**[0475]** An audio input/output interface 874 can be included to provide analog audio to an interconnected speaker 880 or other device, and to receive analog audio input from a connected microphone 886 or other device. As an example, the audio input/output interface 874 may comprise an associated amplifier and analog to digital converter. Alternatively or in addition, the devices 212, 248 can include integrated audio input/output devices 880, 886 and/or an audio jack for interconnecting an external speaker 880 or microphone 886. For example, an integrated speaker 880 and an integrated microphone

886 can be provided, to support near talk, voice commands, spoken information exchange, and/or speaker phone operations.

**[0476]** Among other things, the system 800 may include devices that are part of the vehicle 104 and/or part of a device 212, 248 that is associated with the vehicle 104. For instance, these devices may be configured to capture images, display images, capture sound, and present sound. Optionally, the system 800 may include at least one of image sensors/cameras 878, display devices 882, audio input devices/microphones 886, and audio output devices/speakers 880. The cameras 878 can be included for capturing still and/or video images. Alternatively or in addition, image sensors 878 can include a scanner or code reader. An image sensor/camera 878 can include or be associated with additional elements, such as a flash or other light source. In some cases, the display device 882 may include an audio input device and/or an audio output device in addition to providing video functions. For instance, the display device 882 may be a console, monitor, a tablet computing device, and/or some other mobile computing device.

**[0477]** Fig. 8B is a block diagram of an embodiment of a user/device interaction subsystem 817 in a vehicle system 800. The user/device interaction subsystem 817 may comprise hardware and/or software that conduct various operations for or with the vehicle 104. For instance, the user/device interaction subsystem 817 may include at least one user interaction subsystem 332 and device interaction subsystem 352 as previously described. These operations may include, but are not limited to, providing information to the user 216, receiving input from the user 216, and controlling the functions or operation of the vehicle 104, etc. Among other things, the user/device interaction subsystem 817 may include a computing system operable to conduct the operations as described herein.

**[0478]** Optionally, the user/device interaction subsystem 817 can include one or more of the components and modules provided herein. For instance, the user/device interaction subsystem 817 can include one or more of a video input/output interface 864, an audio input/output interface 874, a sensor module 814, a device interaction module 818, a user identification module 822, a vehicle control module 826, an environmental control module 830, and a gesture control module 834. The user/device interaction subsystem 817 may be in communication with other devices, modules, and components of the system 800 via the communications channel 356.

**[0479]** The user/device interaction subsystem 817 may be configured to receive input from a user 216 and/or device via one or more components of the system. By way of example, a user 216 may provide input to the user/device interaction subsystem 817 via



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wearable devices 802, 806, 810, video input (e.g., via at least one image sensor/camera 878, etc.) audio input (e.g., via the microphone, audio input source, etc.), gestures (e.g., via at least one image sensor 878, motion sensor 888, etc.), device input (e.g., via a device 212, 248 associated with the user, etc.), combinations thereof, and the like.

**[0480]** The wearable devices 802, 806, 810 can include heart rate monitors, blood pressure monitors, glucose monitors, pedometers, movement sensors, wearable computers, and the like. Examples of wearable computers may be worn by a user 216 and configured to measure user activity, determine energy spent based on the measured activity, track user sleep habits, determine user oxygen levels, monitor heart rate, provide alarm functions, and more. It is anticipated that the wearable devices 802, 806, 810 can communicate with the user/device interaction subsystem 817 via wireless communications channels or direct connection (e.g., where the device docks, or connects, with a USB port or similar interface of the vehicle 104).

**[0481]** A sensor module 814 may be configured to receive and/or interpret input provided by one or more sensors in the vehicle 104. In some cases, the sensors may be associated with one or more user devices (e.g., wearable devices 802, 806, 810, smart phones 212, mobile computing devices 212, 248, and the like). Optionally, the sensors may be associated with the vehicle 104, as described in conjunction with Figs. 6A-7B.

**[0482]** The device interaction module 818 may communicate with the various devices as provided herein. Optionally, the device interaction module 818 can provide content, information, data, and/or media associated with the various subsystems of the vehicle system 800 to one or more devices 212, 248, 802, 806, 810, 882, etc. Additionally or alternatively, the device interaction module 818 may receive content, information, data, and/or media associated with the various devices provided herein.

**[0483]** The user identification module 822 may be configured to identify a user 216 associated with the vehicle 104. The identification may be based on user profile information that is stored in profile data 252. For instance, the user identification module 822 may receive characteristic information about a user 216 via a device, a camera, and/or some other input. The received characteristics may be compared to data stored in the profile data 252. Where the characteristics match, the user 216 is identified. As can be appreciated, where the characteristics do not match a user profile, the user identification module 822 may communicate with other subsystems in the vehicle 104 to obtain and/or record profile information about the user 216. This information may be stored in a memory and/or the profile data storage 252.

**[0484]** The vehicle control module 826 may be configured to control settings, features, and/or the functionality of a vehicle 104. In some cases, the vehicle control module 826 can communicate with the vehicle control system 204 to control critical functions (e.g., driving system controls, braking, accelerating, etc.) and/or noncritical functions (e.g., driving signals, indicator/hazard lights, mirror controls, window actuation, etc.) based at least partially on user/device input received by the user/device interaction subsystem 817.

**[0485]** The environmental control module 830 may be configured to control settings, features, and/or other conditions associated with the environment, especially the interior environment, of a vehicle 104. Optionally, the environmental control module 830 may communicate with the climate control system (e.g. changing cabin temperatures, fan speeds, air direction, etc.), oxygen and/or air quality control system (e.g., increase/decrease oxygen in the environment, etc.), interior lighting (e.g., changing intensity of lighting, color of lighting, etc.), an occupant seating system 648 (e.g., adjusting seat position, firmness, height, etc.), steering wheel 640 (e.g., position adjustment, etc.), infotainment/entertainment system (e.g., adjust volume levels, display intensity adjustment, change content, etc.), and/or other systems associated with the vehicle environment. Additionally or alternatively, these systems can provide input, set-points, and/or responses, to the environmental control module 830. As can be appreciated, the environmental control module 830 may control the environment based at least partially on user/device input received by the user/device interaction subsystem 817.

**[0486]** The gesture control module 834 is configured to interpret gestures provided by a user 216 in the vehicle 104. Optionally, the gesture control module 834 may provide control signals to one or more of the vehicle systems 300 disclosed herein. For example, a user 216 may provide gestures to control the environment, critical and/or noncritical vehicle functions, the infotainment system, communications, networking, and more. Optionally, gestures may be provided by a user 216 and detected via one or more of the sensors as described in conjunction with Figs. 6B-7A. As another example, one or more motion sensors 888 may receive gesture input from a user 216 and provide the gesture input to the gesture control module 834. Continuing this example, the gesture input is interpreted by the gesture control module 834. This interpretation may include comparing the gesture input to gestures stored in a memory. The gestures stored in memory may include one or more functions and/or controls mapped to specific gestures. When a match is determined between the detected gesture input and the stored gesture information, the

gesture control module 834 can provide a control signal to any of the systems/subsystems as disclosed herein.

**[0487]** Fig. 8C illustrates a GPS/Navigation subsystem(s) 336. The Navigation subsystem(s) 336 can be any present or future-built navigation system that may use location data, for example, from the Global Positioning System (GPS), to provide navigation information or control the vehicle 104. The Navigation subsystem(s) 336 can include several components or modules, such as, one or more of, but not limited to, a GPS Antenna/receiver 892, a location module 896, a maps database 8100, an automobile controller 8104, a vehicle systems transceiver 8108, a traffic controller 8112, a network traffic transceiver 8116, a vehicle-to-vehicle transceiver 8120, a traffic information database 8124, etc. Generally, the several components or modules 892-8124 may be hardware, software, firmware, computer readable media, or combinations thereof.

**[0488]** A GPS Antenna/receiver 892 can be any antenna, GPS puck, and/or receiver capable of receiving signals from a GPS satellite or other navigation system, as mentioned hereinbefore. The signals may be demodulated, converted, interpreted, etc. by the GPS Antenna/receiver 892 and provided to the location module 896. Thus, the GPS Antenna/receiver 892 may convert the time signals from the GPS system and provide a location (e.g., coordinates on a map) to the location module 896. Alternatively, the location module 896 can interpret the time signals into coordinates or other location information.

**[0489]** The location module 896 can be the controller of the satellite navigation system designed for use in automobiles. The location module 896 can acquire position data, as from the GPS Antenna/receiver 892, to locate the user or vehicle 104 on a road in the unit's map database 8100. Using the road database 8100, the location module 896 can give directions to other locations along roads also in the database 8100. When a GPS signal is not available, the location module 896 may apply dead reckoning to estimate distance data from sensors 242 including one or more of, but not limited to, a speed sensor attached to the drive train of the vehicle 104, a gyroscope, an accelerometer, etc. GPS signal loss and/or multipath can occur due to urban canyons, tunnels, and other obstructions. Additionally or alternatively, the location module 896 may use known locations of Wi-Fi hotspots, cell tower data, etc. to determine the position of the vehicle 104, such as by using time difference of arrival (TDOA) and/or frequency difference of arrival (FDOA) techniques.

**[0490]** The maps database 8100 can include any hardware and/or software to store information about maps, geographical information system information, location information, etc. The maps database 8100 can include any data definition or other structure to store the information. Generally, the maps database 8100 can include a road database that may include one or more vector maps of areas of interest. Street names, street numbers, house numbers, and other information can be encoded as geographic coordinates so that the user can find some desired destination by street address. Points of interest (waypoints) can also be stored with their geographic coordinates. For example, a point of interest may include speed cameras, fuel stations, public parking, and "parked here" (or "you parked here") information. The map database contents can be produced or updated by a server connected through a wireless system in communication with the Internet, even as the vehicle 104 is driven along existing streets, yielding an up-to-date map.

**[0491]** An automobile controller 8104 can be any hardware and/or software that can receive instructions from the location module 896 or the traffic controller 8112 and operate the vehicle 104. The automobile controller 8104 receives this information and data from the sensors 242 to operate the vehicle 104 without driver input. Thus, the automobile controller 8104 can drive the vehicle 104 along a route provided by the location module 896. The route may be adjusted by information sent from the traffic controller 8112. Discrete and real-time driving can occur with data from the sensors 242. To operate the vehicle 104, the automobile controller 8104 can communicate with a vehicle systems transceiver 8108.

**[0492]** The vehicle systems transceiver 8108 can be any present or future-developed device that can comprise a transmitter and/or a receiver, which may be combined and can share common circuitry or a single housing. The vehicle systems transceiver 8108 may communicate or instruct one or more of the vehicle control subsystems 328. For example, the vehicle systems transceiver 8108 may send steering commands, as received from the automobile controller 8104, to an electronic steering system, to adjust the steering of the vehicle 100 in real time. The automobile controller 8104 can determine the effect of the commands based on received sensor data 242 and can adjust the commands as need be. The vehicle systems transceiver 8108 can also communicate with the braking system, the engine and drive train to speed or slow the car, the signals (e.g., turn signals and brake lights), the headlights, the windshield wipers, etc. Any of these communications may occur over the components or function as described in conjunction with Fig. 4.

**[0493]** A traffic controller 8112 can be any hardware and/or software that can communicate with an automated traffic system and adjust the function of the vehicle 104 based on instructions from the automated traffic system. An automated traffic system is a system that manages the traffic in a given area. This automated traffic system can instruct cars to drive in certain lanes, instruct cars to raise or lower their speed, instruct a car to change their route of travel, instruct cars to communicate with other cars, etc. To perform these functions, the traffic controller 8112 may register the vehicle 104 with the automated traffic system and then provide other information including the route of travel. The automated traffic system can return registration information and any required instructions. The communications between the automated traffic system and the traffic controller 8112 may be received and sent through a network traffic transceiver 8116.

**[0494]** The network traffic transceiver 8116 can be any present or future-developed device that can comprise a transmitter and/or a receiver, which may be combined and can share common circuitry or a single housing. The network traffic transceiver 8116 may communicate with the automated traffic system using any known or future-developed, protocol, standard, frequency, bandwidth range, etc. The network traffic transceiver 8116 enables the sending of information between the traffic controller 8112 and the automated traffic system.

**[0495]** The traffic controller 8112 can also communicate with another vehicle, which may be in physical proximity (i.e., within range of a wireless signal), using the vehicle-to-vehicle transceiver 8120. As with the network traffic transceiver 8116, the vehicle-to-vehicle transceiver 8120 can be any present or future-developed device that can comprise a transmitter and/or a receiver, which may be combined and can share common circuitry or a single housing. Generally, the vehicle-to-vehicle transceiver 8120 enables communication between the vehicle 104 and any other vehicle. These communications allow the vehicle 104 to receive traffic or safety information, control or be controlled by another vehicle, establish an alternative communication path to communicate with the automated traffic system, establish a node including two or more vehicle that can function as a unit, etc. The vehicle-to-vehicle transceiver 8120 may communicate with the other vehicles using any known or future-developed, protocol standard, frequency, bandwidth range, etc.

**[0496]** The traffic controller 8112 can control functions of the automobile controller 8104 and communicate with the location module 896. The location module 896 can provide current location information and route information that the traffic controller 8112

may then provide to the automated traffic system. The traffic controller 8112 may receive route adjustments from the automated traffic system that are then sent to the location module 896 to change the route. Further, the traffic controller 8112 can also send driving instructions to the automobile controller 8104 to change the driving characteristics of the vehicle 104. For example, the traffic controller 8112 can instruct the automobile controller 8104 to accelerate or decelerate to a different speed, change lanes, or perform another driving maneuver. The traffic controller 8112 can also manage vehicle-to-vehicle communications and store information about the communications or other information in the traffic information database 8124.

**[0497]** The traffic information database 8124 can be any type of database, such as relational, hierarchical, object-oriented, and/or the like. The traffic information database 8124 may reside on a storage medium local to (and/or resident in) the vehicle control system 204 or in the vehicle 104. The traffic information database 8124 may be adapted to store, update, and retrieve information about communications with other vehicles or any active instructions from the automated traffic system. This information may be used by the traffic controller 8112 to instruct or adjust the performance of driving maneuvers.

**[0498]** Fig. 9 illustrates an optional communications architecture where, the host device 908 may include one more routing profiles, permission modules, and rules that control how communications within the vehicle 104 are to occur. This communications architecture can be used in conjunction with the routing tables, rules and permissions associated with access point 456 and optional firewall 484, or can be in lieu thereof. For example, the host device 908 acts as a mobile hot spot to one or more other devices within vehicle 104, such as, other device 1 912, other device 2 916, other device 3 920, and other device N 924. Optionally, one or more of the other devices 912 can communicate directly with the host device 908 which then provides Internet access to those devices 912 via the device 908. The host device 908 can act as a mobile hot spot for any one or more of the other devices 912, which may not need to communicate over the network/communications buses 224/404, but could instead connect directly to the host device 908 via, for example, NFC, Bluetooth®, WiFi, or the like. When the device 908 is acting as the host device, the device 908 can include one or more routing profiles, permissions, rules modules, and can also act as a firewall for the various inter and intra vehicle communications.

**[0499]** As will be appreciated, there could be alternative host devices, such as, host 904 which could also act as, for example, a co-host in association with device 908. Optionally, one or more of the routing profile, permission information, and rules could be shared

between the co-host devices 904, 908, both of those devices being usable for Internet access for one or more of the other devices, 912-924. As will be appreciated, the other devices 912-924 need not necessarily connect to one or more of host device 908 and the other device 904 via a direct communications link, but could also interface with those devices 904, 908 utilizing the network /communications buses 224/404 associated with the vehicle100. As previously discussed, one or more of the other devices can connect to the network/communications buses 224/404 utilizing the various networks and/or buses discussed herein which would therefore enable, for example, regulation of the various communications based on the Ethernet zone that the other device 912 is associated with.

**[0500]** An embodiment of one or more modules that may be associated with the vehicle control system 204 may be as shown in Fig. 10. The modules can include a communication subsystem interface 1008 in communication with an operating system 1004. The communications may pass through a firewall 1044. The firewall 1044 can be any software that can control the incoming and outgoing communications by analyzing the data packets and determining whether the packets should be allowed through the firewall, based on applied rule set. A firewall 1044 can establish a "barrier" between a trusted, secure internal network and another network (e.g., the Internet) that is not assumed to be secure and trusted.

**[0501]** In some situations, the firewall 1044 may establish security zones that are implemented by running system services and/or applications in restricted user groups and accounts. A set of configuration files and callbacks may then be linked to an IP table firewall. The IP table firewall can be configured to notify a custom filter application at any of the layers of the Ethernet packet. The different users/group rights to access the system may include: system users, which may have exclusive right over all device firewall rules and running software; a big-brother user, which may have access to on board device (OBD) control data and may be able to communicate with the vehicle subsystem 328 and may be able to alter the parameters in the vehicle control system 204; a dealer user, which can have rights to read OBD data for diagnostics and repairs; a dashboard user, which can have rights to launch dashboard applications and/or authenticate guest users and change their permissions to trusted/friend/family, and can read but cannot write into OBD diagnostic data; a world wide web (WWW) data user, which can have HTTP rights to respond to HTTP requests (the HTTP requests also can target different user data, but may be filtered by default user accounts); a guest user, which may have no rights; a

family/friend user, which may have rights to play media from the media subsystem 348 and/or to stream media to the media subsystem 348.

**[0502]** The operating system 1004 can be a collection of software that manages computer hardware resources and provides common services for applications and other programs. The operating system 1004 may schedule time-sharing for efficient use of the system. For hardware functions, such as input, output, and memory allocation, the operating system 1004 can act as an intermediary between applications or programs and the computer hardware. Examples of operating systems that may be deployed as operating system 1004 include Android, BSD, iOS, Linux, OS X, QNX, Microsoft Windows, Windows Phone, IBM z/OS, etc.

**[0503]** The operating system 1004 can include one or more sub-modules. For example, a desktop manager 1012 can manage one or more graphical user interfaces (GUI) in a desktop environment. Desktop GUIs can help the user to easily access and edit files. A command-line interface (CLI) may be used if full control over the operating system (OS) 1004 is required. The desktop manager 1012 is described further hereinafter.

**[0504]** A kernel 1028 can be a computer program that manages input/output requests from software and translates them into data processing instructions for the processor 304 and other components of the vehicle control system 204. The kernel 1028 is the fundamental component of the operating system 1004 that can execute many of the functions associated with the OS 1004.

**[0505]** The kernel 1028 can include other software functions, including, but not limited to, driver(s) 1056, communication software 1052, and/or Internet Protocol software 1048. A driver 1056 can be any computer program that operates or controls a particular type of device that is attached to a vehicle control system 204. A driver 1056 can communicate with the device through the bus 356 or communications subsystem 1008 to which the hardware connects. When a calling program invokes a routine in the driver 1056, the driver 1056 may issue one or more commands to the device. Once the device sends data back to the driver 1056, the driver 1056 may invoke routines in the original calling program. Drivers can be hardware-dependent and operating-system-specific. Driver(s) 1056 can provide the interrupt handling required for any necessary asynchronous time-dependent hardware interface.

**[0506]** The IP module 1048 can conduct any IP addressing, which may include the assignment of IP addresses and associated parameters to host interfaces. The address space may include networks and sub-networks. The IP module 1048 can perform the



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designation of network or routing prefixes and may conduct IP routing, which transports packets across network boundaries. Thus, the IP module 1048 may perform all functions required for IP multicast operations.

**[0507]** The communications module 1052 may conduct all functions for communicating over other systems or using other protocols not serviced by the IP module 1048. Thus, the communications module 1052 can manage multicast operations over other busses or networks not serviced by the IP module 1048. Further, the communications module 1052 may perform or manage communications to one or more devices, systems, data stores, services, etc. that are in communication with the vehicle control system 204 or other subsystems through the firewall 1044. Thus, the communications module 1052 can conduct communications through the communication subsystem interface 1008.

**[0508]** A file system 1016 may be any data handling software that can control how data is stored and retrieved. The file system 1016 can separate the stored data into individual pieces, and giving each piece a name, can easily separate and identify the pieces of data. Each piece of data may be considered a "file". The file system 1016 can construct data structure and logic rules used to manage the information and the identifiers for the information. The structure and logic rules can be considered a "file system."

**[0509]** A device discovery daemon 1020 may be a computer program that runs as a background process that can discover new devices that connect with the network 356 or communication subsystem 1008 or devices that disconnect from the network 356 or communication subsystem 1008. The device discovery daemon 1020 can ping the network 356 (the local subnet) when the vehicle 104 starts, when a vehicle door opens or closes, or upon the occurrence of other events. Additionally or alternatively, the device discovery daemon 1020 may force Bluetooth®, USB, and/or wireless detection. For each device that responds to the ping, the device discovery daemon 1020 can populate the system data 208 with device information and capabilities, using any of one or more protocols, including one or more of, but not limited to, IPv6 Hop-by-Hop Option (HOPOPT), Internet Control Message Protocol (ICMP), Internet Group Management Protocol (IGMP), Gateway-to-Gateway Protocol (GGP), Internet Protocol (IP), Internet Stream Protocol (ST), Transmission Control Protocol (TCP), Exterior Gateway Protocol (EGP), CHAOS, User Datagram Protocol (UDP), etc.

**[0510]** For example, the device discovery daemon 1020 can determine device capabilities based on the opened ports the device exposes. If a camera exposes port 80, then the device discovery daemon 1020 can determine that the camera is using a Hypertext

Transfer Protocol (HTTP). Alternatively, if a device is supporting Universal Plug and Play (UPnP), the system data 208 can include more information, for example, a camera control universal resource locator (URL), a camera zoom URL, etc. When a scan stops, the device discovery daemon 1020 can trigger a dashboard refresh to ensure the user interface reflects the new devices on the desktop.

**[0511]** A desktop manager 1012 may be a computer program that manages the user interface of the vehicle control system 204. The desktop environment may be designed to be customizable and allow the definition of the desktop configuration look-and-feel for a wide range of appliances or devices from computer desktops, mobile devices, computer tablets, etc. Launcher(s), panels, desktop areas, the desktop background, notifications, panes, etc., can be configured from a dashboard configuration file managed by the desktop manager 1012. The graphical elements in which the desktop manager 1012 controls can include launchers, the desktop, notification bars, etc.

**[0512]** The desktop may be an area of the display where the applications are running. The desktop can have a custom background. Further, the desktop may be divided into two or more areas. For example, the desktop may be divided into an upper half of a display and a lower half of the display. Each application can be configured to run in a portion of the desktop. Extended settings can be added to the desktop configuration file, such that, some objects may be displayed over the whole desktop or in custom size out of the context of the divided areas.

**[0513]** The notification bar may be a part of a bar display system, which may provide notifications by displaying, for example, icons and/or pop-up windows that may be associated with sound notifications. The notification mechanism can be designed for separate plug-ins, which run in separate processes and may subscribe to a system Intelligent Input Bus (IBUS)/D-BUS event service. The icons on the notifications bar can be accompanied with application short-cuts to associated applications, for example, a Bluetooth® manager, a USB manager, radio volume and or tone control, a security firewall, etc.

**[0514]** The desktop manager 1012 may include a windows manager 1032, an application launcher 1036, and/or a panel launcher 1040. Each of these components can control a different aspect of the user interface. The desktop manager 1012 can use a root window to create panels that can include functionality for one or more of, but not limited to: launching applications, managing applications, providing notifications, etc.

**[0515]** The windows manager 1032 may be software that controls the placement and appearance of windows within a graphical user interface presented to the user. Generally, the windows manager 1032 can provide the desktop environment used by the vehicle control system 204. The windows manager 1032 can communicate with the kernel 1028 to interface with the graphical system that provides the user interface(s) and supports the graphics hardware, pointing devices, keyboard, touch-sensitive screens, etc. The windows manager 1032 may be a tiling window manager (i.e., a window manager with an organization of the screen into mutually non-overlapping frames, as opposed to a coordinate-based stacking of overlapping objects (windows) that attempts to fully emulate the desktop metaphor). The windows manager 1032 may read and store configuration files, in the system data 208, which can control the position of the application windows at precise positions.

**[0516]** An application manager 1036 can control the function of any application over the lifetime of the process. The process or application can be launched from a panel launcher 1040 or from a remote console. The application manager 1036 can intercept the process name and may take appropriate action to manage that process. If the process is not running, the application manager 1036 can load the process and may bring the process to a foreground in a display. The application manager 1036 may also notify the windows manager 1032 to bring the associated window(s) to a top of a window stack for the display. When a process starts from a shell or a notification out of the context of the desktop, the application manager 1036 can scan files to match the process name with the entry name provided. When a match is found, the application manager 1036 can configure the process according to a settings file.

**[0517]** In some situations, the application manager 1036 may restrict an application as singleton (i.e., restricts the instantiation of a class to one object). If an application is already running and the application manager 1036 is asked to run the application again, the application manager 1036 can bring the running process to a foreground on a display. There can be a notification event exchange between the windows manager 1032 and the application manager 1036 for activating the appropriate window for the foreground process. Once an application is launched, the application may not be terminated or killed. The application can be sent to the background, except, possibly, for some applications (e.g., media player, Bluetooth®, notifications, etc.), which may be given a lowest process priority.

**[0518]** The panel launcher 1040 can be a widget configured to be placed along a portion of the display. The panel launcher 1040 may be built from desktop files from a desktop folder. The desktop folder location can be configured by a configuration file stored in system data 208. The panel launcher 1040 can allow for the launching or executing of applications or processes by receiving inputs from a user interface to launch programs.

**[0519]** A desktop plugin 1024 may be a software component that allows for customization of the desktop or software interface through the initiation of plug-in applications.

**[0520]** One or more gestures used to interface with the vehicle control system 204 may be as described in conjunction with Fig. 11A through 11K. Figs. 11A through 11H depict various graphical representations of gesture inputs that may be recognized by the devices 212, 248. The gestures may be performed not only by a user's body part, such as a digit, but also by other devices, such as a stylus, that may be sensed by the contact sensing portion(s) of a screen associated with the device 212, 248. In general, gestures are interpreted differently, based on where the gestures are performed (either directly on a display or in a gesture capture region). For example, gestures in a display may be directed to a desktop or application, and gestures in a gesture capture region may be interpreted as for the system.

**[0521]** With reference to Figs. 11A-11H, a first type of gesture, a touch gesture 1120, is substantially stationary on a portion (e.g., a screen, a display, etc.) of a device 212, 248 for a selected length of time. A circle 1128 represents a touch or other contact type received at particular location of a contact sensing portion of the screen. The circle 1128 may include a border 1132, the thickness of which indicates a length of time that the contact is held substantially stationary at the contact location. For instance, a tap 1120 (or short press) has a thinner border 1132A than the border 1132B for a long press 1124 (or for a normal press). The long press 1124 may involve a contact that remains substantially stationary on the screen for longer time period than that of a tap 1120. As will be appreciated, differently defined gestures may be registered depending upon the length of time that the touch remains stationary prior to contact cessation or movement on the screen.

**[0522]** With reference to Fig. 11C, a drag gesture 1100 on the screen is an initial contact (represented by circle 1128) with contact movement 1136 in a selected direction. The initial contact 1128 may remain stationary on the screen for a certain amount of time represented by the border 1132. The drag gesture typically requires the user to contact an

icon, window, or other displayed image at a first location followed by movement of the contact in a drag direction to a new second location desired for the selected displayed image. The contact movement need not be in a straight line but have any path of movement so long as the contact is substantially continuous from the first to the second locations.

**[0523]** With reference to Fig. 11D, a flick gesture 1104 on the screen is an initial contact (represented by circle 1128) with truncated contact movement 1136 (relative to a drag gesture) in a selected direction. A flick may have a higher exit velocity for the last movement in the gesture compared to the drag gesture. The flick gesture can, for instance, be a finger snap following initial contact. Compared to a drag gesture, a flick gesture generally does not require continual contact with the screen from the first location of a displayed image to a predetermined second location. The contacted displayed image is moved by the flick gesture in the direction of the flick gesture to the predetermined second location. Although both gestures commonly can move a displayed image from a first location to a second location, the temporal duration and distance of travel of the contact on the screen is generally less for a flick than for a drag gesture.

**[0524]** With reference to Fig. 11E, a pinch gesture 1108 on the screen is depicted. The pinch gesture 1108 may be initiated by a first contact 1128A to the screen by, for example, a first digit and a second contact 1128B to the screen by, for example, a second digit. The first and second contacts 1128A,B may be detected by a common contact sensing portion of a common screen, by different contact sensing portions of a common screen, or by different contact sensing portions of different screens. The first contact 1128A is held for a first amount of time, as represented by the border 1132A, and the second contact 1128B is held for a second amount of time, as represented by the border 1132B. The first and second amounts of time are generally substantially the same, and the first and second contacts 1128A,B generally occur substantially simultaneously. The first and second contacts 1128A,B generally also include corresponding first and second contact movements 1136A,B, respectively. The first and second contact movements 1136A,B are generally in opposing directions. Stated another way, the first contact movement 1136A is towards the second contact 1136B, and the second contact movement 1136B is towards the first contact 1136A. More simply stated, the pinch gesture 1108 may be accomplished by a user's digits touching the screen in a pinching motion.

**[0525]** With reference to Fig. 11F, a spread gesture 1110 on the screen is depicted. The spread gesture 1110 may be initiated by a first contact 1128A to the screen by, for

example, a first digit, and a second contact 1128B to the screen by, for example, a second digit. The first and second contacts 1128A,B may be detected by a common contact sensing portion of a common screen, by different contact sensing portions of a common screen, or by different contact sensing portions of different screens. The first contact 1128A is held for a first amount of time, as represented by the border 1132A, and the second contact 1128B is held for a second amount of time, as represented by the border 1132B. The first and second amounts of time are generally substantially the same, and the first and second contacts 1128A,B generally occur substantially simultaneously. The first and second contacts 1128A,B generally also include corresponding first and second contact movements 1136A,B, respectively. The first and second contact movements 1136A,B are generally in an opposing direction. Stated another way, the first and second contact movements 1136A,B are away from the first and second contacts 1128A,B. More simply stated, the spread gesture 1110 may be accomplished by a user's digits touching the screen in a spreading motion.

**[0526]** The above gestures may be combined in any manner, such as those shown by Figs. 11G and 11H, to produce a determined functional result. For example, in Fig. 11G a tap gesture 1120 is combined with a drag or flick gesture 1112 in a direction away from the tap gesture 1120. In Fig. 11H, a tap gesture 1120 is combined with a drag or flick gesture 1116 in a direction towards the tap gesture 1120.

**[0527]** The functional result of receiving a gesture can vary depending on a number of factors, including a state of the vehicle 104, display, or screen of a device, a context associated with the gesture, or sensed location of the gesture, etc. The state of the vehicle 104 commonly refers to one or more of a configuration of the vehicle 104, a display orientation, and user and other inputs received by the vehicle 104. Context commonly refers to one or more of the particular application(s) selected by the gesture and the portion(s) of the application currently executing, whether the application is a single- or multi-screen application, and whether the application is a multi-screen application displaying one or more windows. A sensed location of the gesture commonly refers to whether the sensed set(s) of gesture location coordinates are on a touch sensitive display or a gesture capture region of a device 212, 248, whether the sensed set(s) of gesture location coordinates are associated with a common or different display, or screen, or device 212, 248, and/or what portion of the gesture capture region contains the sensed set(s) of gesture location coordinates.

**[0528]** A tap, when received by a touch sensitive display of a device 212, 248, can be used, for instance, to select an icon to initiate or terminate execution of a corresponding application, to maximize or minimize a window, to reorder windows in a stack, and/or to provide user input such as by keyboard display or other displayed image. A drag, when received by a touch sensitive display of a device 212, 248, can be used, for instance, to relocate an icon or window to a desired location within a display, to reorder a stack on a display, or to span both displays (such that the selected window occupies a portion of each display simultaneously). A flick, when received by a touch sensitive display of a device 212, 248 or a gesture capture region, can be used to relocate a window from a first display to a second display or to span both displays (such that the selected window occupies a portion of each display simultaneously). Unlike the drag gesture, however, the flick gesture is generally not used to move the displayed image to a specific user-selected location but to a default location that is not configurable by the user.

**[0529]** The pinch gesture, when received by a touch sensitive display or a gesture capture region of a device 212, 248, can be used to minimize or otherwise increase the displayed area or size of a window (typically when received entirely by a common display), to switch windows displayed at the top of the stack on each display to the top of the stack of the other display (typically when received by different displays or screens), or to display an application manager (a "pop-up window" that displays the windows in the stack). The spread gesture, when received by a touch sensitive display or a gesture capture region of a device 212, 248, can be used to maximize or otherwise decrease the displayed area or size of a window, to switch windows displayed at the top of the stack on each display to the top of the stack of the other display (typically when received by different displays or screens), or to display an application manager (typically when received by an off-screen gesture capture region on the same or different screens).

**[0530]** The combined gestures of Fig. 11G, when received by a common display capture region in a common display or screen of a device 212, 248, can be used to hold a first window location constant for a display receiving the gesture while reordering a second window location to include a window in the display receiving the gesture. The combined gestures of Fig. 11H, when received by different display capture regions in a common display or screen of a device 212, 248 or in different displays or screens of one more devices 212, 248, can be used to hold a first window location for a display receiving the tap part of the gesture while reordering a second window location to include a window in the display receiving the flick or drag gesture. Although specific gestures and gesture

capture regions in the preceding examples have been associated with corresponding sets of functional results, it is to be appreciated that these associations can be redefined in any manner to produce differing associations between gestures and/or gesture capture regions and/or functional results.

**[0531]** Gestures that may be completed in three-dimensional space and not on a touch sensitive screen or gesture capture region of a device 212, 248 may be as shown in Figs. 11I-11K. The gestures may be completed in an area where a sensor, such as an optical sensor, infrared sensor, or other type of sensor, may detect the gesture. For example, the gesture 1140 in Fig. 11I may be executed by a person when the person opens their hand 1164 and moves their hand in a back and forth direction 1148 as a gesture 1140 to complete some function with the vehicle 104. For example gesture 1140 may change the station of the radio in the vehicle 104. The sensors 242 may both determine the configuration of the hand 1164 and the vector of the movement. The vector and hand configuration can be interpreted to mean certain things to the vehicle control system 204 and produce different results.

**[0532]** In another example of a gesture 1152 in Fig. 11J, a user may configure their hand 1164 to extend two fingers and move the hand 1164 in an up and down operation 1156. This gesture 1152 may control the volume of the radio or some other function. For instance, this gesture 1152 may be configured to place the vehicle in a "valet" mode to, among other things, restrict access to certain features associated with the vehicle. Again, the sensors 242 may determine how the person has configured their hand 1164, and the vector of the movement. In another example of a gesture 1160 shown in Fig. 11K, a user may extend their middle three fingers at an angle that is substantially 45° for vertical from straight vertical and circle the hand in a counter-clockwise motion 1166. This gesture 1160 may cause the automobile to change the heat setting or do some other function. As can be understood by one skilled in the art, the configurations of the hand and the types of movement are variable. Thus, the user may configure the hand 1164 in any way imaginable and may also move that hand 1164 in any direction with any vector in three-dimensional space.

**[0533]** The gestures 1140, 1152, 1160, as shown in Figs. 11I-11K, may occur in a predetermined volume of space within the vehicle 104. For example, a sensor may be configured to identify such gestures 1140, 1152, 1160 between the front passenger's and front driver's seats over a console area within the passenger compartment of the vehicle 104. The gestures 1140, 1152, 1160 may be made within area 1 508A between zones A

512A and B 512B. However, there may be other areas 508 where a user may use certain gestures, where sensors 242 may be able to determine a certain function is desired. Gestures that may be similar but used in different areas within the vehicle 104 may cause different functions to be performed. For example, the gesture 1140 in Fig. 11I, if used in zone E 512E, may change the heat provided in zone E 512E, but may change the station of a radio if used in zone A 512A and/or zone B 512B. Further, the gestures may be made with other body parts or, for example, different expressions of a person's face and may be used to control functions in the vehicle 104. Also, the user may use two hands in some circumstances or do other types of physical movements that can cause different reactions in the vehicle 104.

**[0534]** Figs. 12A-12D show various embodiments of a data structure 1200 to store different settings. The data structure 1200 may include one or more of data files or data objects 1204, 1250, 1270, 1280. Thus, the data structure 1200 may represent different types of databases or data storage, for example, object-oriented data bases, flat file data structures, relational database, or other types of data storage arrangements. Embodiments of the data structure 1200 disclosed herein may be separate, combined, and/or distributed. As indicated in Figs. 12A-12D, there may be more or fewer portions in the data structure 1200, as represented by ellipses 1244. Further, there may be more or fewer files in the data structure 1200, as represented by ellipses 1248.

**[0535]** Referring to Fig. 12A, a first data structure is shown. The data file 1204 may include several portions 1208-1242 representing different types of data. Each of these types of data may be associated with a user, as shown in portion 1208.

**[0536]** There may be one or more user records 1240 and associated data stored within the data file 1204. As provided herein, the user can be any person that uses or rides within the vehicle or conveyance 104. The user may be identified in portion 1212. For the vehicle 104, the user may include a set of one or more features that may identify the user. These features may be the physical characteristics of the person that may be identified by facial recognition or some other type of system. In other situations, the user may provide a unique code to the vehicle control system 204 or provide some other type of data that allows the vehicle control system 204 to identify the user. The features or characteristics of the user are then stored in portion 1212.

**[0537]** Each user, identified in portion 1208, may have a different set of settings for each area 508 and/or each zone 512 within the vehicle 104. Thus, each set of settings may also

be associated with a predetermined zone 512 or area 508. The zone 512 is stored in portion 1220, and the area 508 is stored in portion 1216.

**[0538]** One or more settings may be stored in portion 1224. These settings 1224 may be the configurations of different functions within the vehicle 104 that are specified by or for that user. For example, the settings 1224 may be the position of a seat, the position of a steering wheel, the position of accelerator and/or brake pedals, positions of mirrors, a heating/cooling setting, a radio setting, a cruise control setting, or some other type of setting associated with the vehicle 104. Further, in vehicles adapted to have a configurable console or a configurable dash or heads-up display, the settings 1224 may also provide for how that heads-up display, dash, or console are configured for this particular user.

**[0539]** Each setting 1224 may be associated with a different area 508 or zone 512. Thus, there may be more settings 1224 for when the user is the driver and in zone A 512A, 512A, of area 1, 508A. However, there may be similar settings 1224 among the different zones 512 or areas 508 as shown in portion 1224. For example, the heating or radio settings for the user may be similar in every zone 512.

**[0540]** The sensors 242 within the vehicle 104 may be able to either obtain or track health data in portion 1228. Health data 1228 may include any type of physical characteristic associated with the user. For example, a heart rate, a blood pressure, a temperature, or other types of heath data may be obtained and stored in portion 1228. The user may have this health data tracked over a period of time to allow for statistical analysis of the user's health while operating the vehicle 104. In this way, if some function of the user's health deviates from a norm (e.g., a baseline measurement, average measurements taken over time, and the like), the vehicle 104 may be able to determine there is a problem with the person and react to that data.

**[0541]** One or more gestures may be stored in portion 1232. Thus, the gestures used and described in conjunction Fig. 11A through 11K may be configurable. These gestures may be determined or created by the user and stored in portion 1132. A user may have different gestures for each zone 512 or area 508 within the vehicle. The gestures that do certain things while driving may do other things while in a different area 508 of the vehicle 104. Thus, the user may use a first set of gestures while driving and a second set while a passenger. Further, one or more users may share gestures as shown in portion 1232. Each driver may have a common set of gestures that they use in zone A 512A,

512A. Each of these gestures may be determined or captured and then stored with their characteristics (e.g., vector, position of gesture, etc.) in portion 1232.

**[0542]** One or more sets of safety parameters may be stored in portion 1236. Safety parameters 1236 may be common operating characteristics for this driver/passenger or for all drivers/passengers that if deviated from may determine there is a problem with the driver/passenger or the vehicle 104. For example, a certain route may be taken repeatedly and an average speed or mean speed may be determined. If the mean speed deviates by some number of standard deviations, a problem with the vehicle 104 or the user may be determined. In another example, the health characteristics or driving experience of the user may be determined. If the user drives in a certain position where their head occupies a certain portion of three-dimensional space within the vehicle 104, the vehicle control system 204 may determine that the safety parameter includes the users face or head being within this certain portion of the vehicle interior space. If the user's head deviates from that interior space for some amount of time, the vehicle control system 204 can determine that something is wrong with the driver and change the function or operation of the vehicle 104 to assist the driver. This may happen, for example, when a user falls asleep at the wheel. If the user's head droops and no longer occupies a certain three dimensional space, the vehicle control system 204 can determine that the driver has fallen asleep and may take control of the operation of the vehicle 204 and the automobile controller 8104 may steer the vehicle 204 to the side of the road. In other examples, if the user's reaction time is too slow or some other safety parameter is not nominal, the vehicle control system 204 may determine that the user is inebriated or having some other medical problem. The vehicle control system 204 may then assume control of the vehicle to ensure that the driver is safe.

**[0543]** Information corresponding to a user and/or a user profile may be stored in the profile information portion 1238. For example, the profile information 1238 may include data relating to at least one of current data, historical data, a user preference, user habit, user routine, observation, location data (e.g., programmed and/or requested destinations, locations of parking, routes traveled, average driving time, etc.), social media connections, contacts, brand recognition (e.g., determined via one or more sensors associated with the vehicle 104, a device 212, 248, etc.), audible recording data, text data, email data, political affiliation, preferred retail locations/sites (e.g., physical locations, web-based locations, etc.), recent purchases, behavior associated with the aforementioned data, and the like. The data in the profile information portion 1238 may be stored in one or more of the data structures 1200 provided herein. As can be appreciated, these one or more data structures

may be stored in one or more memory locations. Examples of various memory locations are described in conjunction with Fig. 2.

**[0544]** One or more additional data fields may be stored in the linked data portion 1242 as data and/or locations of data. The linked data 1242 may include at least one of pointers, addresses, location identification, data source information, and other information corresponding to additional data associated with the data structure 1200. Optionally, the linked data portion 1242 may refer to data stored outside of a particular data structure 1200. For example, the linked data portion 1242 may include a link/locator to the external data. Continuing this example, the link/locator may be resolved (e.g., via one or more of the methods and/or systems provided herein, etc.) to access the data stored outside of the data structure 1200. Additionally or alternatively, the linked data portion 1242 may include information configured to link the data objects 1204 to other data files or data objects 1250, 1270, 1280. For instance, the data object 1204 relating to a user may be linked to at least one of a device data object 1250, a vehicle system data object 1270, and a vehicle data object 1280, to name a few.

**[0545]** An embodiment of a data structure 1200 to store information associated with one or more devices is shown in Fig. 12B. The data file 1250 may include several portions 1216-1262 representing different types of data. Each of these types of data may be associated with a device, as shown in portion 1252.

**[0546]** There may be one or more device records 1250 and associated data stored within the data file 1250. As provided herein, the device may be any device that is associated with the vehicle 104. For example, a device may be associated with a vehicle 104 when that device is physically located within the interior space 108 of the vehicle 104. As another example, a device may be associated with a vehicle 104 when the device registers with the vehicle 104. Registration may include pairing the device with the vehicle 104 and/or one or more of the vehicle systems (e.g., as provided in Fig. 3). In some cases, the registration of a device with a vehicle 104 may be performed manually and/or automatically. An example of automatic registration may include detecting, via one or more of the vehicle systems, that a device is inside the vehicle 104. Upon detecting that the device is inside the vehicle 104, the vehicle system may identify the device and determine whether the device is or should be registered. Registration may be performed outside of a vehicle 104 via providing a unique code to the vehicle 104 and/or at least one of the vehicle systems.

**[0547]** The device may be identified in portion 1256. Among other things, the device identification may be based on the hardware associated with the device (e.g., Media Access Control (MAC) address, Burned-In Address (BIA), Ethernet Hardware Address (EHA), physical address, hardware address, and the like).

**[0548]** Optionally, a device may be associated with one or more users. For example, a tablet and/or graphical user interface (GUI) associated with the vehicle 104 may be used by multiple members of a family. For instance, the GUI may be located in a particular area 508 and/or zone 512 of the vehicle 104. Continuing this example, when a family member is located in the particular area 508 and/or zone 512, the device may include various settings, features, priorities, capabilities, and the like, based on an identification of the family member. The user may be identified in portion 1254. For the device, the user identification portion 1254 may include a set of one or more features that may identify a particular user. These features may be the physical characteristics of the person that may be identified by facial recognition, or some other type of system, associated with the device and/or the vehicle 104. Optionally, the user may provide a unique code to the device, or provide some other type of data, that allows the device to identify the user. The features or characteristics of the user are then stored in portion 1254.

**[0549]** Each device identified in the device identification portion 1256 may have a different set of settings for each area 508 and/or each zone 512, and/or each user of the device. Thus, each set of settings may also be associated with a predetermined zone 512, area 508, and/or user. The zone 512 is stored in portion 1220 and the area 508 is stored in portion 1216.

**[0550]** One or more settings may be stored in portion 1224. These settings 1224 may be similar and/or identical to those previously described. Further, the settings 1224 may also provide for how a device is configured for a particular user. Each setting 1224 may be associated with a different area 508 or zone 512. Thus, there may be more restrictive settings 1224 (e.g., restricted multimedia, texting, limited access to device functions, and the like) for the device when the user is the driver and in zone A 512A, 512A, of area 1, 508A. However, when the user is in another zone 512 or area 508, for example, where the user is not operating a vehicle 104, the settings 1224 may provide unrestricted access to one or more features of the device (e.g., allowing texting, multimedia, etc.).

**[0551]** Optionally, the capabilities of a device may be stored in portion 1258. Examples of device capabilities may include, but are not limited to, a communications ability (e.g., via wireless network, EDGE, 3G, 4G, LTE, wired, Bluetooth®, Near Field

Communications (NFC), Infrared (IR), etc.), hardware associated with the device (e.g., cameras, gyroscopes, accelerometers, touch interface, processor, memory, display, etc.), software (e.g., installed, available, revision, release date, etc.), firmware (e.g., type, revision, etc.), operating system, system status, and the like. Optionally, the various capabilities associated with a device may be controlled by one or more of the vehicle systems provided herein. Among other things, this control allows the vehicle 104 to leverage the power and features of various devices to collect, transmit, and/or receive data.

**[0552]** One or more priorities may be stored in portion 1260. The priority may correspond to a value, or combination of values, configured to determine how a device interacts with the vehicle 104 and/or its various systems. The priority may be based on a location of the device (e.g., as stored in portions 1216, 1220). A default priority can be associated with each area 508 and/or zone 512 of a vehicle 104. For example, the default priority associated with a device found in zone 1 512A of area 1 508A (e.g., a vehicle operator position) may be set higher than an (or the highest of any) alternative zone 512 or area 508 of the vehicle 104. Continuing this example, the vehicle 104 may determine that, although other devices are found in the vehicle, the device, having the highest priority, controls features associated with the vehicle 104. These features may include vehicle control features, critical and/or non-critical systems, communications, and the like. Additionally or alternatively, the priority may be based on a particular user associated with the device. Optionally, the priority may be used to determine which device will control a particular signal in the event of a conflict.

**[0553]** Registration data may be stored in portion 1262. As described above, when a particular device registers with a vehicle 104, data related to the registration may be stored in the registration data portion 1262. Such data may include, but is not limited to, registration information, registration codes, initial registration time, expiration of registration, registration timers, and the like. Optionally, one or more systems of the vehicle 104 may refer to the registration data portion 1262 to determine whether a device has been previously registered with the vehicle 104. As shown in Fig. 12B, User 4 of Device 2 has not been registered. In this case, the registration data field 1262, for this user, may be empty, contain a null value, or other information/indication that there is no current registration information associated with the user.

**[0554]** Additionally or alternatively, the data structure 1200 may include a profile information portion 1238 and/or a linked data portion 1242. Although the profile information portion 1238 and/or the linked data portion 1242 may include different

information from that described above, it should be appreciated that the portions 1238, 1242 may be similar, or identical, to those as previously disclosed.

**[0555]** An embodiment of a data structure 1200 to store information associated with one or more vehicle systems is shown in Fig. 12C. The data file 1270 may include several portions 1216-1279 representing different types of data. Each of these types of data may be associated with a vehicle system, as shown in portion 1272.

**[0556]** There may be one or more system records 1270 and associated data stored within the data file 1270. As provided herein, the vehicle systems may be any system and/or subsystem that is associated with the vehicle 104. Examples of various systems are described in conjunction with Fig. 3 and other related figures (e.g., systems 324-352, etc.). One example of a system associated with the vehicle 104 is the vehicle control system 204. Other systems may include communications subsystems 344, vehicle subsystems 328, and media subsystems 348, to name a few. It should be appreciated that the various systems may be associated with the interior space 108 and/or the exterior of the vehicle 104.

**[0557]** Each system may include one or more components. The components may be identified in portion 1274. Identification of the one or more components may be based on hardware associated with the component. This identification may include hardware addresses similar to those described in conjunction with the devices of Fig. 12B. Additionally or alternatively, a component can be identified by one or more signals sent via the component. Such signals may include an Internet Protocol (IP), or similar, address as part of the signal. Optionally, the signal may identify the component sending the signal via one or more of a header, a footer, a payload, and/or an identifier associated with the signal (e.g., a packet of a signal, etc.).

**[0558]** Each system and/or component may include priority type information in portion 1276. Among other things, the priority type information stored in portion 1276 may be used by the various methods and systems provided herein to differentiate between critical and non-critical systems. Non-limiting examples of critical systems may correspond to those systems used to control the vehicle 104, such as, steering control, engine control, throttle control, braking control, and/or navigation informational control (e.g., speed measurement, fuel measurement, etc.) Non-critical systems may include other systems that are not directly related to the control of the vehicle 104. By way of example, non-critical systems may include media presentation, wireless communications, comfort settings systems (e.g., climate control, seat position, seat warmers, etc.), and the like.

Although examples of critical and/or non-critical systems are provided above, it should be appreciated that the priority type of a system may change (e.g., from critical to non-critical, from non-critical to critical, etc.) depending on the scenario. For instance, although the interior climate control system may be classified as a non-critical system at a first point in time, it may be subsequently classified as a critical system when a temperature inside/outside of the vehicle 104 is measured at a dangerous level (e.g., sub-zero Fahrenheit, greater than 90-degrees Fahrenheit, etc.). As such, the priority type may be associated with temperature conditions, air quality, times of the day, condition of the vehicle 104, and the like.

**[0559]** Each system may be associated with a particular area 508 and/or zone 512 of a vehicle 104. Among other things, the location of a system may be used to assess a state of the system and/or provide how the system interacts with one or more users of the vehicle 104. As can be appreciated each system may have a different set of settings for each area 508 and/or each zone 512, and/or each user of the system. Thus, each set of settings may also be associated with a predetermined zone 512, area 508, system, and/or user. The zone 512 is stored in portion 1220 and the area 508 is stored in portion 1216.

**[0560]** One or more settings may be stored in portion 1224. These settings 1224 may be similar and/or identical to those previously described. Further, the settings 1224 may also provide for how a system is configured for a particular user. Each setting 1224 may be associated with a different area 508 or zone 512. For instance, a climate control system may be associated with more than one area 508 and/or zone 512. As such, a first user seated in zone 1 512A of area 1 508A may store settings related to the climate control of that zone 512A that are different from other users and/or zones 512 of the vehicle 104. Optionally, the settings may not be dependent on a user. For instance, specific areas 508 and/or zones 512 of a vehicle 104 may include different, default, or the same settings based on the information stored in portion 1224.

**[0561]** The various systems and/or components may be able to obtain or track health status data of the systems and/or components in portion 1278. The health status 1278 may include any type of information related to a state of the systems. For instance, an operational condition, manufacturing date, update status, revision information, time in operation, fault status, state of damage detected, inaccurate data reporting, and other types of component/system health status data may be obtained and stored in portion 1278.

**[0562]** Each component and/or system may be configured to communicate with users, systems, servers, vehicles, third parties, and/or other endpoints via one or more

communication type. At least one communication ability and/or type associated with a system may be stored in the communication type portion 1279. Optionally, the communication types contained in this portion 1279 may be ordered in a preferential order of communication types. For instance, a system may be configured to preferably communicate via a wired communication protocol over one or more wired communication channels (e.g., due to information transfer speeds, reliability, and the like). However, in this instance, if the one or more wired communication channels fail, the system may transfer information via an alternative communication protocol and channel (e.g., a wireless communication protocol and wireless communication channel, etc.). Among other things, the methods and systems provided herein may take advantage of the information stored in the communication type portion 1279 to open available communication channels in the event of a communication channel failure, listen on other ports for information transmitted from the systems, provide a reliability rating based on the number of redundant communication types for each component, and more. Optionally, a component or system may be restricted from communicating via a particular communication type (e.g., based on rules, traffic, critical/non-critical priority type, and the like). In this example, the component or system may be forced by the vehicle control system 204 to use an alternate communication type where available, cease communications, or store communications for later transfer.

**[0563]** Additionally or alternatively, the data structure 1200 may include a profile information portion 1238 and/or a linked data portion 1242. Although the profile information portion 1238 and/or the linked data portion 1242 may include different information from that described above, it should be appreciated that the portions 1238, 1242 may be similar, or identical, to those as previously disclosed.

**[0564]** Referring now to Fig. 12D, a data structure 1200 is shown optionally. The data file 1280 may include several portions 1216-1286 representing different types of data. Each of these types of data may be associated with a vehicle, as shown in portion 1282.

**[0565]** There may be one or more vehicle records 1280 and associated data stored within the data file 1282. As provided herein, the vehicle 104 can be any vehicle or conveyance 104 as provided herein. The vehicle 104 may be identified in portion 1282. Additionally or alternatively, the vehicle 104 may be identified by one or more systems and/or subsystems. The various systems of a vehicle 104 may be identified in portion 1284. For example, various features or characteristics of the vehicle 104 and/or its systems may be

stored in portion 1284. Optionally, the vehicle 104 may be identified via a unique code or some other type of data that allows the vehicle 104 to be identified.

**[0566]** Each system may be associated with a particular area 508 and/or zone 512 of a vehicle 104. Among other things, the location of a system may be used to assess a state of the system and/or provide how the system interacts with one or more users of the vehicle 104. As can be appreciated each system may have a different set of settings for each area 508 and/or each zone 512, and/or each user of the system. Thus, each set of settings may also be associated with a predetermined zone 512, area 508, system, and/or user. The zone 512 is stored in portion 1220 and the area 508 is stored in portion 1216.

**[0567]** One or more settings may be stored in portion 1224. These settings 1224 may be similar and/or identical to those previously described. Further, the settings 1224 may also provide for how a vehicle and/or its systems are configured for one or more users. Each setting 1224 may be associated with a different area 508 or zone 512. Optionally, the settings may not be dependent on a particular user. For instance, specific areas 508 and/or zones 512 of a vehicle 104 may include different, default, or the same settings based on the information stored in portion 1224.

**[0568]** The various systems and/or components may be able to obtain or track health status data of the systems and/or components in portion 1278. The health status 1278 may include any type of information related to a state of the systems. For instance, an operational condition, manufacturing date, update status, revision information, time in operation, fault status, state of damage detected, inaccurate data reporting, and other types of component/system health status data may be obtained and stored in portion 1278.

**[0569]** One or more warnings may be stored in portion 1286. The warnings data 1286 may include warning generated by the vehicle 104, systems of the vehicle 104, manufacturer of the vehicle, federal agency, third party, and/or a user associated with the vehicle. For example, several components of the vehicle may provide health status information (e.g., stored in portion 1278) that, when considered together, may suggest that the vehicle 104 has suffered some type of damage and/or failure. Recognition of this damage and/or failure may be stored in the warnings data portion 1286. The data in portion 1286 may be communicated to one or more parties (e.g., a manufacturer, maintenance facility, user, etc.). In another example, a manufacturer may issue a recall notification for a specific vehicle 104, system of a vehicle 104, and/or a component of a vehicle 104. It is anticipated that the recall notification may be stored in the warning data

field 1286. Continuing this example, the recall notification may then be communicated to the user of the vehicle 104 notifying the user of the recall issued by the manufacturer.

**[0570]** Additionally or alternatively, the data structure 1200 may include a profile information portion 1238 and/or a linked data portion 1242. Although the profile information portion 1238 and/or the linked data portion 1242 may include different information from that described above, it should be appreciated that the portions 1238, 1242 may be similar, or identical, to those as previously disclosed.

**[0571]** An embodiment of a method 1300 for storing settings for a user 216 associated with vehicle 104 is shown in Fig. 13. While a general order for the steps of the method 1300 is shown in Fig. 13, the method 1300 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 13. Generally, the method 1300 starts with a start operation 1304 and ends with an end operation 1336. The method 1300 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1300 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-12.

**[0572]** A person may enter the vehicle space 108. One or more sensors 242 may then identify that a person is sitting within the vehicle 104, in step 1308. For example, sensors 242 in a seat, may determine that some new amount of weight has been registered. The amount of weight may fall within predetermined parameters (e.g., over a threshold, in a specific range, etc.). This weight may then be determined to be a person by one or more optical or other sensors 242. The vehicle control system 204 may then determine that a person is in a certain zone 512 or area 508. For example, the sensors 242 may send signals to the vehicle controls system 204 that an event has occurred. This information may be sent to the vehicle control system processor 304 to determine the zone 512 and area 508 where the event occurred. Further, the vehicle control system 204 may then identify the person, in step 1312.

**[0573]** The vehicle control system 204 can receive the information from the sensors 242 and use that information to search the database 1200 that may be stored within the system data 208. The sensor data may be compared to ID characteristics 1212 to determine if the person has already been identified. The vehicle control system 204 may also send the characteristic data from the sensors to the communication network 224 to a server 228 to compare the sensor data to stored data 232 that may be stored in a cloud system. The

person's features can be compared to stored features 1212 to determine if the person in the vehicle 104 can be identified.

**[0574]** If the person has been identified previously and their characteristics stored in portion 1212, the method 1300 proceeds YES to step 1316 where that person may be identified. In identifying a person, the information associated with that person 1240 may be retrieved and provided to the vehicle control system 204 for further action. If a person cannot be identified by finding their sensor characteristics in portion 1212, the method 1300 proceeds NO to step 1320. In step 1320, the vehicle control system 204, using an application, may create a new record in table 1200 for the user. This new record may store a user identifier and their characteristics 1212. It may also store the area 508 and zone 512 in data portions 1216 and 1220. The new record may then be capable of receiving new settings data for this particular user. In this way, the vehicle 104 can automatically identify or characterize a person so that settings may be established for the person in the vehicle 104.

**[0575]** The input module 312 may then determine if settings are to be stored, in step 1324. Settings might be any configuration of the vehicle 104 that may be associated with the user. The determination may be made after receiving a user input from the user. For example, the user may make a selection on a touch sensitive display indicating that settings currently made are to be stored. In other situations, a period of time may elapse after the user has made a configuration. After determining that the user is finished making changes to the settings, based on the length of the period of time since the setting was established, the vehicle control system 204 can save the setting. Thus, the vehicle control system 204 can make settings automatically based on reaching a steady state for settings for user.

**[0576]** The vehicle control system 204 may then store the settings for the person, in step 1328. The user interaction subsystem 332 can make a new entry for the user 1208 in data structure 1204. The new entry may be either a new user or a new settings listed in 1224. The settings may be stored based on the area 508 and zone 512. As explained previously, the settings can be any kind of configuration of the vehicle 104 that may be associated with the user in that area 508 and the zone 512.

**[0577]** The settings may also be stored in cloud storage, in step 1332. Thus, the vehicle control system 204 can send the new settings to the server 228 to be stored in storage 232. In this way, these new settings may be ported to other vehicles for the user. Further, the

settings in storage system 232 may be retrieved, if local storage does not include the settings in storage system 208.

**[0578]** Additionally or alternatively, the settings may be stored in profile data 252. As provided herein, the profile data 252 may be associated with one or more devices 212, 248, servers 228, vehicle control systems 204, and the like. Optionally, the settings in profile data 252 may be retrieved in response to conditions. For instance, the settings may be retrieved from at least one source having the profile data if local storage does not include the settings in storage system 208. As another example, a user 216 may wish to transfer settings stored in profile data 252 to the system data 208. In any event, the retrieval and transfer of settings may be performed automatically via one or more devices 204, 212, 248, associated with the vehicle 104.

**[0579]** An embodiment of a method 1400 to configure the vehicle 104 based on stored settings is shown in Fig. 14. A general order for the steps of the method 1400 is shown in Fig. 14. Generally, the method 1400 starts with a start operation 1404 and ends with an end operation 1428. The method 1400 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 14. The method 1400 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1400 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-13.

**[0580]** The vehicle control system 204 can determine if a person is in a zone 512 or area 508, in step 1408. This determination may be made by receiving data from one or more sensors 242. The vehicle 104 can use facial recognition, weight sensors, heat sensors, or other sensors to determine whether a person is occupying a certain zone 512.

**[0581]** Using the information from the sensors 242, the vehicle control system 204 can identify the person, in step 1412. The vehicle control system 204 can obtain characteristics for the user currently occupying the zone 512 and compare those characteristics to the identifying features in portion 1212 of data structure 1204. Thus, the settings in portion 1224 may be retrieved by identifying the correct zone 512, area 508, and characteristics for the user.

**[0582]** The vehicle control system 204 can first determine if there are settings associated with the identified person for that zone 512 and/or area 508, in step 1416. After identifying the user by matching characteristics with the features in portion 1212, the vehicle control system 204 can determine if there are settings for the user for the area 1216

and zone 1220 the user currently occupies. If there are settings, then the vehicle control system 204 can make the determination that there are settings in portion 1224, and the vehicle control system 204 may then read and retrieve those settings, in step 1420. The settings may be then used to configure or react to the presence of the user, in step 1424. Thus, these settings may be obtained to change the configuration of the vehicle 104, for example, how the position of the seats or mirrors are set, how the dash, console, or heads up display is configured, how the heat or cooling is configured, how the radio is configured, or how other different configurations are made.

**[0583]** Embodiments of a method 1500 for storing settings in cloud storage are shown in Fig. 15. A general order for the steps of the method 1500 is shown in Fig. 15. Generally, the method 1500 starts with a start operation 1504 and ends with an end operation 1540. The method 1500 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 15. The method 1500 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1500 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-14.

**[0584]** The vehicle control system 204 can determine if a person is in a zone 512 or area 508, in step 1508. As explained previously, the vehicle control system 204 can receive vehicle sensor data from vehicle sensors 242 that show a person has occupied a zone 512 or an area 508 of the vehicle 104. Using the vehicle sensor data, the vehicle control system 204 can determine characteristics of the person, in step 1512. These characteristics are compared to the features in portion 1212 of the data structure 1204. From this comparison, the vehicle control system 204 can determine if the person is identified within the data structure 1204, in step 1516. If there is a comparison and the person can be identified, the method 1500 proceeds YES to step 1520. However, if the person cannot be identified, the method 1500 proceeds NO, to step 1524.

**[0585]** In step 1520, the person is identified in portion 1208 by the successful comparison of the characteristics and the features. It should be noted that there may be a degree of variability between the characteristics and the features in portion 1212. Thus, the comparison may not be an exact comparison but may use methods known in the art to make a statistically significant comparison between the characteristics received from the sensors 242 and the features stored in portion 1212. In step 1524, the characteristics received from sensors 242 are used to characterize the person. In this way, the received

characteristics may be used as an ID, in portion 1212, for a new entry for a new user in portion 1208.

**[0586]** The user may make one or more settings for the vehicle 104. The vehicle control system 204 may determine if the settings are to be stored, in step 1528. If the settings are to be stored, the method 1500 proceeds YES to step 1536. If the settings are not to be stored or if there are no settings to be stored, the method 1500 proceeds NO to step 1532. In step 1532, the vehicle control system 204 can retrieve the settings in the portion 1224 of the data structure 1204. Retrieval of the settings may be as described in conjunction with Fig. 14. If settings are to be stored, the vehicle control system 204 can send those settings to server 228 to be stored in data storage 232, in step 1536. Data storage 232 acts as cloud storage that can be used to retrieve information on the settings from other vehicles or from other sources. Thus, the cloud storage 232 allows for permanent and more robust storage of user preferences for the settings of the vehicle 104.

**[0587]** An embodiment of a method 1600 for storing gestures associated with the user is shown in Fig. 16. A general order for the steps of the method 1600 is shown in Fig. 16. Generally, the method 1600 starts with a start operation 1604 and ends with an end operation 1640. The method 1600 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 16. The method 1600 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1600 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-15.

**[0588]** Vehicle control system 204 may receive sensor data from sensors 242 to determine a person is occupying a zone 512 in an area 508 of the vehicle 104, in step 1608. The sensor data may provide characteristics for the person, in step 1612. The vehicle control system 204 may then use the characteristics to determine if the person can be identified, in step 1616. The vehicle control system 204 may compare the characteristics to the features in portion 1212 for the people having been recognized and having data associated therewith. If a comparison is made between the characteristics and the features in portion 1212, the person can be identified, and the method 1600 proceeds YES to step 1620. If there is no comparison, the method 1600 may proceed NO to step 1624. In step 1620, the person may be identified by the vehicle control system 204. Thus, the person's features and associated data record 1240 may be determined and the user identified in portion 1208. If the person is not identified, the vehicle control system 204

can characterize the person in step 1624 by establishing a new record in data structure 1204 using the characteristics, received from the sensors 242, for the features in portion 1212.

**[0589]** Thereinafter, the vehicle control system 204 may determine if gestures are to be stored and associated with the user, in step 1628. The vehicle control system 204 may receive user input on a touch sensitive display or some other type of gesture capture region which acknowledges that the user wishes to store one or more gestures. Thus, the user may create their own gestures such as those described in conjunction with Figs. 11A-11K. These gestures may then be characterized and stored in data structure 1204. If there are gestures to be stored, the method 1600 proceeds YES to step 1636. If gestures are not to be stored the method 1600 may proceed NO to step 1632.

**[0590]** In step 1632, the vehicle control system 204 can retrieve current gestures from portion 1232, which are associated with user 1240. These gestures may be used then to configure how the vehicle 104 will react if a gesture is received. If gestures are to be stored, the vehicle control system 204 may store characteristics, in step 1636, as received from sensor 242 or from one more user interface inputs. These characteristics may then be used to create the stored gestures 1232, in data structure 1204. The characteristics may include what the gesture looks like or appears and also what affect the gesture should have. This information may then be used to change the configuration or operation of the vehicle 104 based on the gesture if it is received at a later time.

**[0591]** An embodiment of a method 1700 for receiving a gesture and configuring the vehicle 104 based on the gesture may be as provided in Fig. 17. A general order for the steps of the method 1700 is shown in Fig. 17. Generally, the method 1700 starts with a start operation 1704 and ends with an end operation 1728. The method 1700 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 17. The method 1700 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1700 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-16.

**[0592]** A vehicle control system 204 can receive sensor data from vehicle sensors 242. The vehicle sensor data can be used by the vehicle control system 204 to determine that a person is in a zone 512 or area 508, in step 1708. The vehicle sensor data may then be used to compare against feature characteristics 1212 to identify a person, in step 1712.

The vehicle control system 204 thereinafter may receive a gesture, in step 1716. The gesture may be perceived by vehicle sensors 242 or received in a gesture capture region. The gesture may be as described in conjunction with Figs. 11A-11K. Upon receiving the gesture, the vehicle control system 204 can compare the gesture to gesture characteristics in portion 1232, in step 1720. The comparison may be made so that a statistically significant correlation between the sensor data or gesture data and the gesture characteristic 1232 is made. Upon identifying the gesture, the vehicle control system 204 can configure the vehicle 104 and/or react to the gesture, in step 1724. The configuration or reaction to the gesture may be as prescribed in the gesture characteristic 1232.

**[0593]** An embodiment of a method 1800 for storing health data may be as shown in Fig. 18. A general order for the steps of the method 1800 is shown in Fig. 18. Generally, the method 1800 starts with a start operation 1804 and ends with an end operation 1844. The method 1800 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 18. The method 1800 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1800 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-17.

**[0594]** Vehicle control system 204 can receive sensor data from sensors 242. The sensor data may be used to determine that a person is in a zone 512 or area 508, in step 1808. The sensor data may then be used to determine characteristics of the person, in step 1812. From the characteristics, the vehicle control system 204 can determine if a person may be identified in data structure 1204, in step 1816. If it is determined that the person can be identified in step 1816, the method 1800 proceeds YES to step 1820. If the person cannot be identified, the method 1800 proceeds NO to step 1824. A person may be identified by matching the characteristics of a person from the sensor data to the features shown in portion 1212. If these comparisons are statistically significant, the person may be identified in portion 1208, in step 1820. However, if the person is not identified in portion 1208, the vehicle control system 204 can characterize the person using the vehicle sensor data, in step 1824. In this way, the vehicle control system 204 can create a new record for a new user in data structure 1204.

**[0595]** Thereinafter, the vehicle control system 204 may receive health and/or safety data from the vehicle sensors 242, in step 1828. The vehicle control system 204 can determine if the health or safety data is to be stored, in step 1832. The determination is

made as to whether or not there is sufficient health data or safety parameters, in portion 1228 and 1236, to provide a reasonable baseline data pattern for the user 1240. If there is data to be received and stored, the vehicle control system 204 can store the data for the person in portions 1228 and 1236 of the data structure 1204, in step 1832.

**[0596]** The vehicle control system 204 may then wait a period of time, in step 1836. The period of time may be any amount of time from seconds to minutes to days. Thereinafter, the vehicle control system 204 can receive new data from vehicle sensors 242, in step 1828. Thus, the vehicle control system 204 can receive data periodically and update or continue to refine the health data and safety parameters in data structure 1204. Thereinafter, the vehicle control system 204 may optionally store the health and safety data in cloud storage 232 by sending it through the communication network 224 to the server 228, in step 1840.

**[0597]** An embodiment of a method 1900 for monitoring the health of a user may be as shown in Fig. 19. A general order for the steps of the method 1900 is shown in Fig. 19. Generally, the method 1900 starts with a start operation 1904 and ends with an end operation 1928. The method 1900 can include more or fewer steps or can arrange the order of the steps differently than those shown in Fig. 19. The method 1900 can be executed as a set of computer-executable instructions executed by a computer system and encoded or stored on a computer readable medium. Hereinafter, the method 1900 shall be explained with reference to the systems, components, modules, software, data structures, user interfaces, etc. described in conjunction with Figs. 1-18.

**[0598]** The vehicle control system 204 can receive health data from sensors 242. The health data may be received in step 1908. The vehicle control system 204 may then compare the received health data to stored health parameters in portion 1228 or portion 1236, in step 1912. The comparison may check if there is statistically significant separation or disagreement between the received health data and the stored health data. Thus, the vehicle control system 204 can make a health comparison of the user based on a baseline of health data previously stored. A statistically significant comparison may include determining if there are any parameters more than three standard deviations from the average or norm, any parameter that is increasing or decreasing over a period of eight different measurements, a measurement that is more than two standard deviations from the norm more than three measurements consecutively, or other types of statistical comparisons.

**[0599]** If the vehicle control system 204 determines that measured health parameter does deviate from the norm, the vehicle control system 204 can determine whether the health data is within acceptable limits, in step 1916. If the health data is within acceptable limits, the method 1900 proceeds YES back to receiving new health data, in step 1908. In this way, the health data is periodically or continually monitored to ensure that the driver is in a healthy state and able to operate the vehicle. If the health data is not within acceptable parameters, the method 1900 may proceed NO to step 1924 where the vehicle control system 204 may react to the change in the health data. The reaction may include any measure to provide for the safety of the user, such as stopping the vehicle, beginning to drive the vehicle, driving the vehicle to a new location, such as a hospital, waking the driver with an alarm or other noise, or performing some other function that may help maintain the health or safety of the user.

**[0600]** The health data received may be a reaction from the driver. For example, the driver may call for help or ask the vehicle for assistance. For example, the driver or passenger may say that they are having a medical emergency and ask the car to perform some function to help. The function to help may include driving the person to a hospital or stopping the car and calling for emergency assistance.

**[0601]** Vehicle Network Security

**[0602]** Vehicle network security is a major obstacle to be overcome in making vehicles Internet capable. Firewall 484 can provide security but, due to the seriousness of the consequences to public safety of a security breach, additional security measures are desirable.

**[0603]** Network security can use a common computer to run simultaneously first and second operating systems, respectively, for critical and non-critical tasks, functions, and operations of each processing module of the vehicle control system 204, whereby, in the event of a security breach event, the second operating system is disabled or its execution discontinued.

**[0604]** Other vehicle network security algorithms will be discussed with reference to Figs. 23-25. An effective approach to protecting the critical tasks, functions, and operations from attack is to have one computer that handles vehicle tasks, functions, and operations and a different computer that handles infotainment tasks, functions, and operations. The first and second computers (and the distributed processing networks of which each of the first and second computers are a part) are disconnected from one another and unable to communicate with one another either wirelessly or non-wirelessly

(e.g., by a signal transmission line such as a bus). The first computer (and/or any component in the distributed processing component of which it is a part) is not discoverable by the vehicle wireless network access points 456 and/or the second computer and does not appear on any network topology (or management information base or MIB) stored in the second computer. The converse may or may not be true with respect to the second computer being discoverable by the first computer; that is, a network topology (or MIB) of a component in the network controlled by the first computer, including the first computer itself, may describe or include information regarding one or more components of the network controlled by the second computer or the second computer itself. Stated another way, the infotainment network (or the distributed processing network containing any component (such as one or more of the IP router 420, IP module 1048, communications module 1052, device discovery daemon 1020, media controller 492, media processor 808, access point 456, match engine 812, video controller 840, audio controller 844, speech synthesis module 820, network transceiver 824, signal processing module 828, device interaction module 818, and combo controller 460) participating in, providing, or handling infotainment content) can be prohibited from communicating with a vehicle non-infotainment control network containing any component participating in, providing, or handling signaling for controlling non-infotainment vehicle control tasks, functions, or operations, such as critical tasks, functions or operations (such as one or more of the vehicle control module 826, location module 896, automobile controller 8104, vehicle systems transceiver 8108, traffic controller 8112, network traffic transceiver 8116, and environmental control module 830). The first computer can have no contactable address (such as a local IP address or global unicast address) on any wireless or non-wireless network, including the infotainment network, and is not addressable, contactable, or otherwise able to communicate with the second computer, a component in the network controlled by the second computer, or any portable computational device (such as the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312).

**[0605]** Critical tasks, functions or operations can include one or more of (depending on the particular vehicle) monitoring, controlling, and/or operating the ECU, TCU, door settings, window settings, and/or blind spot monitor, monitoring, controlling, and/or operating the safety equipment (e.g., airbag deployment control unit, collision sensor, nearby object sensing system, seat belt control unit, sensors for setting the seat belt, *etc.*), monitoring and/or controlling certain critical sensors such as the power source controller

and energy output sensor, engine temperature, oil pressure sensing, hydraulic pressure sensors, sensors for headlight and other lights (*e.g.*, emergency light, brake light, parking light, fog light, interior or passenger compartment light, and/or tail light state (on or off)), vehicle control system sensors, and/or steering/torque sensor, controlling the operation of the engine (*e.g.,* ignition), head light control unit, power steering, display panel, switch state control unit, power control unit, and/or brake control unit, and/or issuing alerts to a user and/or remote monitoring entity of potential problems with a vehicle operation.

**[0606]** Less critical tasks, functions or operations to vehicle operation (which are unrelated to infotainment) can, depending on the application, further include one or more of (depending on the particular vehicle) monitoring, controlling, and/or operating a wireless network sensor (e.g., Wi-Fi and/or Bluetooth sensor), cellular data sensor, emissions control, seating system controller and sensor, monitoring certain non-critical sensors such as ambient (outdoor) weather readings (e.g., temperature, precipitation, wind speed, and the like), odometer reading sensor, trip mileage reading sensor, road condition sensors (e.g., wet, icy, etc.), radar transmitter/receiver output, brake wear sensor, oxygen sensor, ambient lighting sensor, vision system sensor, ranging sensor, parking sensor, heating, venting, and air conditioning (HVAC) system and sensor, water sensor, air-fuel ratio meter, hall effect sensor, microphone, radio frequency (RF) sensor, and/or infrared (IR) sensor.

**[0607]** Infotainment tasks, functions, or operations can include one or more of monitoring, controlling, and/or operating a wireless network sensor (e.g., Wi-Fi and/or Bluetooth sensor), cellular data sensor, emissions control, entertainment system, receiving, processing, and/or providing media and/or multimedia content. Infotainment tasks, functions, or operations are typically performed by one or more of the IP router 420, IP module 1048, communications module 1052, device discovery daemon 1020, media controller 492, media processor 808, access point 456, match engine 812, video controller 840, audio controller 844, speech synthesis module 820, network transceiver 824, signal processing module 828, device interaction module 818, desktop manager 1012, windows manager 1032, application manager 1036, panel launcher 1040, desktop plugin 1024, and combo controller 460.

**[0608]** Another approach is depicted in Fig. 23, which shows a common computer 2300 having a microprocessor 2320 executing first and second virtual machines 2308 and 2312. In common memory 2304, each of the first and second virtual machines is an isolated software container with its own operating system 1004 and executing one or more

applications. By way of example and with reference to the first and second computers discussed above, the first virtual machine can simulate the first computer while the second virtual machine can simulate the second computer. Applications stored in each virtual machine would be those applications responsible for critical tasks, functions, and operations in the first virtual machine 2308 and non-critical tasks, functions, and operations in the second virtual machine 2312. Alternatively, the applications stored in the first virtual machine 2308 can be those controlling vehicle tasks, functions, and operations while those stored in the second virtual machine 2312 can be those controlling infotainment tasks, functions, and operations. For example, the first virtual machine 2308 can include one or more of vehicle control module 826, location module 896, automobile controller 8104, vehicle systems transceiver 8108, traffic controller 8112, network traffic transceiver 8116, and environmental control module 830 while the second virtual machine 2312 can include one or more of the IP module 1048, communications module 1052, device discovery daemon 1020, media controller 492, media processor 808, access point 456, match engine 812, video controller 840, audio controller 844, speech synthesis module 820, network transceiver 824, signal processing module 828, device interaction module 818, and combo controller 460. Because each of the first and second virtual machines is completely separate and independent, multiple virtual machines can run simultaneously on a common computer. A hypervisor module 2316 decouples the first and second virtual machines 2308 and 2312 from the host and dynamically allocates computing resources to each of the first and second virtual machine as needed. Computing resources includes, for example, interrupt requests, input/output memory locations, direct memory access, memory capacity allocated for each operating system, scheduling of central processing units, and the like.

**[0609]** Yet another approach is shown in Fig. 24. As illustrated in Fig. 24, a common computer 2400 includes first and second operating systems 1004a and 1004b stored in common memory 2412. Each of the first and second operating systems 1004a and 1004b executing by the microprocessor 2320, can have one or more of a libraries layer 2408, application framework layer 2416, and application layer 2420. Applications are executed in application layer supported by application framework layer of the respective operating system. For example in the case of infotainment, the application framework layer may include a window manager, activity manager, package manager, resource manager, telephony manager, gesture controller, and/or other managers and services. Each operating system can rely on a common kernel 1028 for process isolation, memory

management, and threading support. Libraries layer includes user libraries that implement common functions with input/output and string manipulation, graphics libraries, database libraries, communication libraries, and/or other libraries.

**[0610]** By way of example and with reference to the prior paragraph, the first operating system and environment can simulate the first computer while the second operating system and environment can simulate the second computer. Applications executing in each operating system and environment would be those applications responsible for critical and non-critical tasks, functions, and operations. More specifically, the applications stored in the application framework layer of the first operating system 1004a can be those controlling vehicle tasks, functions, and operations while those stored in the second operating system 1004b can be those controlling infotainment tasks, functions, and operations. For example, the first operating system 1004a can include one or more of vehicle control module 826, location module 896, automobile controller 8104, vehicle systems transceiver 8108, traffic controller 8112, network traffic transceiver 8116, and environmental control module 830 while the second operating system 1004b can include one or more of the IP module 1048, communications module 1052, device discovery daemon 1020, media controller 492, media processor 808, access point 456, match engine 812, video controller 840, audio controller 844, speech synthesis module 820, network transceiver 824, signal processing module 828, device interaction module 818, and combo controller 460.

**[0611]** The first operating system 1004a can run in a separate execution environment from the second operating system 1004b. For example, one operating system (typically the first operating system 1004a) can run in a root execution environment while the other operating system (typically the first operating system 1004b) runs in a secondary execution environment established under the root execution environment. Processes and applications running on the second operating system, for instance, can access user libraries, manager(s), and service(s) in the secondary execution environment. Generally applications for one operating system do not run on the other operating system.

**[0612]** The kernel 1028 is shared such that the first and second operating systems run concurrently and independently on the shared kernel 1028. Specifically, both operating systems 1004a,b interface to the shared kernel 1028 through the same kernel interface, such as by making system calls to the shared kernel 1028. The shared kernel 1028 manages task scheduling for processes of both operating systems and resource management, such as CPU scheduling, memory access and input/output.

**[0613]** Other techniques exist for running multiple operating systems, including dual-boot, multiple operating systems loaded on a computing device one-at-a-time, hosted virtual machines, and operating system level virtualization.

**[0614]** Fig. 25 depicts an operation of the hypervisor module 2316 or common kernel 1028 (collectively "computer control module").

**[0615]** In step 2500, the computer control module detects a stimulus, such as a potential security breach, attack, or other intrusion or attempted intrusion notification, a clock signal, an interrupt and the like. Examples of breaches, attacks, and other intrusions include denial-of-service attacks, spoofing, man in the middle, ARP spoofing, smurf attack, buffer overflow, heap overflow, format string attack, SQL injection, and cyber attack.

**[0616]** In step 2504, the computer control module collects metrics regarding operations of the first and/or second operating system (e.g., of first or second virtual machine) and/or of the computer or associated therewith (e.g., of the network controlled by the first or second operating system). Metrics include network metrics, computational device metrics, and the like. Examples of network metrics include measuring link utilization, number of hops, speed of the path, packet loss, latency, path reliability, path bandwidth, network overhead, maximum transmission unit or MTU, throughput and the like and of computer metrics include load, transaction times, database access times, available memory, central processing unit ("CPU") usage, memory usage, and the like.

**[0617]** In decision diamond 2508, the computer control module determines whether or not the collected metrics indicate a normal or abnormal operating state of the computer and/or of the first or second operating system and/or associated therewith. A normal operating state is deemed to occur when the collected metrics are within normal operational ranges. An abnormal operating state is deemed to occur when one or more of the collected metrics are outside of normal operational ranges. The ranges are predetermined or preconfigured by the manufacturer. Where some metrics are normal and others abnormal, the metrics may be ranked or scored, with the cumulative score being the basis for the normal or abnormal operating state determination.

**[0618]** In one application, the computer control module acts differently depending on whether the abnormality impacts the first or second operating system. When the first operating system responsible for critical vehicle functions, tasks, or operations is behaving abnormally, the driver can be warned of the potential problem and asked to terminate operation of the vehicle. Execution of certain critical vehicle tasks, functions or

operations can be discontinued in favor of manual control of the vehicle tasks, functions, or operations. Execution of certain critical vehicle tasks, functions, or operations can be discontinued while other more critical tasks, functions, or operations continue to be executed. For example, steering, brakes, headlights, wipers, and vehicle acceleration can continue to be executed while environmental or climate control operations are discontinued. When the second operating system responsible for infotainment functions, tasks, or operations behaves abnormally, the driver can be warned of the potential problem and execution of the second operating system terminated automatically.

**[0619]** The determination as to whether the first or second operating system is behaving abnormally can be different. The first operating system can require more metrics to be abnormal than the second operating system or vice versa. Because the second operating system is more likely to be subject to an attack from the Internet or a portable device, a lesser deviation from normal operational ranges can be considered to be abnormal operation of the second operating system compared to the deviation required for the first operating system to be considered to be operating abnormally. Stated another way, a lower threshold is required to find abnormal operation of the second operating system when compared to the first operating system.

**[0620]** When the operating state is abnormal, the computer control module, in step 2512, shuts down or disables the second virtual machine, operating system, or computer so that the first virtual machine, operating system, or computer continues to perform critical and/or automotive tasks, functions or operations while shutting down, terminating, or discontinuing execution of infotainment tasks, functions, or operations.

**[0621]** When the operating state of a network in communication with the computer control module is abnormal as determined by comparison of a network metric with one or more threshold values, the second, but not the first, operating system can be shut down, particularly when the second operating system (but not the first operating system) is controlling and/or receiving input from the network.

**[0622]** After step 2512 or when the operating state is normal, the computer control module, in step 2516, records the metrics and findings and returns to step 2500.

**[0623]** The above discussion can be applied to a vehicle having separate computers running the first and second operating systems, respectively. In other words, the computer controller would monitor the operations of each of the first and second computers and a corresponding network providing input to each and perform the steps of Fig. 25 with

respect to each of the first and second operating systems in each of the first and second computers and their respective networks.

**[0624]** Critical tasks, functions, and operations can be performed by an application executing in the first operating system and less critical tasks, functions, and operations (and infotainment tasks, functions, and operations) can be performed by an application executing in the second operating system. For instance, vehicle controls (e.g., steering, braking, indicating, etc.) can be considered mission critical and performed in the first operating system environment, whereas environmental controls and radio stations and entertainment presentations can be considered as non-critical and performed in the second operating system environment. Among other things, the critical tasks, functions, and operations can be performed not only by the first operating system but also alternatively by a redundant operating system. The redundant operating system may be configured to run in tandem with the first operating system performing critical tasks, functions, and operations and replace, or receive a "hot" handoff from, the first operating system in the event of a failure or malfunction of the first operating system or an application executing in the first operating system. In a "hot" handoff, the redundant operating system may replace the mission critical operating system without interruption of operation. Additionally or alternatively, the first operating system may utilize one or more of error checking communication protocols, secure communication standards, encrypted communications, high speed communications protocols, and the like.

**[0625]** The Vehicle as an Artificially Intelligent Assistant

**[0626]** The vehicle control system 204 can act as an artificially intelligent assistant that, based on an awareness of a selected vehicle occupant's persona (e.g., his or her physical, psychological, mental and other characteristics, needs, desires, behavior, personality, goals, habits, biometric information, likes or interests, dislikes, preferences, and the like) and/or the persona of family and friends of the selected vehicle occupant, proactively (without a preceding request of the selected vehicle occupant) provides feedback, suggestions, reminders, recommendations, and/or other types of assistance to the selected vehicle occupant. For example, the vehicle control system 204 can characterize, define, and/or analyze a person's persona based on profile data 252 of the person, device data 220 associated with the person, stored data 232, system data 208, and information related to the person as collected by vehicle interior and exterior sensors. In other words, a vehicle occupant's persona can include the information in one or more of the profile data 252 of the person, device data 220 associated with the person, stored data 232, system data 208,

and information related to the person as collected by vehicle interior and exterior sensors. Based on the persona of selected persona and vehicle-related information (such as vehicle context, state, external surroundings, location, past, current, and/or intended path of travel, waypoints, and destination of the vehicle) can proactively provide suggestions, reminders, recommendations and/or other types of assistance to the selected vehicle occupant.

**[0627]** The persona can include a user selected and/or configured avatar, which is provided to the user via any graphical user interface by which the vehicle control system provides suggestions, reminders, recommendations and/or other types of assistance to the selected user as a vehicle occupant. As will be appreciated, an "avatar" is the graphical and/or voice representation of an object that can be the user or the user's alter ego or character or of a person selected by the user. It may take either a three-dimensional form, as in games or virtual worlds, or a two-dimensional form as an icon in Internet forums and other online communities. It can have not only a visual image but also distinct voice, mannerisms, and/or other behavior. It is commonly an object selected and/or configured by the user. Avatars can be used as virtual embodiments of embodied agents, which are driven more or less by artificial intelligence rather than real people.

**[0628]** Each occupant of a vehicle can have a differently configured and/or appearing avatar at his or her display interacting with him or her. As set forth below, the avatar may accompany the user from vehicle-to-vehicle as part of the user's persona, which can be shared from vehicle to vehicle.

**[0629]** For example, the vehicle control system, based on an awareness of a selected person's persona and the vehicle-related information, can note vehicle related alarms, bring to a selected person's attention instant messages, emails, voice mails from, missed phone calls from, current activities of and/or locations of friends, and points of interest near the vehicle or its path of travel.

**[0630]** In a further illustration, the vehicle control system notes that a vehicle driver's anniversary is next week, that the driver's spouse has pinned a bracelet that she likes, that the bracelet is on sale at a specific store, and that the driver has an appointment near the store and, in response, alerts the driver to the sale and spousal interest in the bracelet and asks the driver, via any one of the user interfaces 212, 248, input/output module 312, and user interface/input interfaces 324, whether the vehicle control system can (i) add a stop to the driver's calendar and/or waypoint for the store to the driver's path of travel and/or (ii) make the purchase of the bracelet online for the driver.

**[0631]** In yet a further illustration, the vehicle control system notes that a vehicle warning has been triggered, such as an actual or potential engine or other vehicle malfunction (e.g., low battery charge voltage, low oil pressure, high engine pressure, low fuel level, low tire pressure, air bag initiator malfunction, etc.), identifies vehicle service facilities in proximity to the current vehicle position or path of travel that is capable of repairing or addressing the source of the warning (e.g., a service garage, fuel station, dealership, etc.), contacts the facility to provide details on the malfunction to determine service cost, determine possible appointment times, notifies the driver of the possible appointment times, service cost, and corresponding facility location, and, at the option of the driver, schedules an appointment at the facility and adds a stop to the driver's calendar and/or waypoint for the facility to the driver's path of travel.

**[0632]** In yet a further illustration, the vehicle control system notes that a friend or family member of a vehicle occupant is in spatial proximity to the current vehicle position or path of travel, notifies the vehicle occupant of the identity and current location of the friend or family member, and, at the option of the occupant, contacts the friend or family member to notify them of the vehicle occupant's current position and arrange a meeting at a specified location nearby the current vehicle location or path of travel and adds a stop to the driver's calendar and/or waypoint for the meeting location to the driver's path of travel. This is particularly useful where the friend of family member is mobile too, such as in a vehicle or on a bike.

**[0633]** In yet a further illustration, the vehicle control system notes that the vehicle is on a long distance trip (based on the driver's or other occupant's electronic calendar and/or current location relative to the driver's or other occupant's home location), identifies hotels or motels in proximity to the current vehicle position or path of travel, contacts the hotel or motel to determine possible room types (e.g., one or two beds, bed size, etc.), cost, and availabilities, notifies the driver of the accommodations available and cost, and, at the option of the driver, books an accommodation at a selected hotel or motel and adds a stop to the driver's calendar and/or waypoint for the hotel or motel to the driver's path of travel.

**[0634]** In yet a further illustration, the vehicle control system notes that the vehicle is on a long distance trip, identifies a point or location of interest based on a persona of a vehicle occupant in proximity to the current vehicle position or path of travel, collects and provides information about the point or location of interest to the vehicle occupant, optionally contacts the point or location of interest to determine business hours and costs

to visit the point or location of interest, notifies the occupant of the business hours and cost, and, at the option of the driver, books an accommodation at the point or location of interest and adds a stop to the occupant's calendar and/or waypoint for the point or location of interest to the driver's path of travel. The point or location of interest can be a historical landmark, museum, library, church, store, restaurant, coffee shop, mall, healthcare facility, and the like.

**[0635]** In yet a further illustration, the vehicle control system notes, from the electronic calendar of the driver and/or historic driver behavior, that the destination of the vehicle is a meeting, place of employment, or other point of interest and the location thereof, determines that the path of travel of the vehicle will not arrive at the destination timely such as due to traffic, road construction, or other delays, determines a different route that will arrive timely at the destination, proposes the alternate route to the driver, and, at the driver's option, changes the on board navigation to redirect the driver along the alternate route. The vehicle control system can also send a message, such as an email or instant message, to one or more meeting participants or his or her place of employment to let them know that he or she will or may be late.

**[0636]** In a further illustration, an interior or exterior vehicle sensor 340 senses a condition or activity, such as of a vehicle passenger (e.g., a child passenger unbuckling a seat belt, children fighting in the back seat, an in appropriate gesture of a vehicle occupant, and the like) and notifies a selected vehicle occupant, such as the driver of the condition or activity.

**[0637]** In a further illustration, a vehicle control system based on information received from a sensor, such as a camera sensor 760, can identify and/or distinguish an occupant's actions, clothing, held objects or objects in the possession of the user, and the like and perform an action. For instance, the vehicle control system can direct the occupant to a current sale of an identified object worn by or in the possession of the occupant that is in spatial proximity to the current vehicle location. Information regarding objects associated with the user can also be identified by radio frequency identification readers and tags, barcode readers, quick response code readers and the like.

**[0638]** In a further illustration, the vehicle control system determines that the occupant is driving the vehicle to a specific store and provides an alternate store site based on a busyness of one or more store locations. Parking information (e.g., how many spaces are occupied or free based on parking sensors, metered parking information, etc.) may be used to help determine an optimal store or destination location. A user, for instance, may be

driving down a street and pull into a Starbucks™ parking lot at where the user and five other vehicles cannot find a parking spot. In this case, the user may spend five minutes waiting for the five other vehicles to clear the lot so the user can travel to another location. However, the vehicle control system, knowing that the parking lot associated with that particular Starbucks™ was fully occupied, may cause the vehicle to alter the route (or suggest an alternate route) to go to another Starbucks™ location based on the traffic and/or lack of parking.

**[0639]** In a further illustration, the vehicle control system may use image sensors to translate signs (e.g., road signs, store signs, advertisements, billboards, etc.). The translation process may be provided via the processing power of the mobile device, via processing on the cloud, combinations thereof, etc., and provide the translated signage message to the occupant.

**[0640]** In a further illustration, the vehicle control system may present a translated availability and/or assistance to guide a user in finding products traditionally purchased on trips. This guidance may be based upon the past behavior associated with the user persona. For instance, when a user travels to a new place the user may always (or mostly) shop for toothpaste, water, and ibuprofen. As can be appreciated, some foreign countries may not offer all of the products at a single store, like North American supermarkets. Continuing this example, the vehicle may provide a translation for the purchasing behavior by at least providing one or more shopping outlets where a user can procure toothpaste, water, and ibuprofen. In this example, the vehicle control system may state in the user's own language "You can find toothpaste and ibuprofen at the Apotheke on Dipplestrasse in downtown Munich. For water you may wish to visit the Marktkauf on Maybach Gaenge two blocks south of Dipplestrasse."

**[0641]** In a further illustration, the user may query for translation and visual assistance, such as "What does Aspirin look like in Germany". In response, the system may provide a picture or image and a translation text, voice, etc. via the mobile device and/or the vehicle.

**[0642]** In a further illustration, the vehicle control system and/or the mobile device, based on vehicle location and/or path of travel, may present travel and tourism options based on popular sites and/or destinations and, if selected, add the selected option as a waypoint or destination. For instance, the vehicle control system may provide the popular sites and/or destinations with a message, such as "75% of travelers visit the following destinations." The vehicle control system may develop a "perfect itinerary" based on the destinations desired and the timeframe. In some cases the itinerary may be based on

desired locations and/or locations to be avoided. For instance a user may not wish to visit an industrial neighborhood, and as such the itinerary may provide routes that avoid industrialization.

**[0643]** In a further illustration, the vehicle control system can use a vehicle location-based trigger to activate and/or deactivate features and/or settings at a waypoint or destination, such as a home, a garage, and the like. For instance, the user may be returning home from work (this determination may be predicted based on prior trips made at the same or similar time of day by the same user), at a certain distance from the home, the vehicle may send a signal to a home automation system to set appropriate levels of lighting, thermostat, and/or initiate/deactivate other devices and/or open a garage door or entrance gate. A user may be traveling home from work and the vehicle control system may send a message, such as a text message, phone call, email, etc. to a third party to indicate the user is coming home. In some cases, the message may be identified as being sent from the vehicle (e.g., a vehicle icon with the message). The third party may respond to the message, which is then relayed, visually and or audibly, to the user via the components of the vehicle (e.g., dashboard, head unit, speakers, combinations thereof, etc.). By way of example, a third party may state "Please pick up some eggs and fabric softener before you come home, thanks."

**[0644]** In a further illustration, the vehicle control system can learn which routes one or more users travels at any given time period (hours, days, weeks, months, etc.). This information may be used to adjust routes based on traffic, weather, mood, etc. For instance, a user may plan to travel (or is traveling) to work on a Monday morning where heavy traffic is detected ahead in the user's "usual" Monday morning route. Upon detecting the traffic along the usual route, the vehicle may present the user with alternate route selections, or automatically adjust a route presented to the user. Routes may be altered by the vehicle control system based on past purchases, patterns, preferences and the like associated with a user profile. For instance, if a user visits McDonalds every morning for a cup of coffee and an egg McMuffin, the route guidance may alter the route of the individual to pass along several McDonalds. The route alteration may be terminated once the user stops to purchase products at the McDonalds. As can be appreciated, businesses may pay for route alteration and suggestion as a form of advertising.

**[0645]** In a further illustration, the vehicle control system centers around interactions and learns from user preferences. For instance, the vehicle control system learns that the user tends to like it warmer in the morning than in the afternoon, and adjust temperature

settings in the vehicle accordingly. Further, since there are cameras and facial recognition, it can know my preferences and put them in, no matter what seat the user is in. IN another instance, the user has been surfing the Internet looking for new bikes, and the vehicle control system informs the user that there is a bike shop around the corner and adds the bike shop as a waypoint or destination.

**[0646]** In a further illustration, the vehicle control system synchronizes with an electronic calendar of the user to create (i) smarter alarms and (ii) updates. Smart alarms mean that instead of a standard 15 minute warning before a meeting, if it is an offsite meeting with an address entered, the system can determine how much time it will take based upon traffic, previous driving habits, the amount of time it generally takes to exit the office and get to the car, etc., and change the warning accordingly. The updates can be triggered based upon the time of arrival determination from the GPS or as calculated above and send SMS notices to other attendees or prompt to call the meeting leader. Similarly, if the car determines the user is stopping into Starbucks, it could remotely ask the other meeting attendees if they want anything.

**[0647]** In a further illustration, The vehicle control system knows a child's curfew and also the distance from home. Given that information, it could inform the child driver that he or she must leave to make it home in time to avoid a curfew violation. Further, since it knows the occupants, it could potentially include time to deliver them home too.

**[0648]** In a further illustration, the user is training for a marathon. He has a wearable device attached to his clothing that uses his biometric data (e.g., heart rate, body temperature, energy levels, sleeping habits, etc.) throughout the day. It also has a GPS that tracks location and terrain and an MP3 player. On his way to work, the wearable device has synchronized with the vehicle control system. The user verbally checks off his breakfast from his marathon widget on the home page displayed on the on board console and confirms his goals to be realized that day as well as his calendar appointments. On his way to a meeting later that day, the vehicle control system notes that it is near lunch time, reviews the restaurants in spatial proximity to the vehicle, determines which restaurants have menu items consistent with the user's dietary goals that day, and recommends a nearby restaurant. The user accepts the recommendation, and the vehicle control system books an advanced reservation and adds the restaurant as a waypoint. On his way back to the office, the vehicle control system notes that the user's heart rate is too low, notifies the user, and, upon the user's confirmation, adjusts the oxygen levels in the vehicle, seat and lumbar settings, and temperature levels to inhibit drowsiness.

**[0649]** In a further illustration, a user and his child enter the vehicle while the child is watching programming (such as a movie on Netflix™) on a tablet computer. The vehicle control system recognizes the user, determines his role in the car or seating position (driver), and applies the user's personal settings. The user's phone is automatically paired with the multimedia controller via the local or on board wireless access point. The vehicle control system determines that the child is in the back seat and recognizes his identity. The vehicle control system asks the user if the programming is to be continued to be provided to the child on the child's rear seat display subsystem. After dropping the child off at school, the vehicle control system determines, based on the user's electronic calendar, that the user is behind schedule for a next appointment due to an accident on the current path of travel, recommends an alternate path of travel and sends a message to the meeting participants that the user will be late and providing an estimated arrival time and reason for the late arrival. The message may be automatically generated or dictated by the user via the vehicle infotainment system. After work is over, the user drives home during a baseball game. The persona of the user informs the vehicle control system that the user is a baseball fan and recommends to the user that he tune into the game on radio. At the user's request, the infotainment system tunes automatically into the game broadcast on the radio.

**[0650]** The occupant persona is not limited to information obtained and stored directly by the vehicle. It can include information obtained by the vehicle from other sources, such as from a server 228 over a communication network 228 such as the Internet and IP router 420. An example would be from a social network profile or page of a selected vehicle occupant, a web or home page of the selected vehicle occupant, a telecommunications presence server associated with the selected vehicle occupant, and the like. Another example would be from another vehicle driven or occupied by the selected vehicle occupant. Another example would be from a home computer network of the selected vehicle occupant. In the latter examples, the information can be obtained not only via the Internet but also directly via synchronization when the vehicles are parked in a common garage of the occupant's home even when the ignition of the vehicle(s) is/are turned off. Another example would be from a portable communication or computational device of an occupant, such as from a device or user interface 212, 248. As noted, a transceiver of the vehicle can provide a mobile hot spot functionality not only to any user device(s) therein but also to a computer of another vehicle located in proximity to the selected vehicle.

Synchronization with another vehicle's computer or with a home computer can be done, for example, by the http server capabilities of the vehicles.

**[0651]** The persona can be stored as part of a template locally, remotely, or combinations thereof. The persona can be stored in the cloud, on a personal communication device (such as a phone or tablet computer), in a memory of the vehicle, on a local storage memory, key fob, and the like. It may be encrypted and accessed and/or modified by the user via authorization through a verification system, which may rely on credentials and/or biometric information. The template may be universally applied by all vehicle manufacturers to enable the persona to be portable among vehicles so that the intelligent capability of the vehicle appears to follow the associated user from vehicle to vehicle even when manufactured by different companies. The template can even follow the user from seat position to seat position within a vehicle, automatically populating vehicle settings, such as seat and console settings and features associated with a new seating position, when the user is identified as having moved to the new seat.

**[0652]** A console may not support multimedia entertainment, particularly video. Multimedia content is typically displayed on remote display subsystems dedicated to a specific seating position.

**[0653]** By way of illustration, user personas may be presented (or uploaded) to a vehicle in advance of a user reaching a vehicle (rental cars, etc.). For example, Hertz® car rental agency can maintain a persona for each customer and upload the persona onto the car rented to the customer at the time the leasing is consummated. While the user is walking from the rental desk to the car, the car is automatically adjusting all of the vehicle settings as set forth in the user persona. In this way, the user need not manually select any settings when he or she begins driving the car.

**[0654]** By way of further illustration, as part of a travel package, a rental car system may determine where a user is staying (e.g., hotel, motel, building, etc.), a mobile device number associated with the user, and the like. The system may send a text message, email, phone call, or other signal to the mobile device number to request access to the user's persona template. The template can be incorporated with the vehicle and settings associated with the vehicle may be updated prior to the user reaching the vehicle. Using this method, administrative assistants can reserve a vehicle on behalf of another individual and link the user template to the reservation based on the user's mobile device phone number. The mobile device can act as the key. For instance, a phone number may be embedded in the private key of the mobile device. The public key may be presented to the

rental car. In some cases a combination of phone number and device ID (e.g., EIN, MAC address, etc.) may be used as part of the authentication.

**[0655]** The vehicle control system can apply rule sets or templates to trigger notifications and other actions of the vehicle control system and/or display artificial or computational intelligence based on observing the behavior of a selected person over time. In any of the embodiments disclosed herein, the vehicle control system and/or mobile device may determine patterns, such as, destinations, purchases, etc. to categorize data, advertising, and the like. The artificial or computational intelligence can, for example, have symbolic, sub-symbolic, or hybrid components and/or modules. Examples include neural networks (e.g., acyclic or feedforward neural networks and recurrent neural networks), fuzzy systems, and evolutionary computation.

**[0656]** An example of a home page 3000 displayed by a device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 is shown in Fig. 30. The layout of the home page 3000 is defined by the user profile. When the user is signed as a guest user, a default layout is provided. The various objects in the layout can be configured as widgets or a lightweight version of an application or item of functionality.

**[0657]** The home page 3000t includes, in an upper area 3004 of the screen, user selectable icons for various applications (which if selected open or initiate or recall the application), such as navigation ("Nav" icon) 3016, media ("Media" icon) 3018, phone ("Phone" icon) 3020, rear view (to provide the driver with a video stream from a backup camera) ("Rear View" icon) 3022, other applications 3024, and "my dash" (to provide the user with a display having typical dash indicators, such as speedometer, tacometer, oil pressure, warning lights, battery charge indicator, fuel level, and the like) 3026; an upper information bar 3028 including a greeting to the identified driver 3030, satellite reception indicator 3032, WiFi connectivity indicator 3034, cellular connectivity indicator 3036, weather information 3038, and date 3040; in a central area 3008 of the screen, various types of information, such as navigation input fields 3042 (e.g., "set destination" field (which is a drop target into which location-enabled objects can be dragged and dropped) to provide guidance from the user's current user inputted or satellite-based location to the inputted destination), "set waypoints" field 3044 ((which is a drop target field into which any location-enabled object can be dragged and dropped) to set an ordering of waypoints along a selected or inputted route), suggested locations 3046 (based on upcoming events in the electronic calendar of the user and/or based on the user's preferences, likes, schedule, and observed habits and other persona information) (and therefore have location

information, such as address information, inputted into the calendar entry and/or satellite-based coordinates based on prior driving history)) to be dragged and dropped into the "set destination" and/or "set waypoints" field, favorite locations 3048 (which is a list of user-defined favorite locations and which can also be dragged and dropped into the "set destination" and/or "set waypoints" field (and therefore have corresponding location information, such as satellite-based geographic coordinates or addresses entered in field(s) associated with the respective favorite locations (a home or work address is an example of a user selected favorite location))), recent locations 3050 (which refer to locations visited within a user-defined time interval of the present time and/or at least a predetermined number of times over a user-defined time interval and which can also be dragged and dropped into the "set destination" and/or "set waypoints" field (and therefore have corresponding location information, such as satellite-based geographic coordinates or addresses entered in field(s) associated with the respective recent locations)), "people" 3052 (which can be the contacts of the user or other list of friends and which provide names, contact information, and addresses for people having a corresponding contact profile, which profile can also be dragged and dropped into either the "set destination" or "set waypoints" field), points of interest 3054 (which are points of interest or potential interest to the operator such as food serving locations, fuel stations, lodging facilities, parking, attractions, health care facilities, historical landmarks, and the like and which can also be dragged and dropped into either the set destination or set waypoints field (and therefore have corresponding location information, such as satellite-based geographic coordinates or addresses entered in field(s) associated with the corresponding point of interest)), display of calendar appointments for a selected day 3056, weather information for a selected day (e.g., temperatures, precipitation, wind speed and direction, atmospheric condition (e.g., sunny, partially sunny, cloudy, partly cloudy, *etc.*), 3058 and received and/or sent messages (*e.g.*, emails, voice mails, and/or texts) 3068 from friends (which dropdown menu can include family, business contacts, and other user defined category of contacts); and in a lower area 3012 of the screen, a climate control icon ("Climate" icon) for a climate control application 3060, controls icon ("Control" icon) to control vehicle tasks, functions or operations 3062, and speaker volume settings (shown by the speaker and triangle images) 3064 and controls to the left and right of the speaker image 3066 and 3070.

**[0658]** When a suggested, favorite, recent location, people, or points of interest object or object identifier is dragged and dropped by a sensed gesture or stylus or mouse into the

"set destination" or "set waypoint" fields, the navigation subsystem 336, based on the current satellite-based location of the vehicle, automatically determines a route from the vehicle's current location to the stored location associated with the dragged and dropped object. As more objects are dragged and dropped into either the "set destination" or "set waypoint" fields, the route is altered to accommodate the various associated locations. A traceroute on a map and/or directions can be provided to the vehicle operator. The traceroute or directions can be updated to show the vehicle's current location. The traceroute or directions can be altered to reflect traffic and/or road conditions (when the user selects "quickest" route), surface street or highway preferences, roadside aesthetics (when the user selects "most scenic" route), and the like. This information can be displayed by the user selection of the "Nav" icon 3016.

**[0659]** The screen can provide a map on the background to assist navigation configuration. As the user configures the "set destination" and "set waypoint" fields, the traceroute can be updated on the background map. In other words, the various location-enabled objects and the "set destination" and "set waypoint" fields are overlays of the map.

**[0660]** As noted, the screen configuration and content, such as the arrangement of the various icons and displayed information, can be rearranged or reconfigured by the user to reflect his or her needs or desires.

**[0661]** Because the screen content is complex and/or content-heavy and can distract the operator when driving, the screen may be altered when the vehicle is in a driving mode relative to a parked mode. In a driving mode, the wheels are in motion and the gear shift is out of the "parked" position. In the parked mode, the wheels are not in motion and the gear shift is in the "parked" position. The home screen of Fig. 30 therefore can be closed automatically on the driver's console display and disabled when the vehicle is in the driving mode and opened automatically and enabled when the vehicle is in the parked mode.

**[0662]** Certain applications can be launched automatically when the vehicle is in the driving mode. An example would be the navigation application so that the console display shows the display for the navigation application instead of the home screen of Fig. 30. One or more other applications can be selected by the user as the display in driving mode.

**[0663]** Alternatively or additionally, when the vehicle is placed in reverse gear with the home screen active, the rear-view application can be launched automatically to display, in the rear view application display, live video from one or more rear cameras on the back of



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the vehicle. When the vehicle is placed in forward gear, the rear view application can be automatically closed to terminate the rear view application display and the navigation application automatically opened to provide the navigation display.

**[0664]** The operation of the profile identification module 848 will be discussed with reference to Fig. 36.

**[0665]** In step 3600, the, the profile identification module 848 detects a stimulus, such as the vehicle changing operational state, expiration of a selected time period, a door opening or closing, and the like.

**[0666]** In step 3604, the profile identification module 848 selects a current vehicle occupant, which can be the driver or a passenger.

**[0667]** In step 3608, the profile identification module 848 determines a seating position of the selected vehicle occupant; that is, the module 848 determines which of the driver's seat, front passenger seat, driver's side rear passenger seat, middle rear passenger seat, and passenger's side rear passenger seat the selected vehicle occupant is occupying. This can be done by the user identification module 822.

**[0668]** In step 3612, the profile identification module 848 determines the types of information to collect for the persona of the selected occupant. The type of information to be collected can vary by occupant identity, age of occupant, an association of the occupant with the vehicle, and/or occupant seating position. For example, the driving history during the recent vehicle use may be collected for a driver but not a passenger. The driving history during the recent vehicle use may be collected for an adult passenger but not for a child passenger. The driving history during the recent vehicle use may be collected for a vehicle owner but not for a guest driver or driver having a default profile.

**[0669]** In step 3616, the profile identification module 848 collects the selected types of information.

**[0670]** In step 3620, the profile identification module 848 determines whether there is a next occupant to be selected. If so, the profile identification module 848 returns to step 3604. If not, the profile identification module 848 returns to step 3600 and awaits the next stimulus instance.

**[0671]** An operation of the vehicle control system 204 will be discussed with reference to Figs. 37A-B.

**[0672]** In step 3700, the vehicle control system 204 detects a stimulus, such as the vehicle changing operational state, expiration of a selected time period, a door opening or closing, and the like.

**[0673]** In step 3704, the vehicle control system 204 selects a current vehicle occupant.

**[0674]** In step 3708, the vehicle control system 204 determines a seating position of the selected occupant.

**[0675]** In step 3712, the profile identification module 848 accesses, at the request of the vehicle control system 204, the persona of the selected occupant.

**[0676]** In step 3716, the vehicle control system 204 determines vehicle related information. This information includes typically any information collected by an interior or exterior vehicle sensor 104, 242, including a satellite navigation system, such as GPS 488.

**[0677]** In step 3720, the vehicle control system 204 determines other relevant types of information, such as the information referenced above in the examples and illustrations. The other relevant types of information can include, for instance, a persona of a selected person not currently in the vehicle, an instant message, email, voice mail from, missed phone call from, current activity of and/or current location of a friend and/or family member of the selected vehicle occupant, a location, hours of operation, and/or descriptive information about a point and/or location of interest near the vehicle and/or its path of travel, a location, hours of operation, and/or descriptive information about a vehicle service facility near the vehicle and/or its path of travel, a location, hours of operation, and descriptive information about a hotel and/or motel near the vehicle and/or its path of travel, a current location of the friend or family member near the vehicle and/or its path of travel, a road condition such as traffic, road construction, or other delay near the vehicle and/or its path of travel, and the like. This information can be collected from the server 228 via the communication network 224.

**[0678]** In decision diamond 3724, the vehicle control system 204 determines whether or not to perform an action. This determination can be based on a rule-based or template-based analysis of the persona of the selected occupant, vehicle related information, and other relevant types of information. The particular rules selected to apply to the collected information to determine whether or not to perform an action and what action to perform can depend on the identification of the selected vehicle occupant and/or seating position of the selected vehicle occupant. Actions that can be performed include those referenced above, including making an appointment or reservation, purchasing an item on line, adding a waypoint to a path of travel on a navigation system, adding an entry into the selected occupant's calendar, changing a destination or path of travel on a navigation

system, warning or notifying the occupant, and sending a message to a person regarding an arrival time at a waypoint or destination.

**[0679]** When the vehicle control system 204 determines not to perform an action, the vehicle control system 204, in decision diamond 3728, determines if there is a next occupant to be selected in the vehicle. If not, the vehicle control system returns to step 3700 and, if so, to step 3704.

**[0680]** When an action is to be performed, the vehicle control system 204 in step 3732 optionally prompts the occupant whether or not the action is to be performed.

**[0681]** When instructed, the action is performed in step 3736.

**[0682]** In step 3740, the profile identification module 848 updates the persona of the selected vehicle occupant to reflect the action performed and the surrounding context. This can be important for the vehicle control system 204 creating new rules describing the likely behavior of the selected vehicle occupant.

**[0683]** In decision diamond 3728, the vehicle control system 204 determines if there is a next occupant to be selected in the vehicle. If not, the vehicle control system returns to step 3700 and, if so, to step 3704.

**[0684]** Operation of the Device Discovery Module 2080

**[0685]** The device discovery daemon 1020 can discover automatically computational devices within the vehicle that connect or attempt to connect to network 356 or communication subsystem 1008 or that disconnect or attempt to disconnect from the network 356 or communication subsystem 1008. The device discovery daemon 1020 discovers automatically computational devices, such as portable user communication devices, located within the vehicle and connects, wirelessly, the portable user communication device with the network 356 or communication subsystem 1008.

**[0686]** The device discovery daemon 1020 may intercept emitted signals from one or more devices in or about the vehicle to pair a device with the network 356 or communication subsystem 1008. Rather than requiring an active pair handshake, the network 356 or communication subsystem 1008 may utilize certain receivers to "listen" for cell tower registration signals, sent messages, sent packets (packet sniffing), etc. From this information, the device discovery daemon 1020 may isolate a MAC address, or other identifier, associated with a device and register the device with the vehicle, a vehicle zone, a user, etc. In some cases, and upon detecting a device signal, the device discovery daemon 1020 may request permission from a user before pairing the device. In one example, the pairing may be initiated by the device discovery daemon 1020 (upon a first

registration) to a user's device. Subsequent pairings may be initiated by a user's device to the network 356 or communication subsystem 1008. One or more of Bluetooth, Near Field Communications (NFC), and other protocols may be used to pair a device with the network 356 or communication subsystem 1008.

**[0687]** Fig. 20 depicts an operation of the device discovery daemon 1020.

**[0688]** In this operation, the device discovery daemon 1020 detects a computational device attempting to connect to or otherwise connectable with the vehicle network 356 or communication subsystem 1008 and, applying rules, determines when it is appropriate to connect with the computational device. The computational device may be a module installed on a backplane, a vehicle component and/or module that is attempting to be installed, a portable user communication device, and the like. The daemon can ping the local communication network each time the vehicle starts or each time a vehicle door opens or closes. The daemon can perform a Bluetooth™ and WiFi™ device discovery too. For each communication device that responds to the ping, the daemon can use plural protocols, such as HPPOPT, ICMP, IGMP, GGP, IP, ST, TCP, EGP, CHAOS, and UDP to populate a device's folder in the device data with device capabilities. Device capabilities are determined by the opened port(s) the device exposes.

**[0689]** The device discovery daemon 1020, in conjunction with the combo controller can determine a spatial location of the computational device as a prerequisite to permitting the computational device, even if properly authenticated, to connect to the vehicle network 356 or communication subsystem 1008. The spatial location can be required to be in an area 508 or set of areas 508 and/or zone or set of zones. Depending on the type of computational device, the computational device, for example, may be required to be in the area two 508B for connection to be accepted. This can be the case for a portable personal communication device, such as a wireless or cellular phone, tablet computer, personal digital assistant, laptop, and the like. For other types of computational devices, the computational device, for example, may be required to be in area one 508A (such as the engine space) and/or area N 508n (such as the trunk). Thus, different types of computational devices can have different location requirements as a prerequisite for connectivity to be enabled or accepted. This can be the case for an engine control module, vehicle sensor, or other device that controls or senses a vehicle task, function or operation that, for instance, either connects wirelessly or by a wire-line connection, to the red zone 417, green zone 413, or I/O backplane on the network/bus 408.

**[0690]** In step 2000, the device discovery daemon 1020 detects a computational device connectable with the vehicle network 356 or communication subsystem 1008. "Connectable" can refer to the computational device being physically within the vehicle, the computational device having a threshold signal strength or connection quality with the vehicle network, the computational device being configured properly to connect with the vehicle network, and the like. "Connection" can be done either wirelessly or by wired connection.

**[0691]** Detection can be done by pinging the computational device and/or receiving a ping from the computational device. As an example, to connect to a Wi-Fi LAN a computational device must be equipped with a wireless network interface controller. The combination of a computer, such as the computer in the computational device, and interface controller is called a station. All stations share a single radio frequency communication channel. Transmissions on this channel are received by all stations within range. The hardware does not signal the user that the transmission was delivered and is therefore called a best-effort delivery mechanism. A carrier wave is used to transmit the data in packets, referred to as "Ethernet frames". Each station is constantly tuned in on the radio frequency communication channel to pick up available transmissions.

**[0692]** Device detection can be in response to or triggered by a sensed event other than receipt of a ping from the computational device. As noted, device detection can be receipt of information from one or more on board sensors that a new occupant has entered the vehicle. Exemplary information includes a door opening or closing, a successful authentication of an occupant or computational device, a sensed load in a seat, detection of movement within the vehicle, and detection of initiation of a vehicle task, function or operation, such as a key inserted in an ignition, engine start up, and the like.

**[0693]** In step 2004 and as noted above, the device discovery daemon 1020 accesses computational device accesses configuration and other information and capabilities of the connected computational device. This information can include device type and/or class, manufacturer name, product and/or device identifier or name, firmware identification, services running, device operating system, network address(es), capabilities, user credentials, and the like. The device discovery daemon 1020 can determine presence of the computational device on any input channel, such as Ethernet, USB, WiFi, Bluetooth, and the like.

**[0694]** In decision diamond 2008, the device discovery daemon 1020 determines whether or not the computational device is recognized and/or authenticated properly.

Recognition can be based on any of the configuration and other information and is deemed to occur when selected fields of the information map to and are the same as similar fields previously encountered and/or recorded in system data 208 by the device discovery daemon 1020. Authentication is deemed to occur when the credentials match stored credentials for the recognized computational device.

**[0695]** When the computational device is not recognized and/or authenticated successfully, the device discovery daemon 1020, in decision diamond 2012, determines whether the computational device is in a predetermined area or zone of the vehicle for the type of computational device corresponding to the computational device. As will be appreciated, some wireless protocols, particularly WiFi™, use an access point (or hotspot) having a defined range, which can be commensurate with the area of the vehicle passenger cabin. The passenger cabin can be surrounded by walls that substantially block radio waves to prevent computational devices external to the passenger cabin from connecting to the network. Multiple overlapping access points can be used to cover larger passenger cabins, such as buses, trains, planes and the like. This determination can be based on received signal strength from the computational device, a satellite-based position of the computational device compared to a satellite-based position of the vehicle or sub-area of the passenger cabin, triangulation based on the relative received signal strengths of multiple access points, camera feedback or image processing of camera or video feed of the passenger compartment, occupant information received from other sensors such as occupant location or presence information received from an infrared sensor 740, motion sensor 744, weight sensor 748, biometric sensor 756, camera sensor 760, audio sensor 764, and associated device sensor 720, user input and the like. User input can be received by a screen pop-up on the computational device requesting the user to designate whether or not and what vehicle the user is currently in and/or what seat position the user has in that vehicle.

**[0696]** A level of confidence can be assigned by the device discovery daemon 1020 to the computational device indicating a likelihood or probability that the computational device is located within the passenger compartment. This level of confidence can be based on consideration and analysis of multiple of the factors identified above. When multiple factors indicate that the user is within the passenger compartment, a higher likelihood is assigned to that determination; likewise, when multiple factors indicate that the user is outside of the passenger compartment, a lower likelihood is assigned to the determination. When no or an unsatisfactory response is received from the user in response to a request

for user input and/or the level of confidence is below a selected threshold, the user is deemed to be located outside of the predetermined area and/or zone.

**[0697]** A further spatial determination can be made by the device discovery daemon 1020 based on how the computational device connected to the automotive network. If the computational device is hard wire connected, or plugged in, to the automotive network (which can be determined by known techniques), the spatial location of the computational device can be assumed to be within the vehicle regardless of other location mechanisms employed by the device discovery module.

**[0698]** A further spatial determination can be made by the device discovery daemon 1020 based on whether or not the computational device has moved within a defined time interval. This indicates that the computational device may not be within the vehicle as movement of a computational device within the vehicle is less likely than a computational device located outside of the vehicle, where the person corresponding to the computational device is often moving relative to the position of the vehicle.

**[0699]** A further spatial determination can be made by the device discovery daemon 1020 based on whether the signal strength or signal-to-noise ratio associated with a ping or other signal from the computational device varies significantly over a selected time interval. The signal-to-noise ratio associated with signaling from a computational device located within the vehicle would remain relatively constant while the signal-to-noise ratio associated with signaling from a computational device located outside of the vehicle would likely vary significantly as the person associated with the computational device moves relative to the vehicle and/or network 356 or communication subsystem 1008.

**[0700]** A further spatial determination can be made by the device discovery daemon 1020 based on an analysis of signal characteristics. Signal characteristics can include one or more of, but is not limited to analyzing signal attenuation, where a signal with a shrinking strength or increasing strength may be determined to be moving in relative proximity or position to the vehicle, analyzing any Doppler shift in the frequency, which may indicate movement in reference to the vehicle and/or network 356 or communication subsystem 1008, analyzing any kind of delay between receiving the same signal at the various transceivers 260 and/or sensors 242A-N. A difference in the time of receipt can be used to triangulate where the location of the signal originated and if that location is outside the vehicle or inside the vehicle.

**[0701]** A further spatial determination can be made by the device discovery daemon 1020 based on an analysis of location information. Beyond the signal characteristics, the

device discovery daemon 1020may receive information from one or more sensors 242A-N to determine a location of the vehicle. If the location of the vehicle is in an area where there is not a likelihood of signal congestion, for example, in the driveway of someone's home, then all received signals may be determined to have been with inside the vehicle. Thus, as signals are received and if the location has changed, the device discovery daemon 1020 may determine whether the current location is an area where there may be more signals received that would be outside the vehicle or whether the signals received has changed.

**[0702]** Analysis of the person sending the signal may also be used by the device discovery daemon 1020. Thus, the device discovery daemon 1020 may access historical signal data (which is a record of devices that have previously been granted access to the vehicle communications network) to determine if the signals have been received from this device or from this person before. Thus, the signal may identify a person documented in the signal data, and the device discovery daemon 1020 may determine if that person has used or connected with the device discovery daemon 1020 previously. Further, the device discovery daemon 1020 can determine if there is movement of the vehicle. If a signal remains within the car after the vehicle moves, then that signal can be determined to be inside the vehicle. For example, if the signal is received at the beginning of a route and then at some time thereinafter the signal continues to be received, then it is determined that signal may be inside the vehicle.

**[0703]** Further, sensor data may be analyzed by the device discovery daemon 1020. Sensor data may include such things as determining if there are people and the number of people within a car. Thus, if there are three people in the vehicle and three signals are received, all three signals may be determined to be inside the vehicle. Further, it may be possible for the sensors 242 to determine if a device is currently being used inside the vehicle. For example, if an optical sensor can view a device within its field of vision and/or if an electromagnetic field sensor determines that there is EMF radiation emanating from a location in the vehicle, then the device discovery daemon 1020 can determine that that signal is originating inside a vehicle.

**[0704]** A further spatial determination can be made based on the type (or service) of computational device attempting to interact with the automotive network. If the computational device is not the type (or service) of device expected to be positioned within the passenger compartment, its attempt to connect to the automotive network can be disregarded completely. If the computational device is the type (or service) of device

that can be connected to the vehicle network but is not the type (or service) of device expected to be associated with an occupant (such as a non-infotainment vehicle task, function, or operation control module, sensor module, a module plugged into a backplane (such as an XM radio module), or other type of device not permitted or expected to be associated with an occupant), the spatial determination may be deemed to be satisfied by the computational device being located somewhere within the vehicle even if outside of the passenger compartment. Conversely, if the computational device is the type (or service) of device that would normally be carried by a vehicle occupant, the spatial location query would be satisfied only when the computational device location were within the passenger compartment. This would prevent an unauthorized computational device, such as a cell phone or tablet computer, from connecting to the automotive network simply by being held above, beside, or beneath the vehicle. The mapping of type of computational device to permissible location (e.g., area and/or zone) within the vehicle can be effected in a look up table or other set of rules.

**[0705]** The device discovery daemon 1020 may receive one or more of these analyses and resolve the information. Thus, device discovery daemon 1020 can cross-correlate information from different analyses to determine if the signal is within the vehicle. Different weight may be given to different analyzes to make a determination about where the signal originates. In this way, a more robust decision is made as to whether or not the signal originates in the vehicle and should be allowed to connect to the universal bus or the routing system of the vehicle.

**[0706]** While this logic is described with respect to the location of the computational device, it is to be understood that this determination is optional. Whether or not a communication device is enabled to connect to the vehicle network 356 or communication subsystem 1008 can be based solely on successful authentication. In this way, the vehicle on board computer can connect automatically to the owner's home virtual private network to upload and/or download information, settings, and other information (such as user input into the vehicle computer, vehicle driving history (e.g., miles traveled, travel traceroutes, speeds traveled, and locations visited), vehicle service information (such as gas and fluid levels, engine problems, alarms or warnings activated, and the like), input received by on board applications from the user (such as scheduled appointments, notes, documents, and the like), applications downloaded, and the like. Synchronization of the on board vehicle and home computer can occur automatically whether the vehicle is turned on or off. This can be highly beneficial when the vehicle is parked in the garage.

**[0707]** When the computational device is recognized and/or authenticated and/or when the computational device is determined to be within a proper area and/or zone of the vehicle for the device type of the computational device, the device discovery daemon 1020, in optional step 2016 determines a spatial location and/or seat position of the computational device to determine appropriate rights and/or privileges and/or restrictions of the user of the computational device as defined by user account or profile associated with the user, the device type of the computational device, the seat position of the user, or area or zone in which the user and/or computational device is located.

**[0708]** In step 2020, the device discovery daemon 1020 permits or enables connection of the computational device with the vehicle network 356 or communication subsystem 1008 and optionally stipulates or defines what set of tasks, functions, and/or operations the user of the computational device can perform using the computational device, such as based on the location of the computational device within the vehicle and/or based on the authentication credentials (e.g., the identity of the computational device user).

**[0709]** When the computational device is determined to be outside of a defined area and/or zone of the vehicle (e.g., outside the passenger compartment or cabin) and the device discovery daemon 1020 does not recognize and/or authenticate the computational device successfully, the device discovery daemon 1020, in step 2024, denies access of the computational device to connect to or access the vehicle network 356 or communication subsystem 1008.

**[0710]** An example of the device discovery daemon 1020 operation will now be discussed. Assume that a vehicle owner purchases an XM radio module off the shelf from a vendor. The user then plugs in the module to the vehicle network. In attempting to enable the functionality of the XM radio, the device discovery daemon 1020 first attempts to recognize and/or authenticate the module. During the process, the XM radio module can be permitted to communicate through the vehicle network or an antenna internal to the module with a remote website to confirm that the XM radio was purchased by the vehicle owner and/or perform licensing validation checks. The vehicle owner's XM radio account is likely already associated with the XM radio module when purchased.

**[0711]** When the XM radio module is plugged into a backplane (Fig. 4) in the vehicle network 356 or communication subsystem 1008, the trigger event occurs, and the device discovery daemon 1020 and combo controller commence operation. After device discovery is completed successfully by the device discovery daemon 1020, the combo controller downloads, from the user's XM account, the user's XM preferences (e.g.,

favorites) and causes the XM functionality in the vehicle to be configured accordingly. During installation, the combo controller can provide an installation in process dialog the user and, upon successful completion, an installation complete dialog. After acknowledging that the installation is complete, a new application icon for the XM radio appears in the upper area of the screen of Fig. 30. The new application icon can have a different appearance than other previously installed application icons to inform the user that the new application is available. When the user launches the new application, the application screen is shown. The application screen of any application depends on the application and user preferences.

**[0712]** The environment 400 of Fig. 4 can interface with three different types of blade processors. A first type of blade processors is installed prior to sale by a manufacturer or vendor. These blade processors are in a manufacturer "crate" and not replaceable or upgradeable by the customer but only by a certified service facility. A second type of blade processors can be installed post-sale by or on behalf of the customer. These blade processors are in a customer "crate". A third type of blade processors interfaces with the first and second type of blade processors. These blade processors are in an accessory "crate". The blade processors generally refer to executable instructions executing on a microprocessor. Each blade typically includes a corresponding set of functions (such as 802.11 WiFi™ interface, Bluetooth™ radio, cellphone radio, storage unit, or satellite position system (such as GPS)), a flash memory, a microprocessor, and a network interface. Typically, the function is software or a combination of hardware and software. Examples include a media controller blade, video controller blade, audio controller blade, profile identification module blade, and the like. This configuration may also be used for a wide variety of other software, such as applications, drivers, and the like, and devices, such as an infotainment system, satellite receiving system, and the like and combinations thereof. For example, an aftermarket infotainment system upgrade or component and/or module can be installed by the customer. The infotainment system upgrade or component and/or module searches for, locates, and connects to a suitable antenna installed prior to sale. The output of the blade processor is an IP message framed into an Ethernet packet. The blade processor can be compatible with the Car Area Network ("CAN") protocol. The CAN control system, which was intended for sensor feedback and controller control signaling through a relatively slow, serial bus, can be integrated into the blade processor architecture by terminating CAN buses in one or more Ethernet bus controllers. The

output is configured for a discrete Ethernet-based sensor or controller, with the translation to the CAN protocol being made at a CAN Ethernet controller subsystem.

**[0713]** A "crate" " commonly has a backplane connector and on-backplane Ethernet interfaces that enable blade processors to communicate with one another using Ethernet messages. The crate can be a USB hub have a series of ports to permit devices to connect to the USB hub; therefore, each "crate" generally has a corresponding USB hub and ports connected thereto.

**[0714]** A master blade processor can be provided. The master blade processor can be substantially the same as the other blade processors except for scheduling and control functionality. The master blade processor can include a service manager that inventories hardware and software capabilities of components and/or modules available (or connected) through hard wire connections within the vehicle and/or computational devices connected wirelessly to the vehicle local area network (e.g., through a wireless access point or local hot spot maintained by the vehicle control system). The output of the inventory step is a network topology comprising assigned network addresses, component and/or module description and capabilities, operational status, and "next hop" addresses to demonstrate positions of components and/or modules next to one another. An application resource table can be maintained that maps application identity, functional description, and/or application type against computational resource requirements and/or capabilities. Requests to the master blade processor allow various applications to access distributed services or automatically disable features not supported by the vehicle's computer system.

**[0715]** The master blade processor can coordinate a health check for the various components and/or modules in or connected wirelessly to the vehicle's computer system and be responsible for sending a keep alive messages (or status queries or interrogation messages sent at periodic intervals) to the various components and/or modules to evaluate health or identify malfunctions. If no response is received within a predetermined time period after keep alive message transmission, a malfunction is assumed to exist.

**[0716]** For components and/or modules requiring high availability, the master blade processor can create a high availability set with a required number of blade processors. This table controls the priority of which blades are capable of becoming master blade processors in the event of a malfunction of the current master blade processor. Shadow copies of each high availability component (e.g., device) and/or module (e.g., application) are created and maintained for backup purposes in the event of a malfunction of the corresponding active blade processor. High availability applications write all variables to

a file created at application initiation residing in vehicle memory. In the event of a malfunction of a high availability application, the master blade processor reassigns the high availability application to a new blade processor. The application can be reinitiated or refreshed or synchronized (using the shadow file) on the newly assigned blade processor. In this manner, the master blade processor is able to redistribute applications to blade processors and/or stopping execution of applications to realize a selected level of performance for the entire vehicle computer system.

**[0717]** A table can be maintained mapping a network address (e.g., a MAC and/or IPv6 address) of each component and/or module against information about the corresponding component and/or module and/or a pointer to a variable file for the component and/or module in memory. Entries on the table may have a corresponding state of health or be added when the corresponding component and/or module passes a health check or removed when the corresponding component and/or module fails to pass a health check.

**[0718]** Upon start up, the master blade processor checks the application resource requirement entries in an application resource table and assigns each application to a blade processor having the most applicable and/or available resources. If an application has specific requirements for execution (e.g., a multimedia infotainment application), the application is assigned to and locked to a specific blade processor (such as a multimedia controller).

**[0719]** An operation of the master blade processor will be discussed with reference to Fig. 38.

**[0720]** In step 3800, the blade processor detects a stimulus. The stimulus can be system boot sequence.

**[0721]** In step 3804, the master blade processor identifies and inventories enabled on board computational resources (such as each blade processor, IP router, vehicle sensors, database management systems, and the like, and the capabilities thereof. On board components and/or modules are typically physically connected to a network bus.

**[0722]** In step 3808, the master blade processor identifies and inventories enabled portable computational resources and the capabilities thereof. Portable components, such as tablet computers and smart phones, are typically wirelessly connected, via a wireless access point, to a network bus.

**[0723]** In step 3812, the master blade processor assigns a network address to each enabled resource.

**[0724]** In step 3816, the master blade processor maintains and stores the resulting network topology in system data 208.

**[0725]** In one configuration, a blade processor is not identified as the "master" blade processor prior to system booting. An application executes on a designated blade processor (such as a blade processor handling multimedia system or media subsystem functions) at boot time to detect the presence of a blade processor having specific capabilities. When the blade processor having the specific capabilities is identified, a variable associated with the designated blade processor is changed from "master" to "slave" and the system reboots, thereby transferring system control to the identified master blade processor. A table can be created controlling a priority of which blade processors are capable of becoming master blade processors in the event of master blade processor malfunction. When a master blade processor malfunctions, a next in priority blade processor is selected as the new master blade processor.

**[0726]** An operation of the master blade processor will be discussed with reference to Fig. 39.

**[0727]** In step 3900, the master blade processor detects a stimulus. Exemplary stimuli include determining that a component and/or module has failed a health check, receipt of a request for a component and/or module for blade processor resources to execute, and the like.

**[0728]** In step 3904, the master blade processor determines the requirements for execution of a selected component and/or module, such as set forth in the application resource requirement table. The selected component and/or module can, for example, be a blade processor, software, such as an application, a component, such as a sensor, a satellite receiving system, and the like, and/or a combination thereof.

**[0729]** In decision diamond 3908, the master blade processor, based on the resource inventory output in step 3808, determines whether a blade processor is available to execute the selected component and/or module. This determination can be done by any number of techniques. It can be based on one or more of a degree of compatibility of the selected component and/or module with each of the blade processor, a current availability of a blade processor to execute the selected component and/or module (e.g., whether the blade processor is currently executing another component and/or module), a relative importance or priority of the selected component and/or module relative to a relative importance of a currently executing component and/or module on a blade processor, whether the blade processor can satisfy the requirements of the selected component and/or

module, a current available bandwidth of a blade processor which may be executing another component and/or module, and the like.

**[0730]** In step 3912, which is performed when a blade processor is available to execute the selected component and/or module, the master blade processor assigns the selected component and/or module to a blade processor for execution. The assignment is recorded in a resource allocation table which maps application identity and/or description against an identifier of the assigned blade processor. If an application has specific requirements for execution (e.g., a multimedia infotainment application or firewall application), the master blade processor may permanently assign the application (or lock the assignment) to a specific blade processor. The master blade processor can, for unlocked assignments, redistribute or reassign components or modules to blade processors or stop components or modules from executing to realize a maximum performance level for the system and/or ensure that critical vehicle, less critical vehicle, or infotainment tasks, functions, or operations are performed.

**[0731]** By way of example, the master blade processor can stop a lower importance or priority component and/or module from executing in favor of a higher importance or priority component and/or module requiring a blade processor to execute. For example, a critical task, function or operation has a higher level of importance or priority than a less critical vehicle task, function or operation. A less critical vehicle task, function or operation can have a higher level of importance or priority than an infotainment task, function or operation or vice versa.

**[0732]** The master blade processor, in next step 3916, updates the network topology.

**[0733]** In step 3920, which is performed when a blade processor is unavailable to execute the selected component and/or module, the master blade processor denies the selected component and/or module permission to execute.

**[0734]** When the master blade processor determines that a minimum set of blade processor resources and/or capabilities is not operational, it will send a system reset message to clear operator warning circuitry within an allocated timeframe.

**[0735]** Streaming of Media

**[0736]** An integrated circuit board configuration can be provided to enable media streaming to computational devices wirelessly connected to the vehicle network via an access point 456 of the vehicle. In this manner, different media can be provided simultaneously to different user interfaces (e.g., on board display subsystems) of different vehicle occupants.

**[0737]** Fig. 21 depicts a configuration of the media controller subsystem 348 for simultaneously streaming multiple channels of media (e.g., multimedia or infotainment content). Media content 2100, such as audio, video, picture, and/or text media, is received by the network transceiver 824 and provided to a common media processing board 2104. The processing board 2104 comprises a network control server 2108, such as a distributed network control ("DNC") server, a media server 2112, such as a digital living network alliance ("DLNA") server, and virtual network console ("VNC") software 2116. The network control server 2108 has an IP address and/or a routable, global unicast address while the media server has a contactable electronic address (such as a media access control or MAC address) on the vehicle network 356 or communication subsystem 1008.

**[0738]** As will be appreciated, each of the network control and media servers 2108 and 2112 comprise a microprocessor and memory to buffer media content, execution of application programming, long term storage of program instructions and/or data, and the like, In one application, the media server 2112 comprises functionality of the media controller 804, media processor 808, and signal processing module 828.

**[0739]** A user portable (remote) or Bring Your Own Device (BYOD) computational device 2120 is in wireless or wired communication with the board 2104, such as via a wireless protocol (*e.g.*, Bluetooth™, WiFi™, and the like). The VNC software 2116 effectively provides the remote computational device 2120 (e.g., portable communication device) with remote access to the board 2104, which is typically part of the vehicle on board computer (e.g., the console computer). As will be appreciated, the VNC software can operate in accordance with the RFB (Remote Frame Buffer) protocol on top of the TCP/IP suite of protocols. The result is that the remote computational device appears to the on board computer as if it were part of the on board vehicle computer or vehicle control system 204. This enables the remote computational device to provide commands to the media controller subsystem 348 for desired multimedia content and media presentation features and settings (such as volume, contrast, resolution, channel selection, and the like). In some applications, the remote computational device must download an application from the vehicle to enable multimedia requests from the remote computational device to pull information from the multimedia controller, where the media can be streamed to its final destination. The commands are provided, by the VNC software 2116 indirectly to the media server 2112 for delivery to the network control server 2108 or directly to the network control server 2108, which retrieves the requested content from an external network (e.g., an Internet or radio network) accessible source. The media may

then be provided to a display at the seat position of the user and/or to the BYOD computational device 2120 (via the wireless access point). When the requested media content is available locally (already stored in vehicle memory), the media content is provided from local storage in preference to accessing the media content via the Internet. When the requested media is not available locally, it is obtained via the Internet and is cached in local storage in parallel with streaming to the user's display and/or BYOD computational device 2120. Each display at each seat position can independently provide a corresponding user with a playlist of audio or video from independent sources.

**[0740]** With reference to Fig. 22, the operation of the media controller subsystem 348 will be discussed. In step 2200, the VNC software 2116 receives a command or request for content from the user of the BYOD computational device. The device has been previously connected successfully by the device discovery daemon or combo controller to the vehicle network 356 or communication subsystem 1008.

**[0741]** Typically, the combo controller has ports in the crate, implements certain device discovery functions, and packetizes information for transmission via IP over Ethernet. The combo controller commonly installs the correct driver for the discovered device. It then maps the device (e.g., USB) address to a local TCP/IP address for interaction with one of the blade processors.

**[0742]** In step 2204, the media server determines, from the system data 208, portable computational device information and capabilities, the identity of the user of the device, an identity of the portable computational device associated with the user, and/or the spatial location of the device (e.g., area and/or zone in which the device is located). This information has been previously determined by the device discovery daemon or combo controller but may be updated by the media server using the location techniques discussed above.

**[0743]** In step 2208, the media server applies appropriate filters and restrictions based on the identity of the user (e.g., user account) and/or spatial location of the device (e.g., user context). The filters or restrictions can include, for example, age-related content filters and/or restrictions, seating location filters and/or restrictions, and privacy filters and/or restrictions. The filters and/or restrictions can ban the type of content requested or the source of the content (e.g., a blacklist of web sites), redirect the request to a different source of the content, and/or limit the user to content from approved sources, such as permitted by a whitelist. Other user account restrictions can be applied by the media server before the content request is passed to the network control server 2108.

**[0744]** The owner of the vehicle can configure the multimedia controller menus. Initially, the menu allows for all seat positions to access any media that is available through the multimedia controller. The owner can create profiles for different potential vehicle occupants. By creating the profiles, the owner is able to allow or disallow access to media from selected seat positions, including access to media menus (e.g., audio or video playlists, software applications (such as Internet browsers, applications to control passenger compartment climate control functions, games, and the like). The owner can also limit media and/or media menu access based on a MAC address of a computational device 2120 of an occupant. Only devices having a permitted MAC address can access media and/or menus while those not having a permitted MAC address cannot. This can ensure that control is not only position-based but also device-based.

**[0745]** In step 2212 and if permitted by the media server, the network control server 2108 accesses the filtered content request (which may be altered to reflect user account restrictions) and retrieves the permissible content via the public network. The network control server 2108, for example, can access the media content 2100 from a media source accessed through an external network, such as a radio network or other type of untrusted public network (such as the Internet). The filtered content request may, for example, be for different content than that originally requested, differently formatted content than that originally requested, differently sourced content (e.g., from a different web server or site) than that originally requested, and the like.

**[0746]** In step 2216, the network control server 2108 receives the permissible content from a publicly networked source (e.g., web server or site) and passes the retrieved content to the media server 2112. Based on user account restrictions and/or user context, the media server applies appropriate filters and restrictions to remove or filter out inappropriate content. The filters or restrictions can include, for example, age-related content filters and/or restrictions, seating location filters and/or restrictions, and privacy filters and/or restrictions.

**[0747]** In one application, the combo controller connects via IP over Ethernet and assigns a local IP address to the BYOD device connected to a port in the consumer crate. The USB layer of the combo controller packetizes information from the BYOD device and communicates with a USB access program that executes on a multimedia blade processor. The USB access program de-packetizes the information and connects to the USB I/O subsystem of the multimedia blade processor to transfer the information to either local

storage or directly to one of the output devices associated with the appropriate seating position.

**[0748]** Other user account restrictions can be applied by the media server before the content is passed by the media server to the user. For example, when the user is driving the vehicle video can be removed automatically from the content to avoid distracting the driver so that only the audio channel accompanying the video channel is provided to the user. In another example and in response to determining that the requesting user or user is driving the vehicle rather than being a (non-driving) passenger, screen magnification can be applied automatically to the visual content to assist the driver of the vehicle; that is, the user is the driver and larger font is easier to see than smaller font. In other examples, the visual content, in response to determining that the requesting user or user is driving the vehicle rather than being a (non-driving) passenger, is presented or rendered automatically in a large font and/or icon size (e.g., without changing screen resolution) compared to the font and/or icon size for the content displayed to a (non-driving) passenger to reduce driver distraction. In yet another example, the media server 2112 determines that the user is driving the car rather than being a (non-driving) passenger and enables or disables automatically removal of all unnecessary animations from the content to be displayed. In yet another example, the media server 2112 determines that the user is driving the car rather than being a (non-driving) passenger and enables automatic removal of background images from, while leaving one or more displayed foreground images in, the content to be displayed. In yet another example, the media server 2112 determines that the user is driving the car rather than being a (non-driving) passenger and automatically enables or renders high contrast (e.g., between text and background colors) to make the displayed content more visible to the user. The feature and/or setting and/or filters could be applied to the displayed content only when the vehicle is in motion or in forward or reverse gear and not parked even when the user is the driver.

**[0749]** Rather than automatic detection, any of the above features and/or settings and/or filters can be a standard feature and/or setting and/or filter and can be applied to the on board vehicle display for the driver but not to the on board vehicle displays of other (non-driving) passengers. In other words, the feature or setting or filter would not be applied to the on board vehicle display of a (non-driving) passenger. Alternatively, the feature and/or setting and/or filter would be applied to the on board vehicle display for the driver only when the vehicle is in motion or in forward or reverse gear but not when the vehicle is parked.

**[0750]** In step 2220, the media server 2112 configures the filtered media for the capabilities of the user device and/or on board vehicle display and in accordance with user preferences. The media server 2112 directly provides, or streams, the media stream or indirectly provides, or streams, the media stream via the VNC software 2116 to the user computational device 2120 and/or on board vehicle display for presentation to the user. Stated another way, the network control server 2108 provides the media content 2100 while the media server 2112 provides the channel for the media content 2100 to be provided to the user computational device 2120.

**[0751]** The media controller subsystem 348 can handle multiple (e.g., eight or more) media and/or multimedia streams simultaneously by differing channels. The streams of information may be separated and served on different channels via one or more of WiFi, Bluetooth, NFC, and other communications protocols. Multiple BYOD computational devices can be served simultaneously and can mix and match or otherwise control what is streamed and where it is streamed.

**[0752]** Assisted driver Display

**[0753]** The device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 (such as the on board display for the driver) can be reconfigured when the vehicle changes state from parked or substantially motionless to be in motion or in forward or reverse gear to facilitate the driver's ability to view visual content and avoid driver distractions. Other devices or user interfaces 212, 248, user interface (s)/input interface(s) 324 and/or I/O modules 312 of other vehicle occupants or passengers typically are not reconfigured even when the vehicle is in gear or motion. When the state of the vehicle changes to parked (or not in motion), the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 of the driver returns to a different configuration, which is typically the same configuration as the devices or user interfaces 212, 248, user interface (s)/input interface(s) 324 and/or I/O modules 312 of other vehicle occupants or passengers.

**[0754]** There are a number of reconfigurations that may be implemented for the unimpaired driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 in response to a change of state of the vehicle, particularly from parked or stationary to be in motion or in forward or reverse gear.

**[0755]** For example, the media controller subsystem 348 can remove video automatically from the content to be displayed by the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 of the driver to avoid

distracting the driver so that only the audio channel accompanying the video channel is provided to the user. A still image derived from one or more frames of the video content can replace the video component in the displayed content.

**[0756]** In another example, the media controller subsystem 348 applies screen magnification automatically to the visual content to assist the driver of the vehicle; that is, the user is the driver and larger font is easier to see than smaller font. The screen magnifier is software that interfaces with a computer's graphical output to present enlarged screen content. The simplest form of magnification presents an enlarged portion of the original screen content, the focus, so that it covers some or all of the full screen. This enlarged portion should include the content of interest to the user and the pointer or cursor, also suitably enlarged. As the user moves the pointer or cursor the screen magnifier should track with it and show the new enlarged portion.

**[0757]** In another example, the media controller subsystem 348 presents or renders the automatically in a large font and/or icon size (e.g., without changing screen resolution) to reduce driver distraction. The large font and/or icon size, unlike screen magnification, applies to all, and not simply a portion of, displayed content.

**[0758]** In yet another example, the media controller subsystem 348 initiates automatically a screen reader (or other text-to-speech program) to audibly provide the visual content to the user. A screen reader is a software application that attempts to identify and interpret what is being displayed on the screen (or, more accurately, sent to standard output, whether a video monitor is present or not). This interpretation is then re-presented to the user with text-to-speech and/or sound icons. Screen readers can be used in combination with the screen magnifier to read the content within the enlarged portion of the screen content.

**[0759]** More specifically, screen narration in vehicle can describe the layout of a current display, including a current position, page, functionality, etc., of displayed content and the position of a digit of the user and/or cursor relative to displayed objects. The names of the displayed objects in proximity to the current digit and/or cursor location can be audibly identified. In another example, a user can identify a displayed object to be located and the media controller subsystem 348 can use "hotter", "hot", "colder", and cold" game to inform the user where his or her digit and digit movement is relative to the identified object. For example, the media controller subsystem 348 can tell the user that "you're getting warmer" as the user's digit moves closer to the identified object.

**[0760]** In yet another example, the media controller subsystem 348 determines that the user is driving the car rather than being a (non-driving) passenger and enables or disables automatically remove all unnecessary animation effects , such as fading effects (e.g., fade windows), from the displayed content.

**[0761]** In yet another example, the media controller subsystem 348 automatically removes background images from the displayed content while leaving one or more displayed foreground images. The removed background image can be replaced with a uniform background, such as a commonly colored or white background.

**[0762]** In yet another example, the media controller subsystem 348 enables automatically a longer (than normal) period for notification dialog boxes to stay open on the display.

**[0763]** In yet another example, the media controller subsystem 348 automatically disables automatic arrangement of windows when the mouse cursor is moved to the edge of the screen.

**[0764]** In yet another example, the media controller subsystem 348 automatically enables activate a window by hovering over it with the mouse cursor.

**[0765]** In yet another example, the media controller subsystem 348 automatically enables keyboard web page navigation.

**[0766]** In yet another example, the media controller subsystem 348 automatically enables or renders high contrast (e.g., between text and background colors) to make the displayed content more visible to the user.

**[0767]** In yet another example, the media controller subsystem 348 automatically changes the color and transparency of window borders (making the borders easier to see).

**[0768]** In yet another example, the media controller subsystem 348 automatically changes the thickness of focus rectangle (around the currently selected item in a dialog box).

**[0769]** In yet another example, the media controller subsystem 348 automatically changes the color, size, and/or thickness of the on-screen mouse pointer.

**[0770]** In yet another example, the media controller subsystem 348 automatically changes the keyboard settings (e.g., select how long you need to press a key before the keyboard character starts repeating, the speed at which keyboard characters repeat, and the rate at which the cursor blinks, etc.).

**[0771]** In yet another example, the media controller subsystem 348 automatically ignores colors, font styles and font sizes used on web pages, or formats web pages using a user specified or default style sheet.

**[0772]** In yet another example, the media controller subsystem 348 automatically enables or renders in the content an increased size of a mouse-selectable screen element or object to provide a larger target.

**[0773]** In yet another example, the media controller subsystem 348 automatically enables mouse keys to move the mouse pointer or cursor.

**[0774]** In yet another example, the media controller subsystem 348 automatically enables one or more of sticky keys (which allow the user to enter a combination of multiple keys without having to hold a first key down when he or she depresses a second key), toggle keys (which play an alert each time the user presses Caps Lock, Num Lock, or Scroll Lock keys), and filter keys (which causes the computer to ignore keystrokes that occur in rapid succession or keystrokes held down for several seconds unintentionally).

**[0775]** In yet another example, the media controller subsystem 348 automatically causes the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to be configured to enable blind typing. In blind typing, the driver can write naturally with a finger on the interface and the interface can determine, from the natural written script, a command or request of the driver. This configuration typically requires the interface to be configured as a touchpad. While other systems require the driver to focus away from the road — either by selecting letters from menus or on a displayed keyboard — blind typing permits the driver to input commands or requests to the vehicle control system without having to visually focus on any screen.

**[0776]** Although many of the above display changes or reconfigurations have been used to enable impaired users to access a computer, the driver is typically not disabled or impaired (e.g., not visually impaired or disabled). These changes or reconfigurations can however be highly beneficial in enabling a driver to interact with the computer in a manner that substantially avoids or inhibits driver distraction.

**[0777]** Rather than automatic detection, any of the above features and/or settings and/or filters can be a standard feature and/or setting and/or filter and can be applied to the on board vehicle display for the driver but not to the on board vehicle displays of other (non-driving) passengers. In other words, the feature or setting or filter would not be applied to the on board vehicle display of a (non-driving) passenger. Alternatively, the feature and/or setting and/or filter would be applied to the on board vehicle display for the driver

only when the vehicle is in motion or in forward or reverse gear and not when the vehicle is parked.

**[0778]** A user interface (UI), such as the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312, may be provided that includes an area for navigation by a user. As a user navigates the UI area, the user may be provided with one or more of sounds, audio narration, haptic/tactile feedback, visual indicator (e.g., not associated with the UI), and the like. For example, a location in the UI area may represent a button and/or other icon. When the user makes contact with the location having the button, a sound and/or tactile feedback may be presented to the user to indicate where the user's pointer (e.g., one or more finger, hand, etc.) is located. As one example, as a user reaches a location in the UI area associated with a "call" button, the sound presented may be a ring (e.g., a bell), and a vibration may be provided to the UI. Alternatively, screen narration by a screen reader can be provided, which informs conversationally the user where his or her digit is located. For example, the narration can be to recite the name corresponding to the button. In another example, as a user moves a pointer about the UI area, a frequency of sound may change to indicate a position in the UI area (e.g., the low left portion of the UI area may provide a low pitch and/or frequency sound, while a position in the upper right portion of the UI area may have a higher pitch and/or frequency sound, and portions in between can have different pitches and/or frequencies, etc. – similar to the Theremin musical instrument).

**[0779]** By way of example, a graphical UI or GUI may allow a user to interact with certain displayed buttons, features, and/or menus while a vehicle is stationary, but may restrict access and/or interaction when the vehicle is moving. One example of this restricted interaction involves greying-out buttons associated with an associated phone feature when the vehicle moves. In the embodiments provided herein, the display can be completely turned off or blanked out when moving and a user may still be able to interact with features. Because the user will not be distracted by the visual presentation of elements the user is free to drive while interacting.

**[0780]** In some embodiments a GUI may be used where a display of the GUI is turned off to provide the above described functionality.

**[0781]** A display navigation mode can be selectively triggered by the user to implement any of the above configurations and/or features. When the user wishes to enter display navigation mode, the user can provide a command, such as by voice or gesture, to enter that mode. In that mode, any of the above assistive configurations or features can be

implemented. For example, voice navigation is activated and the residence time of the user's touch on the touch screen required to select a contacted icon is lengthened to avoid incidental or accidental icon selection as the user moves his or her hand/digit around the touch screen. When the user arrives at a desired location, the icon will be activated after touch contact for the longer residence time. When the icon is selected, the touch screen can return to normal operating mode with a shorter residence time for icon activation.

**[0782]** The user can alternatively use a roller or track ball and selector to effect narrated screen navigation.

**[0783]** In another embodiment, the user contacts an arbitrary and substantially planar or flat control surface, such as an arm rest, dash, steering wheel, glove box door, center or rear center console, window (e.g., windshield), passenger compartment roof, seat surface, door panel, or other electrically, magnetically, electromagnetically, and optically nonreactive surface to activate icons on the activated or deactivated vehicle computer center or rear center display. The control surface can be any arbitrary surface selected by the user. This can be done by optically or visually separating the surface into segments, each segment corresponding to a segment on the display. The movement of the user's hand or digit is tracked optically over the surface with reference to the segments. As the user moves his or her hand, the user can be audibly told where his or her hand is relative to the display. When the user's hand/digit is at a selected location, the user can leave his or her hand/digit at that location for a selected residence time to cause the icon in the corresponding segment of the display to be activated.

**[0784]** The activated or deactivated vehicle computer center or rear center display can be any of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312, may be provided that includes an area for navigation by a user.

**[0785]** An example is described with reference to Figs. 33-34. Figure 34 depicts the display of Fig. 30 with defined segments overlaid on the display. This is done to show the process of mapping the control surface to the displayed objects. Fig. 33 shows the same defined segments positioned on the control surface 3300. Each segment of the control surface 3300 corresponds to an information-containing and/or activatable or selectable object of the current display. As the display changes in response to user input or otherwise, the type, identity, and/or arrangement of displayed information and objects changes requiring the display to be remapped to the control surface 3300. Remapping

typically requires the defined segments to be redefined and reconfigured to reflect the new display configuration.

**[0786]** As shown by Fig. 33, the dividing lines define various cells, each of which corresponds to displayed content on the display of Fig. 34. Specifically, cell 3304a corresponds to display field comprising driver name 3028, cell 3304b to satellite reception indicator 3032, cell 3304c to WiFi connectivity indicator 3034, cell 3304d to cellular connectivity indicator 3036, cell 3304e to display field comprising weather information 3038, cell 3304f to display field comprising date 3040, cell 3034g to icon 3380, cell 3034h to navigation ("Nav" icon) 3016, cell 3034i to media ("Media" icon) 3018, cell 3034j to phone ("Phone" icon) 3020, cell 3034k to rear view ("Rear View" icon) 3022, cell 3034l to other applications icon 3024, cell 3034m to icon 3384, cell 3034n to "my dash" icon 3026, cell 3034o to navigation display field 3088, cell 3034zz to suggested icon, cell 3034p to set destination icon, cell 3034q to display field containing destination, cell 3034r to display field containing suggested waypoint, cell 3034s to display field containing suggested waypoint, cell 3034t to set destination icon, cell 3034u to set destination box, cell 3034v to favorites icon, cell 3034w to recent locations, cell 3034x to people icon, cell 3034y to points of interest icon, cell 3034yy to set waypoints, cell 3034z to set waypoints box, cell 3034aa to go icon, cell 3034bb to calendar icon 3092, cell 3034cc to weather icon 3096, cell 3034dd to display field containing appointment, cell 3034ee to display field containing appointment, cell 3034ff to display field containing appointment, cell 3034gg to display field containing appointment, cell 3034hh to display field containing appointment, cell 3034ii to display field containing appointment, cell 3034jj to display field containing weather information, cell 3034kk to display field containing weather information, cell 3034ll to display field containing weather information, cell 3034mm to display field containing weather information, cell 3034nn to display field containing weather information, cell 3034oo to display field containing weather information, cell 3304pp to friends icon, cell 3304qq to received and/or sent messages 3068, cell 3304rr to received and/or sent messages 3068, cell 3304ss to received and/or sent messages 3068, cell 3304tt to received and/or sent messages 3068, cell 3304uu to received and/or sent messages 3068, cell 3304vv to received and/or sent messages 3068, cell 3304ww to icon 3098, cell 3304xx to a climate control icon ("Climate" icon), cell 3304aaa to a controls icon ("Control" icon) to control vehicle tasks, functions or operations 3062, cell 3304bbb to speaker volume setting 3064, cells 3304ccc and ddd to controls to the left and right of the speaker image 3066 and 3070, respectively, and cell 3304eee to speaker icon.

**[0787]** By way of example, the user's digit points at 3304h, which corresponds to the navigation icon 3016 of the home page 3000 of Fig. 30. By leaving the user's digit stationary in that location for a selected period of time, the media controller subsystem 348 determines that the user desires to activate the navigation icon 3016, which causes a different display to be rendered. The new display is remapped to the control surface so that the dividing lines on the control surface mirror the dividing lines overlain on the new display. By way of further example, the user's digit points at 3304f, which corresponds to the display field for date and time of the home page 3000 of Fig. 30. A screen reader reads the date and time to the user. By way of further example, the user's digit points at 3304dd, which corresponds to the display field for appointment of the home page 3000 of Fig. 30. A screen reader reads the displayed appointment information to the user.

**[0788]** Optical tracking of the user's digit enables the location of the digit. Optical tracking typically determines in real-time the position of the digit by tracking the positions of either active or passive infrared markers attached to the object. The position of the point of reflection is determined using the camera sensors 760, motion sensors 744, and/or infrared sensors 740. In one configuration, the user's digit is equipped with . Markers can be light reflectors („passive markers", e.g. retroreflectors) or light emitters ("active markers", e.g. LEDs). To also measure the orientation of a body, several (greater than or equal to 3) of these markers have to be arranged at a known geometry. The camera sensors 760 scan a certain volume and detect the light that comes from the markers. These images are processed to identify and calculate potential marker positions (in image coordinates). The result of each measurement are coordinates that describe the position of the markers, and hence the position and orientation of the body carrying the markers.

**[0789]** Other techniques can be employed. The cell dividing lines can be projected onto the control surface by the camera sensors 760. The position of a selected digit of the user can be tracked using image processing of images of the control surface with the cell boundary or dividing lines in the images. Examples of other techniques include video tracking, such as blob tracking, kernel-based tracking, contour tracking, visual feature matching, match moving, motion capture, motion estimation, Swistrack, and single particle tracking.

**[0790]** The operation of the control surface will be discussed with reference to Fig. 35.

**[0791]** In step 3500, the media controller subsystem 348 detects a stimulus, such as ignition of the engine, motion of the vehicle, the vehicle being placed in gear, a gesture or other activation command from the user, and the like.

**[0792]** In response, the media controller subsystem 348, in step 3504, maps the current display of a selected one of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to a selected control surface. This can include proportional sizing the control surface to the display and determining cell and cell boundary locations. The sizes of the cells are commonly proportional to the corresponding displayed content.

**[0793]** In step 3508, the media controller subsystem 348 determines, by one or more of the motion sensors 744, infrared sensors 740, and camera sensors 760, whether a user's digit has moved relative to the stationary cell boundaries and cells on the mapped control surface.

**[0794]** When movement is detected, the media controller subsystem 348, in step 3512, detects or determines, by one or more of the motion sensors 744, infrared sensors 740, and camera sensors 760, the position of the digit on the control surface relative to the cells and cell boundaries.

**[0795]** In step 3516, the detected position of the digit is mapped to the currently displayed content. This is done by mapping the cell where the tip of the digit is positioned to the corresponding displayed content on the display.

**[0796]** In step 3520, the media controller subsystem 348 performs an action based on the detected digit position. The action depends on the type of displayed content corresponding to the digit position. When the displayed content is activatable or selectable, the media controller subsystem 348 activates the corresponding task, function or operation. When the displayed content is not activatable or selectable, a screen reader in the media controller subsystem 348 reads the displayed content to the user. Some operations are drag-and-drop operations where content is moved by the user's digit from one location to another, such as a destination or waypoint being dragged from one location and dropped into a set destination or wet waypoint box. This can be done by detecting the user's digit in a first location, determining that the displayed content can be dragged and dropped to another location, waiting for the digit to move to a second location, and, when in the second location, dropping the content into displayed content corresponding to the second location when the displayed content permits this operation to be performed.

**[0797]** As noted, when the task, function or operation causes the display to change the control surface is remapped to the display.

**[0798]** In another embodiment, the UI may not include any display at all. Because any surface can receive input, as provided herein, a display is not needed. Examples of this type of display-less UI can be implemented on any surface that has a substantially flat or planar area or surface. In one embodiment, the UI area may include a capacitive and/or resistive touch interface region. In another embodiment, the UI area may be a surface that includes an area visible from at least one image sensor (e.g., camera, etc.). Other examples of a display-less UI may include a volume of space in which a user can move a pointer.

**[0799]** In the examples provided above, a user may navigate the non-displayed UI elements (e.g., icons, buttons, etc.) using sound, haptic feedback, etc.

**[0800]** An operation of the media controller subsystem 348 will now be described with reference to Fig. 26.

**[0801]** In step 2600, a stimulus is detected by the media controller subsystem 348 based on input from one or more vehicle sensors. An exemplary stimulus includes a change in vehicle operating state. Common changes in vehicle operating state include a change from "parked" to "forward gear" and vice versa, from "parked" to "reverse gear" and vice versa, from "forward gear" to "reverse gear" and vice versa, and from stationary to in motion and vice versa.

**[0802]** In decision diamond 2604, the media controller subsystem 348 selects a device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 and determines whether or not it is associated with the driver. This is typically determined by determining whether or not the selected device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 is located in an area and/or zone occupied by the driver. Location of the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 can be determined using the techniques noted above.

**[0803]** When the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 is located in the area and/or zone of the driver, the media controller subsystem 348, in step 2608, reconfigures the user interface to enable or disable (depending on the initial and final states) one of the features, settings, or filters discussed above.

**[0804]** When the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 is not located in the area and/or zone of the driver, the media controller subsystem 348, in step 2608, does not reconfigure the user interface to enable or

disable (depending on the initial and final states) one of the features, settings, or filters discussed above.

**[0805]** After performing either of steps 2608 or 2612, the media controller subsystem 348 selects a next device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 and returns to decision diamond 2604.

**[0806]** This process is continued until all devices or user interfaces 212, 248, user interface (s)/input interface(s) 324 and/or I/O modules 312 have been considered.

**[0807]** In other embodiments, the media controller subsystem 348 can audibly warn of or describe an image detected via an infrared sensor, motion sensor or camera sensor that is in the path of the vehicle. Known image processing and image recognition techniques can be used to identify the object image and compare the image to a projected path of the vehicle. An exemplary technique acquires the image, pre-processes the acquired image, performs feature extraction from the pre-processed image, performs detection and/or segmentation using the extracted features, and performs high level processing and decision making. The path of the vehicle, as determined by a steering wheel setting and a projected path of the center line of the vehicle for that setting along with a width of the vehicle can be compared against the position of the object. When the projected path causes any portion of the vehicle to contact the object or be within an unsafe distance of the object, appropriate instructions or warnings can be issued. Thus, not only can a warning containing the object description be provided to the driver but also directions can be audibly provided to enable the driver to miss the object. For example, the driver can be instructed by one or more of the following: "Watch Out!"; "Turn the wheel left, a little more, a little more, perfect, straighten out"; "Turn the wheel right, a little more, a little more, perfect, straighten out"; and the like. This can provide invaluable assistance to driver's who struggle, for example, with backing up the vehicle due to depth perception and/or orientation issues.

**[0808]** User Account Management and Occupant Control of Vehicle Tasks, Functions and Operations

**[0809]** The vehicle control system 204 can manage user accounts that stipulate, control, and define rights and privileges of each user of the vehicle and vehicle network. Different users and/or devices may include different accounts. In some cases these accounts may include user and/or device-specific privileges.

**[0810]** For example, a system user has exclusive rights and privileges over all communication device firewall rules and running software. The system user can control

selected vehicle tasks, functions and operations and infotainment via predetermined or preconfigured gestures. A manufacturer or vendor user can have local or remote access to on board control system data and alter the parameters and settings in the vehicle control system and to perform diagnosis and repair. A dashboard user can have rights to launch a dashboard application and authenticate guest or default users and change permissions to trusted friends or family members. Dashboard users can read on board diagnostic system data but cannot overwrite or change it. A user can be both a system and dashboard user. An Internet source interacting with the vehicle has only http rights to respond to http requests received from the vehicle. The requests can target different user data but these are filtered by default user accounts. Guest users have no rights. Family and friend users have rights to play media from the media controller and to stream its media to the controller. They may or may not have rights to control vehicle tasks, functions and operations, whether or not by gesture. The back seat displays are part of this group of users. The back seat displays can be smart WiFi removable communication devices that can be removed from the vehicle in WiFi range of the communication network.

**[0811]** In one example, a child user may wish to change the temperature in his zone of the vehicle. Continuing the example, the child may have an account that allows access to this feature (but not other more critical features). As such the child may change the temperature via the device or other control. The child, however, may not be entitled to change the feature for an area or zone other than that in which he or she is currently located. Additionally or alternatively, a driver may have a broader account and privileges. In this case, the driver may control critical features, and even tasks, operations, and functions, of a vehicle. Remote control of a vehicle or infotainment task, operation, or function through the on board vehicle computer and by a portable or handheld computational device, such as a cellular phone or tablet computer, interconnected with the vehicle computer, can be permitted for some users but not others. For example, a privileged user can control an infotainment or climate control function on the dashboard from the back seat of the vehicle. The control of the vehicle or infotainment task, function, or operation may be made via a device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312. Accordingly, occupant control of a (typically non- or less critical) vehicle task, function, or operation (such as an infotainment task, function or operation) can be done using an on board (or vehicle mounted) computational device or a portable computational device discrete from and not mounted on the vehicle.

**[0812]** In another example, a user in the rear passenger seat of a vehicle may wish to take control of specific features that are allowed in that zone. Such features may include controlling the climate, changing a radio station or infotainment presentation, opening a window, setting a volume level, setting a screen contrast and/or resolution, and/or adjusting a seat position. The control of these features may be provided to the user in the rear passenger seat via a display, gesture control region, or other device associated with the zone in which the rear passenger is seated. Associated devices may include the user's smart-phone, tablet, computer, and/or other device.

**[0813]** In yet another example, a vehicle occupant can perform a first set of vehicle tasks, functions and operations when in a first area and/or zone and a different set of vehicle tasks, functions, and operations when in a different second area and/or zone. For instance, a vehicle occupant can drive the car or perform another critical vehicle task, function or operation when seated in the driver's seat but not when seated in a different seat. When the vehicle occupant is in the back seat, he is unable to be a back seat driver of the vehicle or perform another critical vehicle task, function or operation.

**[0814]** In yet another example, a vehicle occupant can perform a first set of vehicle tasks, functions and operations when the vehicle is in a first operating state and a different set of vehicle tasks, functions, and operations when the vehicle is in a second operating state. The vehicle occupant, for instance, can watch a video on the driver's center console or display subsystem when parked and/or the vehicle is stationary (not in motion) but cannot watch the video on the driver's center console or display subsystem when the vehicle is in gear and/or motion.

**[0815]** In yet another example, a different authentication procedure is used for the vehicle occupant when requesting a first set of vehicle tasks, operations, and functions than when requesting a second set of vehicle tasks, operations, and functions. When the vehicle occupant is entitled to drive the vehicle or perform another critical vehicle task, function or operation, a different and higher or more stringent set of authentication requirements can be required than when the vehicle occupant is not entitled to drive the vehicle. For instance, multiple authentication techniques may be used in the former case but only one in the latter case.

**[0816]** As noted, the vehicle control system 204 manages user accounts, which contain user credentials, such as user identifiers, passwords, user biometric data (e.g., fingerprints, retina images, facial characteristics, user weight, and other physical characteristics), and rights and privileges of the user in performing vehicle tasks, functions, and operations,

both critical and non-critical. In addition to the rights and privileges defined in the user account, the vehicle control system 204 can consider additional gating or filtering factors, such as current user position (e.g., what area and/or zone the user is located or seated in), in determining what rights and privileges apply currently to the user.

**[0817]** The vehicle control system 204 can manage and enforce accounts for authenticated and non-authenticated users. Each account specifies rights and privileges for the corresponding user and/or security/authentication requirements and/or personal settings of the user (such as seat and lumbar settings, climate control settings, lighting settings, configuration of instrument cluster, rear view mirror settings, driving modes (such as fuel economy, sport, city, and the like), media channel settings or presets, media delivery preferences, music genre preferences, scheduled programs, playlists, synchronization with cloud-based data associated with the user (such as iCloud™ of Apple™, Outlook™, and the like with examples of cloud-based data being electronic calendar, email, contacts, media content, texts, voice mail messages, and the like), application-specific personalization and selections, display settings and configurations, and the like) and other information noted above with respect to the profile data 252 and device data 220. These will be henceforth encompassed by any reference to a user's account.

**[0818]** For example, an owner of the vehicle would have the right and privilege not only to access infotainment media but also to access and control critical and non- or less critical vehicle tasks, functions, and operations. Because he is entitled to the highest level of rights and privileges, his or her authentication requirements may be more demanding than another vehicle occupant not having such rights and privileges. A child of the vehicle owner on the other hand would have a very restricted or no right to access and control vehicle tasks, functions, and operations (except for climate control, seat, and/or window settings) and restricted rights to access infotainment media. As noted above, a child filter could be configured by the vehicle owner to prevent the child from accessing age-restricted media.

**[0819]** A guest of the vehicle owner having no corresponding account would be provided with a default account having default and restricted rights and privileges to access vehicle and infotainment tasks, functions, and operations, and settings and configurations, which could be expanded based on input from the owner. This could be done in response to a query by the vehicle control system 204 that the vehicle occupant is not recognized (or authenticated). The vehicle control system 204 could provide the

owner with multiple default accounts, one for an adult with driving privileges, one for an adult without driving privileges, and one for a child, and request the owner select the appropriate default account for the occupant. An identifier of the occupant and optionally authentication credentials would be inputted by the owner, and the vehicle control system 204 could store image processing information of the occupant's facial or other image, biometric information, and/or occupant weight for purposes of authentication. The owner could define, in an account created or modified by the owner, the rights and privileges of the person associated with the account.

**[0820]** An operation of the vehicle control system 204 is shown in Fig. 27.

**[0821]** In step 2700, the vehicle control system 204 detects a stimulus, such as a driver prompt, presence of an occupant, and the like. As noted above, the presence of an occupant can be sensed by seat weight sensors, image processing analysis, motion detection, proximity of a key fob, and/or biometric information.

**[0822]** In decision diamond 2704, the vehicle control system 204 determines whether or not each of the vehicle occupants has been authenticated successfully. Authentication can be performed by any suitable technique and using any suitable input, such as by one or more of receiving and validating user credentials, sensing an occupant's weight in a seat (with the weight being different from weight ranges predefined for each known occupant), image processing performed on the facial characteristics of the various vehicle occupants (and comparing the sensed facial characteristics against those for known occupants), biometrics (such as a fingerprint image of the occupant sensed by the occupant touching a touchscreen display, retinal scan, heart rhythm as received by conductive elements on a vehicle component such as the steering wheel or gear shift) (which are compared against corresponding stored biometrics for known occupants), and the like. An unauthenticated occupant could be recognized by sensing an occupant's weight in a seat (with the weight being different from weight ranges predefined for each known occupant), image processing performed on the facial characteristics of the various vehicle occupants (with the sensed facial characteristics failing to match stored facial characteristics for known occupants), unrecognized biometrics (which do not correspond to biometrics for known occupants), and the like.

**[0823]** Authentication using image processing applied to video images of occupants in the vehicle can be performed by any suitable technique. In one technique, facial recognition occurs in two stages, namely face detection and recognition. The face detection stage attempts to obtain an acceptable image from the video stream of the

vehicle occupants to use in the face recognition stage. The face recognition process uses the image obtained from the detection stage and compares it with a database of known faces. When the facial image obtained from the detection stage matches a known stored facial image, authentication is successful. When the facial image obtained from the detection stage fails to match a known stored facial image, authentication is unsuccessful. As noted, image processing can be augmented by other security mechanisms for higher level privileges, such as authentication by user credentials (*e.g.*, pattern lock, PIN, or other password).

**[0824]** When the user is authenticated successfully, the vehicle control system 204, in step 2708, retrieves the corresponding account for the successfully authenticated user.

**[0825]** In step 2712, the vehicle control system 204 next determines the area and/or zone (e.g., seat position) occupied by the authenticated user, such as by using any of the techniques discussed herein, including without limitation image processing information of the various occupants, sensed seat weight, user input, location coordinates received from a portable computational device, such as a cell phone, tablet computer, or personal digital assistant associated with the user, and the like. The vehicle control system 204 may also determine an operating state of the vehicle, e.g., in motion, parked, in gear, in neutral, and the like.

**[0826]** In step 2716, based on location (e.g., seat position) of the corresponding authenticated user and/or the operating state of the vehicle, the vehicle control system 204 enables eligible rights, privileges, settings and configurations set forth in the corresponding account and disables ineligible right or privileges or alters settings and configurations.

**[0827]** When the user is not authenticated successfully, the vehicle control system 204, in step 2720, creates an account for the unauthenticated user as set forth above. As noted, the account can be a default account.

**[0828]** Another application of the vehicle control system 204 for authentication by facial recognition is shown in Figs. 28-29.

**[0829]** In step 2800, the vehicle control system 204 detects a stimulus or trigger event.

**[0830]** In step 2804, the vehicle control system 204 provides, via the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312, the user with a face detection screen, such as that shown in Fig. 29. As shown in Fig. 29, the face detection screen 2900 is a dashed outline 2904 of a human face having eye holes 2908a and b to enable the user to align his or her face with the screen for a higher quality

video image of the user's face. This screen 2900 prompts the user to align his or her face such that the facial recognition camera can obtain a good image. The screen can show the video feed from the facial recognition camera with the dashed outline as an overlay. The dashed outline is intended to assist users situate his or her image properly in the camera's field of view. An instruction line 2912 can appear at the top of the screen 2900.

**[0831]** When an acceptable facial image is not obtained so that facial recognition cannot be performed, the vehicle control system 204 proceeds 2803to a manual sign-in step (discussed below) and provides the user with a face recognition failure notification dialog over the screen 2900 of the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 in step 2812. If a proper facial image is obtained, the vehicle control system 204, in step 2816, searches through a repository of stored facial images to find a match and, during the mapping, provides the user with a recognition progress indicator modal on the screen 2900.

**[0832]** When recognition is not successful or no match is found, the vehicle control system 204 proceeds to step 2812 and the manual sign-in step discussed below.

**[0833]** When recognition is successful and a match is found, the vehicle control system 204 proceeds to step 2820 and applies the personal settings of the user, such as any or all of the settings referenced above. A settings application progress modal can be displayed over the displayed screen.

**[0834]** In step 2812, the vehicle control system 204 provides the user with a manual sign-in screen (not shown) requesting input of the user's credentials. The manual sign-in screen, for example, can include fields for user identifier and password and options to sign in or continue as a guest.

**[0835]** When the credentials are not received within a time out period or are incorrect or at the request of the user in step 2812, the vehicle control system 204 can create 2828 a guest or default account for the user as discussed above and applies default settings.

**[0836]** When the credentials are received and successfully authenticated, the vehicle control system 204 in step 2820 applies the personal settings of the user.

**[0837]** The vehicle control system 204, after steps 2820, 2824, or 2828 proceeds to step 2832 and provides a home screen page, such as home page 3000, configured in accordance with the applicable settings.

**[0838]** Configuration of Haptic Feedback and Visual Preferences in Vehicle User Interfaces

**[0839]** The profile data 252 can include, for each occupant in a corresponding user profile, physical impairment information, such as information regarding a disability. The physical impairments include vision impairments (e.g., low vision, blindness, night and color blindness, and light sensitivity), hearing impairments (such as hearing loss, hard-of-hearing, and deafness), dexterity and mobility impairments (such as caused by arthritis, cerebral palsy, multiple sclerosis, loss of limb or digit, spinal cord injury, and repetitive stress injury), and language and/or communication impairments (such as aphasia, delayed speech, dyslexia, and other conditions resulting in difficulties remembering, solving problems, and/or perceiving sensory information).

**[0840]** System data 208 can include rules to implement by the vehicle control system 204 an accessibility or assistive technology. This can include reconfiguring, for example, the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312. Once the user having the impairment is located in the vehicle or correlated with a particular seat position and/or device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312, the accessibility or assistive technology can be applied to the corresponding device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312. The type of accessibility or assistive technology employed can depend not only on the type and capabilities of the device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 but also on the seat position of the impaired user. Specifically, when the impaired user is a driver of the vehicle, he or she may receive different accessibility or assistive technology compared to when he or she is a non-driving vehicle occupant or passenger.

**[0841]** The type of assistance provided by the vehicle control system 204 depends on the particular impairment and/or disability involved. For example, if the vehicle control system 204 were to determine that the user has a particular impairment and/or disability, the vehicle control system 204 can recommend and/or implement automatically other feature or device settings and/or accessible technology that may provide improved access for the user. By way of illustration, information, commands, warnings, and requests provided by way of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to users with vision impairments can be one or more of the use of screen magnification, high contrast (e.g., between text and background colors such as white text on a black background, large font size and/or icon size (e.g., without changing screen resolution), color changes on the screen, a screen reader (or other

text-to-speech program), speech recognition software (such as to operate the computer and/or software), enablement of a read mode, keyboard web page navigation, and the like. Information, commands, warnings, and requests provided by way of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to users with a hearing impairment can be one or more of the use of text or visual alternatives for sounds, high volume levels, changed computer sounds, sign language interpretation or translation (e.g., by image processing and acquisition based on visual images captured by one or more camera sensors), a text phone application, and the like. Information, commands, warnings, and requests provided by way of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to users with a dexterity and/or mobility impairment can be one or more of the use of particular mouse settings (e.g., mouse button configuration and timing (such as double-click speed), to make the mouse pointer more visible, and to alter the scroll speed of the mouse wheel or how quickly the mouse pointer responds to movements of the mouse), an increased size of a mouse-selectable screen element to provide a larger target, mouse keys to move the mouse pointer, sticky keys, toggle keys, filter keys, keyboard shortcuts, access keys, keyboard settings, an on-screen keyboard, speech recognition software (such as to dictate into almost any application (e.g., the user can dictate documents and email, surf the web, and control selected vehicle tasks, functions, and operations by voice command)), disablement of the automatic arrangement of windows when the mouse cursor is moved to the edge of the screen, enablement of activate a window by hovering over it with the mouse cursor, keyboard web page navigation, a disability assistive keyboard (such as an alternative keyboard) displayed on the screen, a keyboard filter, and the like. Information, commands, warnings, and requests provided by way of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to users with a language and/or communication impairment can be one or more of the use of sticky keys, toggle keys, filter keys, enablement of remove background images, disablement of all unnecessary animations, long period for notification dialog boxes to stay open, a keyboard filter, speech recognition software, enablement of a read mode, a screen reader, keyboard web page navigation, and a speech synthesizer, and the like. Information, commands, warnings, and requests provided by way of the driver's device or user interface 212, 248, user interface (s)/input interface(s) 324 and/or I/O module 312 to users with a learning impairment can be one or more of the use of a word prediction program, a

reading tool, a learning disability program, a speech synthesizer, and speech recognition programs.

**[0842]** For users with an impairment, an assistive technology can use haptic feedback to provide information to a user. Haptic technology, or haptics, is a tactile feedback technology which takes advantage of the sense of touch by applying forces, vibrations, or motions to the user. Haptic feedback commonly uses the sense of touch in a user interface to provide information to an end user. The user interface can be any device with which a body part of the user is in contact and through which haptic feedback can be transmitted. Examples include a steering wheel, tactile electronic display, seat, seat belt, foot pedal, gear shift, center or rear center console, arm rest, other contact surface, and the like. In one configuration, the assistive technology is a system where at least two actuators are positioned beneath a user interface to provide vibratory feedback when a user makes contact with the unit. One actuator can induce a feedback vibration while one or more other actuator creates a second vibration to suppress the first from propagating to unwanted regions of the interface, thereby "localizing" the haptic experience. To minimize driver's attention away from the road or for a visually impaired occupant, tactile (or haptic or aural) feedback can be used to help a user identify which button / icon they are touching or pressing, without drawing their visual attention away from the road. It can also be used, for the hearing impaired, haptic feedback can be used to identify external sounds, such as sirens of an emergency vehicle, and/or a vehicle horn and/or information about a vehicle task, function or operation, such as an engine-related warning being activated, vehicle speed, vehicle gear currently engaged, and the like. Each type of information to be provided by haptic feedback to the user can have a correspondingly different haptic feedback response to enable the user to distinguish between types of information. For example, a police siren can have a different haptic feedback than an ambulance siren, both of which can have a different haptic feedback from an engine-related warning.

**[0843]** The external sound can be detected by one or more sound sensors positioned interiorly and/or exteriorly to the vehicle. Each sensor generates an analog or digital representation of the sound detected over a selected frequency range. The vehicle control system uses template matching to associate the profile of the sound detected with a corresponding matching profile of type of sound. In other words, the sound profile is the template and the sensed sound profile of a police siren is matched to the template sound profile.

**[0844]** Sensed sound template matching can be used to generate an alert or sound in a different frequency range to a user. All or part of the sensed sound profile can be frequency shifted to provide a corresponding output sound profile covering a different frequency range. The matching type of sound can have a unique corresponding output sound profile. The output sound profile can be played to the vehicle occupants over the sound system of the vehicle. The output sound profile may be suited to a user's particular frequency and/or hearing disability such that the output sound profile contains a set of frequencies that the user can hear. The sound may even adjust an audible signal presented to a user (e.g., statically, dynamically, and/or combinations thereof) to provide a differently shaped or phase-shifted sound profile. The sound profile over certain frequency ranges can be exaggerated in magnitude and/or the sound profile over certain frequency ranges can be decreased in magnitude or eliminated altogether. The output sound profile is played over the vehicle's sound system in temporal proximity to the detection of the corresponding external sound profile to alarm the occupant. In one configuration, the output sound profile is played over the spatially dispersed speakers in the passenger compartment with sound delays (or phase shifts) and/or magnitude levels at each speaker simulating the sound delays and/or magnitude levels of the various portions of the sound sensed by the various sound detectors positioned inside and/or outside of the vehicle. This can indicate to the user spatially where the origin or source of the sound is located relative to the vehicle.

**[0845]** Alternative to or in addition to playing the output sound profile, visual signals and/or alerts to a user (e.g., flashing lights, increasing intensity associated with a visual signal, animated icons, etc.) can be provided visually to the user. The color, brightness, duration, and/or intensity of the light emitted and/or appearance of the animated icon can vary by the matching type of sound profile such that each type of sound profile has a unique set of visual signals and/or alerts to the user.

**[0846]** The general interfaces of a vehicle, including but not limited to, at least one of the infotainment system, interfaces, graphical user interfaces, and the like, can be configured to display color-blind friendly colors so that the interface is meaningful and usable for a color-blind user. Colors, contrast, brightness, etc. may be configured to provide an optimum user experience based on the type of color-blindness.

**[0847]** The vehicle control system can adjust or modify settings on manual controls to account for a user impairment or medical condition, age, physical condition or characteristics, and/or driving history. This information can be recorded in a

corresponding user profile, obtained over the Internet from a remote source (such as driving history from a law enforcement agency), and/or sensed by observing the user's behavior over time. For instance, the user may not respond quickly to a vehicle sensed obstacle in the path of the vehicle, may move, shake or jitter the steering wheel slightly during vehicle operation. The user response time, pedal displacement of the user, force applied to a pedal by the user, steering wheel displacement during straight-line driving, and the like can be monitored by the vehicle control system and the monitored behavior analyzed and stored in the corresponding user profile. Analysis can by matching the observed behavior against various templates. The closest template is associated with a corresponding set of configuration rules regarding what settings to use for manual controls of the vehicle, The abilities can be based on driving or responsiveness tests and/or driver profiles maintained by a law enforcement or driver regulating agency.

**[0848]** Based on impairment, medical condition, age, and/or abilities, for example, the steering wheel, pedals, and/or other systems can be adjusted for play and/or responsiveness. For example, an individual who suffers from one or more of Parkinsons, old age, shaking, etc. may require more "play" in the steering wheel such that any shaking and/or small movements of the individual do not adversely affect the steering sensitivity of the vehicle. Upon detecting the user impairment, the vehicle control system may alter the characteristics of the steering wheel, for example, by reducing the sensitivity associated with movement. In one case, the sensitivity may be changed by modifying the electrical output in response to receiving a certain mechanical angular movement of the steering wheel. For instance, an angular movement of 10 degrees at the steering wheel may be the minimum default angular movement to cause the wheels on a vehicle to begin to turn. Upon detecting a user's disability, this minimum default angular movement may be increased to 30 degrees, as an example. Therefore, small movements (e.g., under 30 degrees) will not affect the steering. The changes to be implemented are typically based on rule sets in the system data 208 which map a set of user-related descriptors to recommended or required changes. The descriptors typically describe one or more of user impairment, medical condition, age, and/or abilities.

**[0849]** As can be appreciated, the sensitivity associated with a steering wheel and/or other manual vehicle control systems may be increased based on a user's abilities. Using the example provided above, an angular movement of 10 degrees at the steering wheel may be the minimum default angular movement to cause the wheels on a vehicle to begin to turn. Upon detecting a user's ability (e.g., quick reactions, steady hands, past driving

history, past vehicle history, etc.) this minimum default angular movement may be decreased to 5 degrees, as an example. Therefore, smaller movements (e.g., of 5 degrees applied at the wheel) will cause the vehicle to begin turning (similar to racing vehicles and/or high-end cars, etc.).

**[0850]** In other examples, (brake, emergency brake, accelerator and/or clutch) pedal movement range can be adjusted; that is, the vehicle control system can automatically adjust one or more of pedal stroke length, sensitivity, etc., based at least partially on user profile data and abilities.

**[0851]** The adjustment based on user profile and abilities can be extended to adjust settings and configurations of automated vehicle response systems. A collision avoidance system is an automobile safety system designed to reduce the severity of an accident. Also known as precrash system, forward collision warning system or collision mitigating system, it uses radar and sometimes laser and camera sensors to detect an imminent crash. Once the detection is done, these systems either provide a warning to the driver when there is an imminent collision or take action autonomously without any driver input (by braking or steering or both). In one approach, the collision avoidance system works in multiple phases. In a first phase, the collision avoidance system provides warning of an impending accident, while the hazard warning lights are activated, the side windows and sunroof are closed and the front seat belts are tensioned. In a second phase, the warning is followed by light braking, strong enough to win the driver's attention. In a third phase, the collision avoidance system initiates autonomous partial braking. In a fourth phase, the collision avoidance system decelerates the car followed by automatic deceleration at full braking power, roughly half a second before projected impact. In another approach, the collision avoidance system provides a warning to the driver through a Heads Up Display that visually resembles brake lamps. If the driver does not react, the system pre-charges the brakes and increases the brake assist sensitivity to maximize driver braking performance. In another approach, the collision avoidance system comprises radar and camera-based crash imminent braking in which radar technology detects a possible crash threat and alerts the driver. If the driver does not appear to react quickly enough or does not react at all, the system intervenes to apply the brakes in an effort to avoid the crash. In another approach, the collision avoidance system has three warning stages. In the first warning stage, the collision avoidance system includes audible and visual warnings to brake. If ignored, the collision avoidance system in the second stage tugs on the shoulder portion of the seat belt two to three times as an additional tactile warning to the driver to

take action. In a third stage, the collision avoidance system predicts that a collision is unavoidable and includes full seat belt slack takeup for more effective seat belt protection and automatic application of the brakes to lessen the severity of the predicted crash. In another approach, the collision avoidance system highlights pedestrians in front of the vehicle at night by alerting the driver with an audible chime and visually displaying them via a Heads Up Display. In another approach, the collision avoidance system uses electronic stability control sensors to measure steering angle, vehicle yaw and lateral acceleration of the vehicle and brake assist (BAS) sensors to detect emergency braking, The collision avoidance system can tighten the seat belts, adjust seat positions including rear seats (if installed), raise folded rear headrests (if installed) and close the sunroof and windows if it detects a possible collision (including rollover). The collision avoidance system can use radar to monitor the traffic situation ahead and provide automatic partial braking if the driver does not react to the warnings and the system detects a severe danger of an accident. The disclosure can be applied to other automated response systems besides collision avoidance systems.

**[0852]** The vehicle can adjust the settings of the automotive response systems, such as a collision avoidance system, to reflect a driver's unique abilities and/or impairments. The settings for instance can be for instance the time at which a warning of a potential collision is provided to the driver, the duration of the driver response or reaction time interval from a warning of a collision is provided to the driver and the initiation of automated braking, the braking force or deceleration of automated braking, and the time over which automated braking occurs. For example, a driver with particularly quick responses can have less fault tolerant triggers than a driver with slow responses; that is, the collision avoidance system for the former driver will trigger automated braking later than the collision avoidance system for the latter driver.

**[0853]** An operation of the vehicle control system will be discussed with reference to Fig. 31.

**[0854]** In step 3100, the vehicle control system senses a stimulus, such as ignition of the vehicle, the vehicle being placed in gear, a door opening or closing to permit a person to enter or exit the vehicle, activation of a graphical user interface, and the like.

**[0855]** In step 3104, the vehicle control system determines an identity of each occupant and, based on the occupant's user profile, whether or not the occupant has an impairment. The occupant may be identified by any suitable technique, including authentication, electronic address information of a portable communication device associated with the

user, image recognition, seat sensor feedback (e.g., weight of occupant), seat and lumbar settings selected by the occupant, and the like.

**[0856]** When the occupant has an impairment, the vehicle control system determines, in step 3108, occupant seating and/or interface location. The interface can be, for example, a graphical user interface, steering wheel, brake, clutch, or accelerator pedal, gear shift, or other communication interface by which the occupant is provided or provides information to the vehicle control system.

**[0857]** In step 3112, the vehicle control system configures the vehicle communication interface based on the type and/or severity of the occupant impairment(s), seating position of the occupant, and/or type of interface.

**[0858]** In step 3116, the vehicle control system selects a next occupant of the vehicle and returns to decision diamond 3104.

**[0859]** An operation of the vehicle control system will be discussed with reference to Fig. 32.

**[0860]** In step 3200, the vehicle control system senses a stimulus, such as ignition of the vehicle, the vehicle being placed in gear, a door opening or closing to permit a person to enter or exit the vehicle, activation of a graphical user interface, and the like.

**[0861]** In step 3204, the vehicle control system determines an identity of each occupant, retrieves the corresponding user profile and relevant system data. The occupant may be identified by any suitable technique, including authentication, electronic address information of a portable communication device associated with the user, image recognition, seat sensor feedback (e.g., weight of occupant), seat and lumbar settings selected by the occupant, and the like.

**[0862]** In decision diamond 3208, the vehicle control system, based on the occupant's user profile and/or relevant system data, determines whether or not the occupant has an ability that deviates sufficiently from a normal range for the subject vehicle communication interface and/or automated vehicle response system. The normal range is defined for each type of activity and for each type of interface and/or automated control system. As will be appreciated, different types of activities, different types of interfaces, and/or different types of automated control systems have differing normal ranges.

**[0863]** When the occupant has an activity that deviates sufficiently from a normal range, the vehicle control system retrieves and applies rule sets, in step 3212, to determine what settings of the vehicle communication interface and/or automated vehicle response system require alteration.

**[0864]** In step 3216, the vehicle control system configures the vehicle communication interface and/or automated vehicle response system based on the rule set application.

**[0865]** The vehicle control system then returns to step 3200.

**[0866]** The exemplary systems and methods of this disclosure have been described in relation to configurable vehicle center or rear center consoles and associated devices. However, to avoid unnecessarily obscuring the present disclosure, the preceding description omits a number of known structures and devices. This omission is not to be construed as a limitation of the scopes of the claims. Specific details are set forth to provide an understanding of the present disclosure. It should however be appreciated that the present disclosure may be practiced in a variety of ways beyond the specific detail set forth herein.

**[0867]** Furthermore, while the exemplary aspects, embodiments, options, and/or configurations illustrated herein show the various components of the system collocated, certain components of the system can be located remotely, at distant portions of a distributed network, such as a LAN and/or the Internet, or within a dedicated system. Thus, it should be appreciated, that the components of the system can be combined in to one or more devices, such as a Personal Computer (PC), laptop, netbook, smart phone, Personal Digital Assistant (PDA), tablet, etc., or collocated on a particular node of a distributed network, such as an analog and/or digital telecommunications network, a packet-switch network, or a circuit-switched network. It will be appreciated from the preceding description, and for reasons of computational efficiency, that the components of the system can be arranged at any location within a distributed network of components without affecting the operation of the system. For example, the various components can be located in a switch such as a PBX and media server, gateway, in one or more communications devices, at one or more users' premises, or some combination thereof. Similarly, one or more functional portions of the system could be distributed between a telecommunications device(s) and an associated computing device.

**[0868]** Furthermore, it should be appreciated that the various links connecting the elements can be wired or wireless links, or any combination thereof, or any other known or later developed element(s) that is capable of supplying and/or communicating data to and from the connected elements. These wired or wireless links can also be secure links and may be capable of communicating encrypted information. Transmission media used as links, for example, can be any suitable carrier for electrical signals, including coaxial

cables, copper wire and fiber optics, and may take the form of acoustic or light waves, such as those generated during radio-wave and infra-red data communications.

**[0869]** Also, while the flowcharts have been discussed and illustrated in relation to a particular sequence of events, it should be appreciated that changes, additions, and omissions to this sequence can occur without materially affecting the operation of the disclosed embodiments, configuration, and aspects.

**[0870]** A number of variations and modifications of the disclosure can be used. It would be possible to provide for some features of the disclosure without providing others.

**[0871]** It should be appreciated that the various processing modules (e.g., processors, vehicle systems, vehicle subsystems, modules, etc.), for example, can perform, monitor, and/or control critical and non-critical tasks, functions, and operations, such as interaction with and/or monitoring and/or control of critical and non-critical on board sensors and vehicle operations (e.g., engine, transmission, throttle, brake power assist/ brake lock-up, electronic suspension, traction and stability control, parallel parking assistance, occupant protection systems, power steering assistance, self-diagnostics, event data recorders, steer-by-wire and/or brake-by-wire operations, vehicle-to-vehicle interactions, vehicle-to-infrastructure interactions, partial and/or full automation, telematics, navigation/SPS, multimedia systems, audio systems, rear seat entertainment systems, game center or rear center consoles, tuners (SDR), heads-up display, night vision, lane departure warning, adaptive cruise control, adaptive headlights, collision warning, blind spot sensors, park/reverse assistance, tire pressure monitoring, traffic signal recognition, vehicle tracking (e.g., LoJack™), dashboard/instrument cluster, lights, seats, climate control, voice recognition, remote keyless entry, security alarm systems, and wiper/window control). Processing modules can be enclosed in an advanced EMI-shielded enclosure containing multiple expansion modules. Processing modules can have a "black box" or flight data recorder technology, containing an event (or driving history) recorder (containing operational information collected from vehicle on board sensors and provided by nearby or roadside signal transmitters), a crash survivable memory unit, an integrated controller and circuitry board, and network interfaces.

**[0872]** Critical system controller(s) can control, monitor, and/or operate critical systems. Critical systems may include one or more of (depending on the particular vehicle) monitoring, controlling, operating the ECU, TCU, door settings, window settings, blind spot monitor, monitoring, controlling, operating the safety equipment (e.g., airbag deployment control unit, collision sensor, nearby object sensing system, seat belt control

unit, sensors for setting the seat belt, etc.), monitoring and/or controlling certain critical sensors such as the power source controller and energy output sensor, engine temperature, oil pressure sensing, hydraulic pressure sensors, sensors for headlight and other lights (e.g., emergency light, brake light, parking light, fog light, interior or passenger compartment light, and/or tail light state (on or off)), vehicle control system sensors, wireless network sensor (e.g., Wi-Fi and/or Bluetooth sensors, etc.), cellular data sensor, and/or steering/torque sensor, controlling the operation of the engine (e.g., ignition, etc.), head light control unit, power steering, display panel, switch state control unit, power control unit, and/or brake control unit, and/or issuing alerts to a user and/or remote monitoring entity of potential problems with a vehicle operation.

**[0873]** Non-critical system controller(s) can control, monitor, and/or operate non-critical systems. Non-critical systems may include one or more of (depending on the particular vehicle) monitoring, controlling, operating a non-critical system, emissions control, seating system controller and sensor, infotainment/entertainment system, monitoring certain non-critical sensors such as ambient (outdoor) weather readings (e.g., temperature, precipitation, wind speed, and the like), odometer reading sensor, trip mileage reading sensor, road condition sensors (e.g., wet, icy, etc.), radar transmitter/receiver output, brake wear sensor, oxygen sensor, ambient lighting sensor, vision system sensor, ranging sensor, parking sensor, heating, venting, and air conditioning (HVAC) system and sensor, water sensor, air-fuel ratio meter, hall effect sensor, microphone, radio frequency (RF) sensor, and/or infrared (IR) sensor.

**[0874]** It is an aspect of the present disclosure that one or more of the non-critical components and/or systems provided herein may become critical components and/or systems, and/or vice versa, depending on a context associated with the vehicle.

**[0875]** Optionally, the systems and methods of this disclosure can be implemented in conjunction with a special purpose computer, a programmed microprocessor or microcontroller and peripheral integrated circuit element(s), an ASIC or other integrated circuit, a digital signal processor, a hard-wired electronic or logic circuit such as discrete element circuit, a programmable logic device or gate array such as PLD, PLA, FPGA, PAL, special purpose computer, any comparable means, or the like. In general, any device(s) or means capable of implementing the methodology illustrated herein can be used to implement the various aspects of this disclosure. Exemplary hardware that can be used for the disclosed embodiments, configurations and aspects includes computers, handheld devices, telephones (e.g., cellular, Internet enabled, digital, analog, hybrids, and

others), and other hardware known in the art. Some of these devices include processors (e.g., a single or multiple microprocessors), memory, nonvolatile storage, input devices, and output devices. Furthermore, alternative software implementations including, but not limited to, distributed processing or component/object distributed processing, parallel processing, or virtual machine processing can also be constructed to implement the methods described herein.

**[0876]** In yet another embodiment, the disclosed methods may be readily implemented in conjunction with software using object or object-oriented software development environments that provide portable source code that can be used on a variety of computer or workstation platforms. Alternatively, the disclosed system may be implemented partially or fully in hardware using standard logic circuits or VLSI design. Whether software or hardware is used to implement the systems in accordance with this disclosure is dependent on the speed and/or efficiency requirements of the system, the particular function, and the particular software or hardware systems or microprocessor or microcomputer systems being utilized.

**[0877]** In yet another embodiment, the disclosed methods may be partially implemented in software that can be stored on a storage medium, executed on programmed general-purpose computer with the cooperation of a controller and memory, a special purpose computer, a microprocessor, or the like. In these instances, the systems and methods of this disclosure can be implemented as program embedded on personal computer such as an applet, JAVA® or CGI script, as a resource residing on a server or computer workstation, as a routine embedded in a dedicated measurement system, system component, or the like. The system can also be implemented by physically incorporating the system and/or method into a software and/or hardware system.

**[0878]** Although the present disclosure describes components and functions implemented in the aspects, embodiments, and/or configurations with reference to particular standards and protocols, the aspects, embodiments, and/or configurations are not limited to such standards and protocols. Other similar standards and protocols not mentioned herein are in existence and are considered to be included in the present disclosure. Moreover, the standards and protocols mentioned herein and other similar standards and protocols not mentioned herein are periodically superseded by faster or more effective equivalents having essentially the same functions. Such replacement standards and protocols having the same functions are considered equivalents included in the present disclosure.



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**[0879]** The present disclosure, in various aspects, embodiments, and/or configurations, includes components, methods, processes, systems and/or apparatus substantially as depicted and described herein, including various aspects, embodiments, configurations embodiments, subcombinations, and/or subsets thereof. Those of skill in the art will understand how to make and use the disclosed aspects, embodiments, and/or configurations after understanding the present disclosure. The present disclosure, in various aspects, embodiments, and/or configurations, includes providing devices and processes in the absence of items not depicted and/or described herein or in various aspects, embodiments, and/or configurations hereof, including in the absence of such items as may have been used in previous devices or processes, e.g., for improving performance, achieving ease and\or reducing cost of implementation.

**[0880]** The foregoing discussion has been presented for purposes of illustration and description. The foregoing is not intended to limit the disclosure to the form or forms disclosed herein. In the foregoing Detailed Description for example, various features of the disclosure are grouped together in one or more aspects, embodiments, and/or configurations for the purpose of streamlining the disclosure. The features of the aspects, embodiments, and/or configurations of the disclosure may be combined in alternate aspects, embodiments, and/or configurations other than those discussed above. This method of disclosure is not to be interpreted as reflecting an intention that the claims require more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed aspect, embodiment, and/or configuration. Thus, the following claims are hereby incorporated into this Detailed Description, with each claim standing on its own as a separate preferred embodiment of the disclosure.

**[0881]** Moreover, though the description has included description of one or more aspects, embodiments, and/or configurations and certain variations and modifications, other variations, combinations, and modifications are within the scope of the disclosure, e.g., as may be within the skill and knowledge of those in the art, after understanding the present disclosure. It is intended to obtain rights which include alternative aspects, embodiments, and/or configurations to the extent permitted, including alternate, interchangeable and/or equivalent structures, functions, ranges or steps to those claimed, whether or not such alternate, interchangeable and/or equivalent structures, functions, ranges or steps are disclosed herein, and without intending to publicly dedicate any patentable subject matter.

**What is claimed is:**

1. A method, comprising:

(a) receiving, by a microprocessor executable vehicle control system, a request from a vehicle occupant to perform a vehicle task, function and/or operation;

(b) determining, by the microprocessor executable vehicle control system, that the vehicle occupant has been authenticated successfully;

(c) accessing, by the microprocessor executable vehicle control system, an account for the vehicle occupant, the account defining rights and privileges of the user with respect to controlling a vehicle task, function and/or operation;

(d) determining, by the microprocessor executable vehicle control system, at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle; and

(e) based upon the account corresponding to the vehicle occupant and the at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle, applying, by the microprocessor executable vehicle control system, the following rules:

(i) when the account permits the vehicle occupant to perform the requested vehicle task, function and/or operation, performing or causing to be performed the vehicle task, function, and/or operation; and

(ii) when the account does not permit the vehicle occupant to perform the requested vehicle task, function and/or operation, not performing or causing to be performed the vehicle task, function, and/or operation.

2. The method of claim 1, wherein, in step (e), the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the area and/or zone occupied by the vehicle occupant and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when in a first area and/or zone and a different set of vehicle tasks, functions, and operations when in a different second area and/or zone.

3. The method of claim 1, wherein, in step (e), the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the operating state of the vehicle and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when the vehicle is in a first operating state and a different set of vehicle tasks, functions, and operations when the vehicle is in a second operating state.

4. The method of claim 1, wherein rule (i) applies and the vehicle occupant is able to control the requested vehicle task, function and/or operation using one or more of a cell phone, laptop, tablet computer, and personal digital assistant.

5. The method of claim 1, wherein a different authentication procedure is used for the vehicle occupant when requesting a first set of vehicle tasks, operations, and functions than when requesting a second set of vehicle tasks, operations, and functions.

6. The method of claim 1, wherein the account comprises rights and privileges for the vehicle occupant with respect to a vehicle task, function or operation, security and/or authentication requirements and/or credentials for the vehicle occupant, and personal settings of the vehicle occupant.

7. The method of claim 6, wherein the personal settings of the vehicle occupant comprise a plurality of a seat setting, climate control setting, lighting setting, configuration of an instrument cluster on a screen, rear view mirror setting, driving mode, media channel setting or preset, media delivery preference, music genre preference, scheduled program, playlist, synchronization with cloud-based data associated with the vehicle occupant, application-specific personalization and selections, and a display setting and configuration.

8. A vehicle, comprising:

a microprocessor executable vehicle control system operable to:

receive a request from a vehicle occupant to perform a vehicle task, function and/or operation;

determine that the vehicle occupant has been authenticated successfully;

access an account for the vehicle occupant, the account defining rights and privileges of the user with respect to controlling a vehicle task, function and/or operation;

determine at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle; and

based upon the account corresponding to the vehicle occupant and the at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle, apply the following rules:

(i) when the account permits the vehicle occupant to perform the requested vehicle task, function and/or operation, performing or causing to be performed the vehicle task, function, and/or operation; and

(ii) when the account does not permit the vehicle occupant to perform the requested vehicle task, function and/or operation, not performing or causing to be performed the vehicle task, function, and/or operation.

9. The vehicle of claim 8, wherein the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the area and/or zone occupied by the vehicle occupant and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when in a first area and/or zone and a different set of vehicle tasks, functions, and operations when in a different second area and/or zone.

10. The vehicle of claim 8, wherein the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the operating state of the vehicle and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when the vehicle is in a first operating state and a different set of vehicle tasks, functions, and operations when the vehicle is in a second operating state.

11. The vehicle of claim 8, wherein rule (i) applies and the vehicle occupant is able to control the requested vehicle task, function and/or operation using one or more of a cell phone, laptop, tablet computer, and personal digital assistant.

12. The vehicle of claim 8, wherein a different authentication procedure is used for the vehicle occupant when requesting a first set of vehicle tasks, operations, and functions than when requesting a second set of vehicle tasks, operations, and functions.

13. The vehicle of claim 8, wherein the account comprises rights and privileges for the vehicle occupant with respect to a vehicle task, function or operation, security and/or authentication requirements and/or credentials for the vehicle occupant, and personal settings of the vehicle occupant.

14. The vehicle of claim 13, wherein the personal settings of the vehicle occupant comprise a plurality of a seat setting, climate control setting, lighting setting, configuration of an instrument cluster on a screen, rear view mirror setting, driving mode, media channel setting or preset, media delivery preference, music genre preference, scheduled program, playlist, synchronization with cloud-based data associated with the vehicle occupant, application-specific personalization and selections, and a display setting and configuration.

15. A tangible and non-transient computer readable medium comprising microprocessor executable instructions to perform functions, comprising:

(a) receiving a request from a vehicle occupant to perform a vehicle task, function and/or operation;

(b) determining that the vehicle occupant has been authenticated successfully;

(c) accessing an account for the vehicle occupant, the account defining rights and privileges of the user with respect to controlling a vehicle task, function and/or operation;

(d) determining at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle; and

(e) based upon the account corresponding to the vehicle occupant and the at least one of an area and/or zone occupied by the vehicle occupant and an operating state of the vehicle, applying the following rules:

(i) when the account permits the vehicle occupant to perform the requested vehicle task, function and/or operation, performing or causing to be performed the vehicle task, function, and/or operation; and

(ii) when the account does not permit the vehicle occupant to perform the requested vehicle task, function and/or operation, not performing or causing to be performed the vehicle task, function, and/or operation.

16. The computer readable medium of claim 15, wherein, in function (e), the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the area and/or zone occupied by the vehicle occupant and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when in a first area and/or zone and a different set of vehicle tasks, functions, and operations when in a different second area and/or zone.

17. The computer readable medium of claim 15, wherein, in function (e), the microprocessor executable vehicle control system applies the rules based on the account corresponding to the vehicle occupant and the operating state of the vehicle and wherein the vehicle occupant can perform a first set of vehicle tasks, functions and operations when the vehicle is in a first operating state and a different set of vehicle tasks, functions, and operations when the vehicle is in a second operating state.

18. The computer readable medium of claim 15, wherein rule (i) applies and the vehicle occupant is able to control the requested vehicle task, function and/or operation using one or more of a cell phone, laptop, tablet computer, and personal digital assistant.

19. The computer readable medium of claim 15, wherein a different authentication procedure is used for the vehicle occupant when requesting a first set of

vehicle tasks, operations, and functions than when requesting a second set of vehicle tasks, operations, and functions.

20. The computer readable medium of claim 15, wherein the account comprises rights and privileges for the vehicle occupant with respect to a vehicle task, function or operation, security and/or authentication requirements and/or credentials for the vehicle occupant, and personal settings of the vehicle occupant.

21. The computer readable medium of claim 20, wherein the personal settings of the vehicle occupant comprise a plurality of a seat setting, climate control setting, lighting setting, configuration of an instrument cluster on a screen, rear view mirror setting, driving mode, media channel setting or preset, media delivery preference, music genre preference, scheduled program, playlist, synchronization with cloud-based data associated with the vehicle occupant, application-specific personalization and selections, and a display setting and configuration.

## ABSTRACT

**[0882]** Methods and systems for a vehicle control system to control user access to vehicle tasks, functions and/or operations based on rights and privileges set forth in user accounts.



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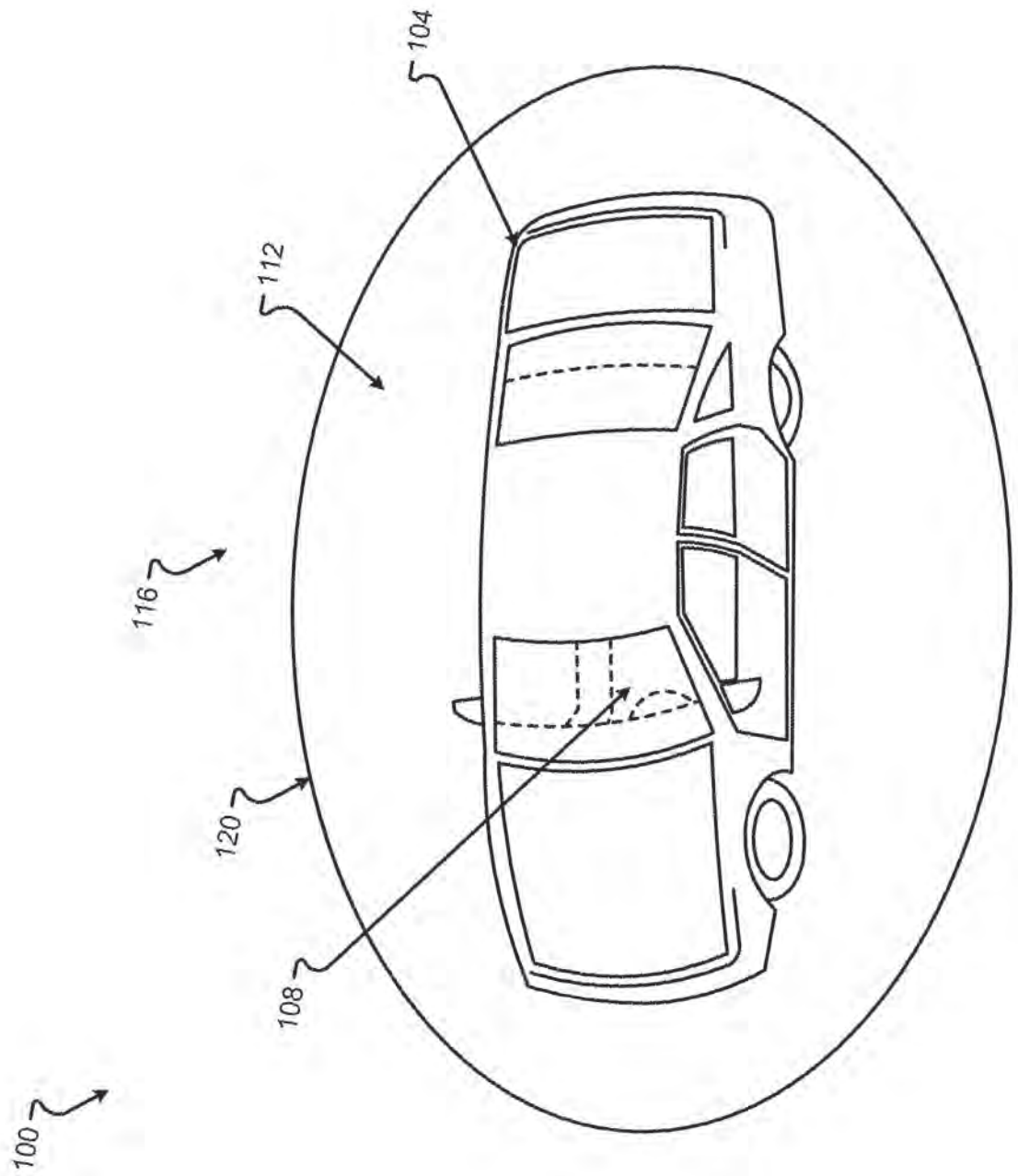
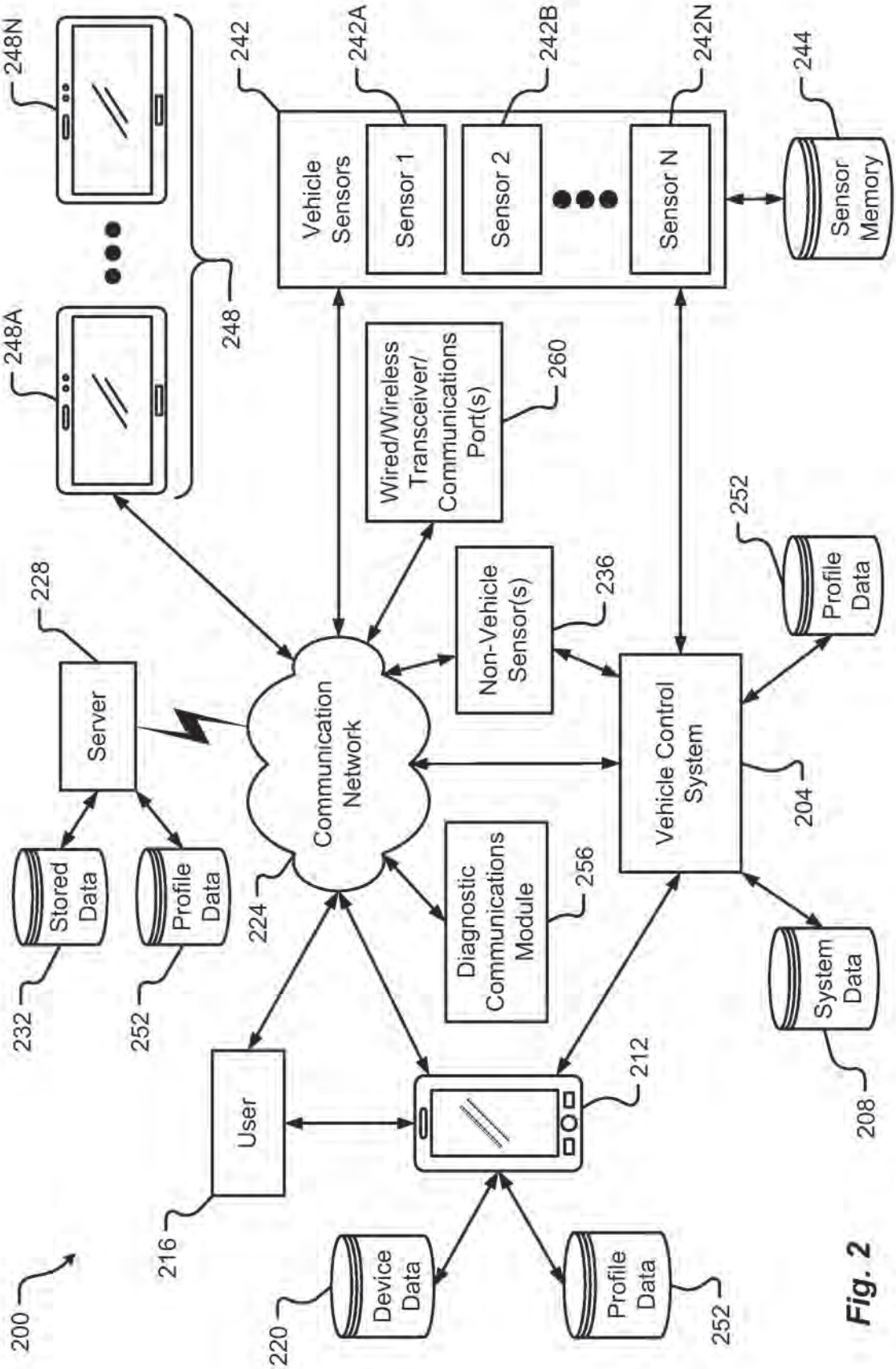



Fig. 1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248N
248A
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242A
242B
242N
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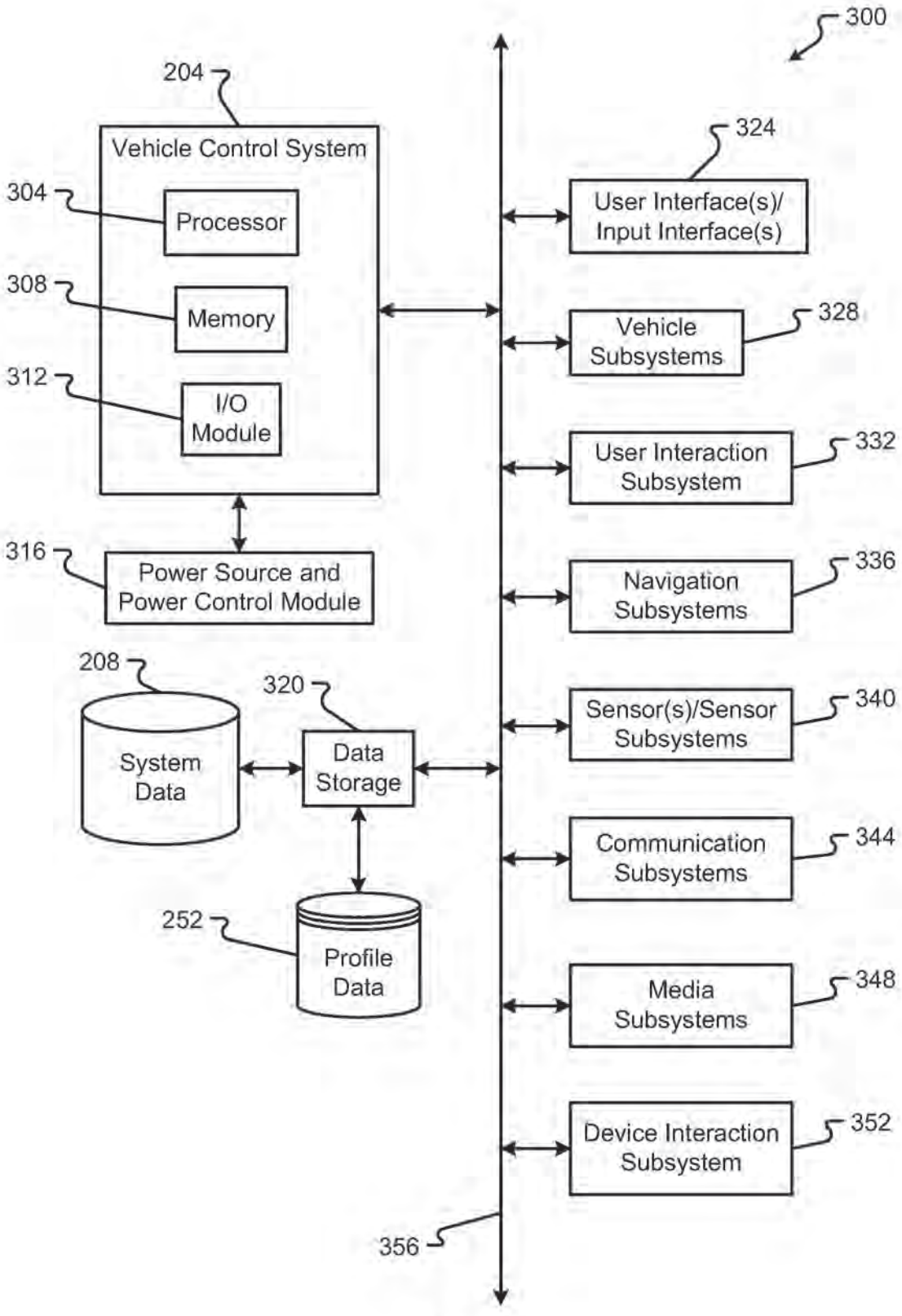
Vehicle Sensors
Sensor 1
Sensor 2
Sensor N
Sensor Memory
Wired/Wireless Transceiver/ Communications Port(s)
260
Non-Vehicle Sensor(s)
236
252
Profile Data
228
Server
Communication Network
224
Vehicle Control System
204
Stored Data
232
Profile Data
252
Diagnostic Communications Module
256
System Data
208
User
216
212
Device Data
220
Profile Data
252

*Fig. 2*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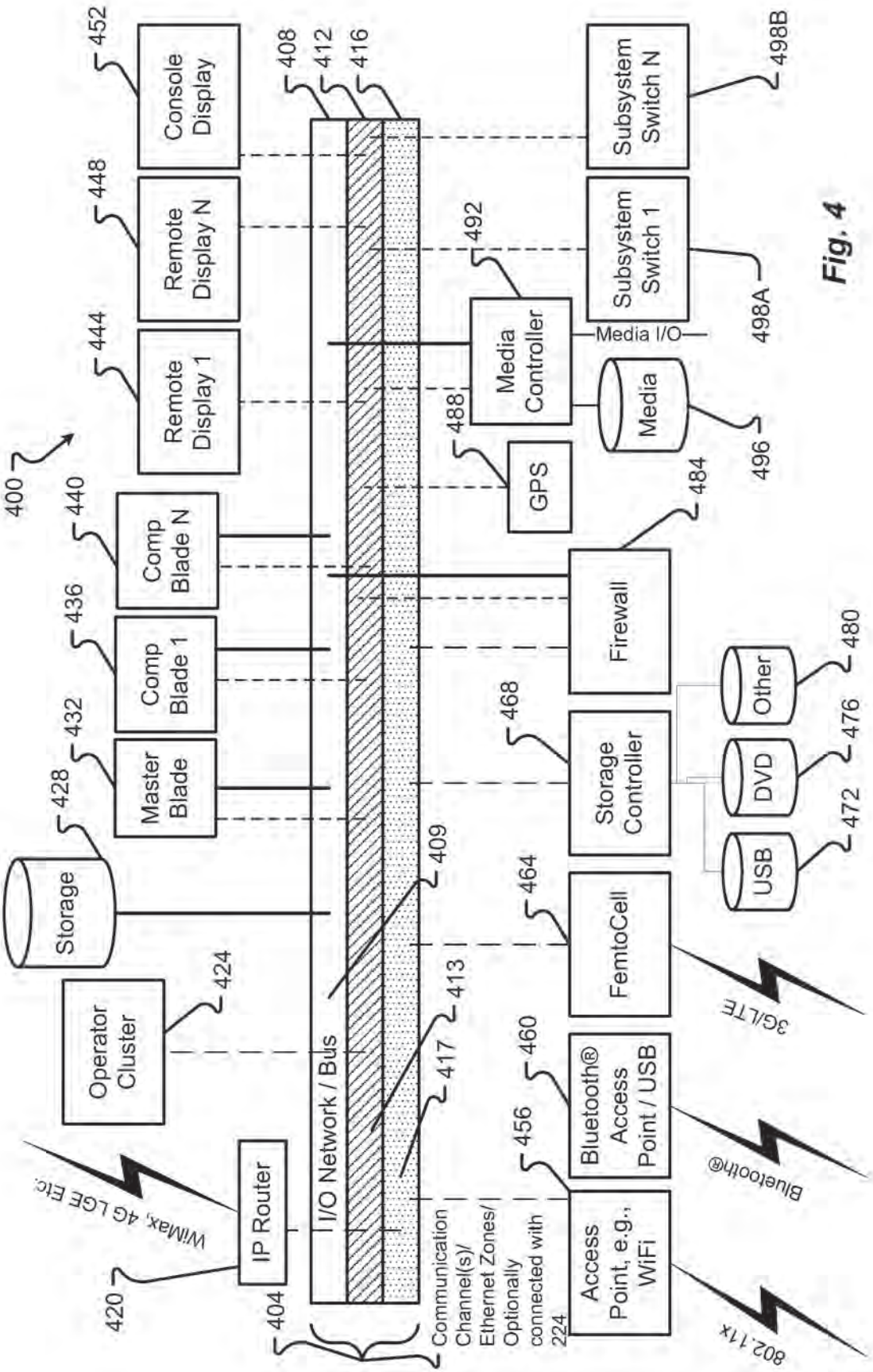
204
Vehicle Control System
304
Processor
308
Memory
312
I/O Module
316
Power Source and Power Control Module
208
System Data
320
Data Storage
252
Profile Data
324
User Interface(s)/ Input Interface(s)
328
Vehicle Subsystems
332
User Interaction Subsystem
336
Navigation Subsystems
340
Sensor(s)/Sensor Subsystems
344
Communication Subsystems
348
Media Subsystems
352
Device Interaction Subsystem
356

*Fig. 3*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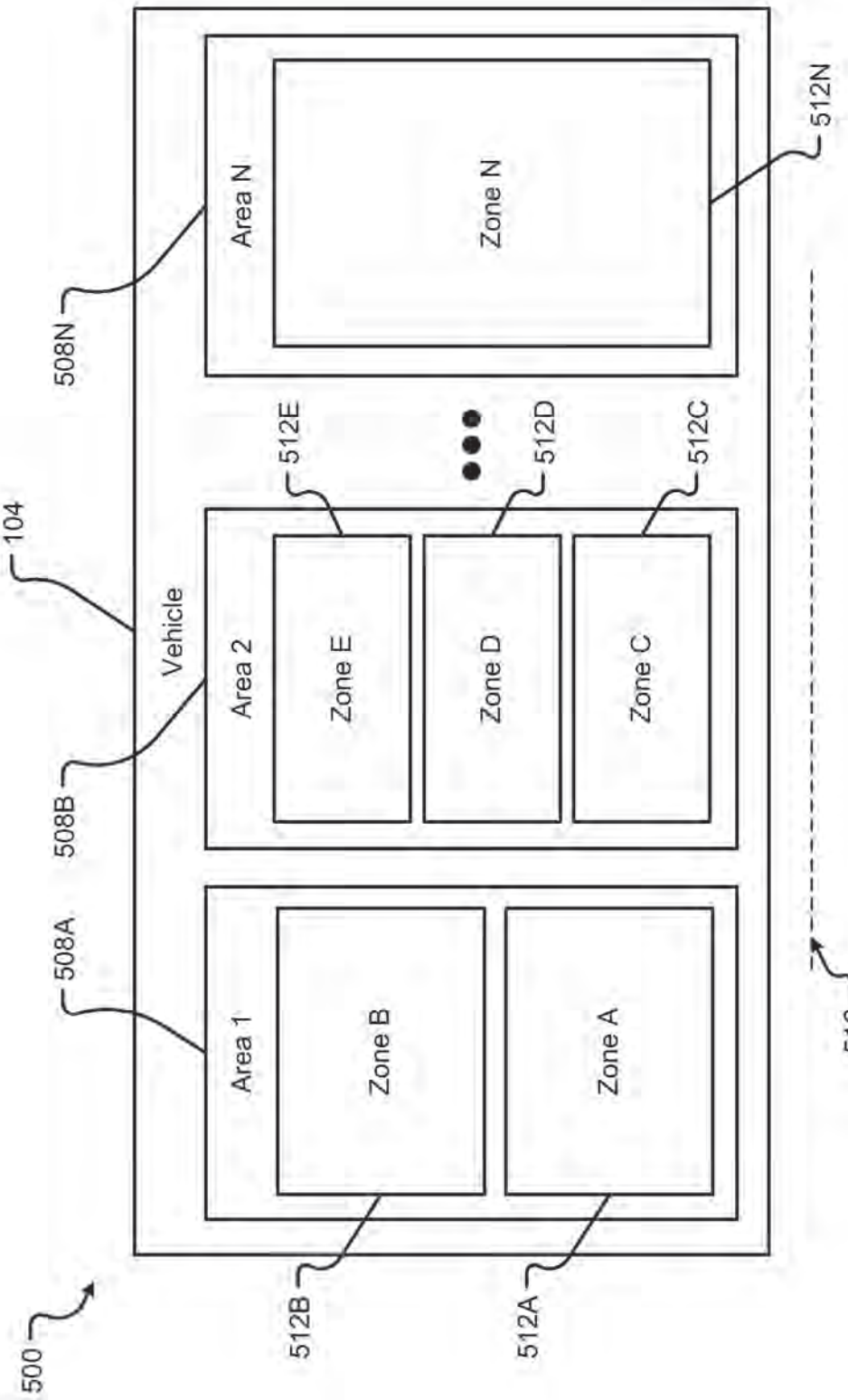
468
472
476
480
484
488
492
496
498A
498B
I/O Network / Bus
Communication Channel(s)/ Ethernet Zones/ Optionally connected with 224
Console Display
Remote Display N
Remote Display 1
Comp Blade N
Comp Blade 1
Master Blade
Storage
Operator Cluster
IP Router
Access Point, e.g., WiFi
Bluetooth® Access Point / USB
FemtoCell
Storage Controller
Firewall
GPS
Media Controller
Media
Media I/O
Subsystem Switch N
Subsystem Switch 1
Other
DVD
USB
WiMax, 4G LGE Etc.
802.11x
Bluetooth®
3G/LTE

Fig. 4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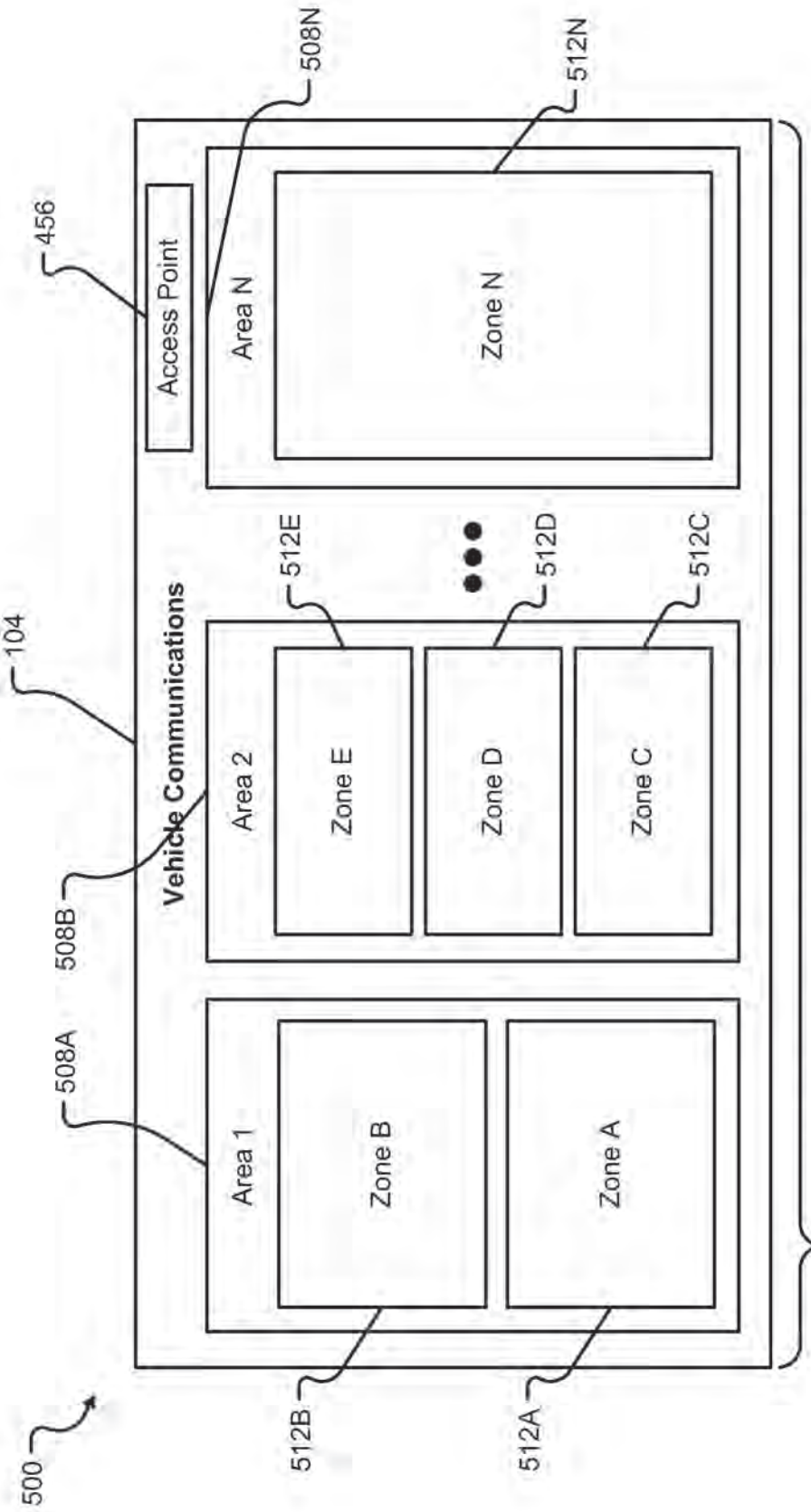
104
Vehicle
508A
Area 1
Zone B
Zone A
512B
512A
508B
Area 2
Zone E
Zone D
Zone C
512E
512D
512C
508N
Area N
Zone N
512N
516
520

Fig. 5A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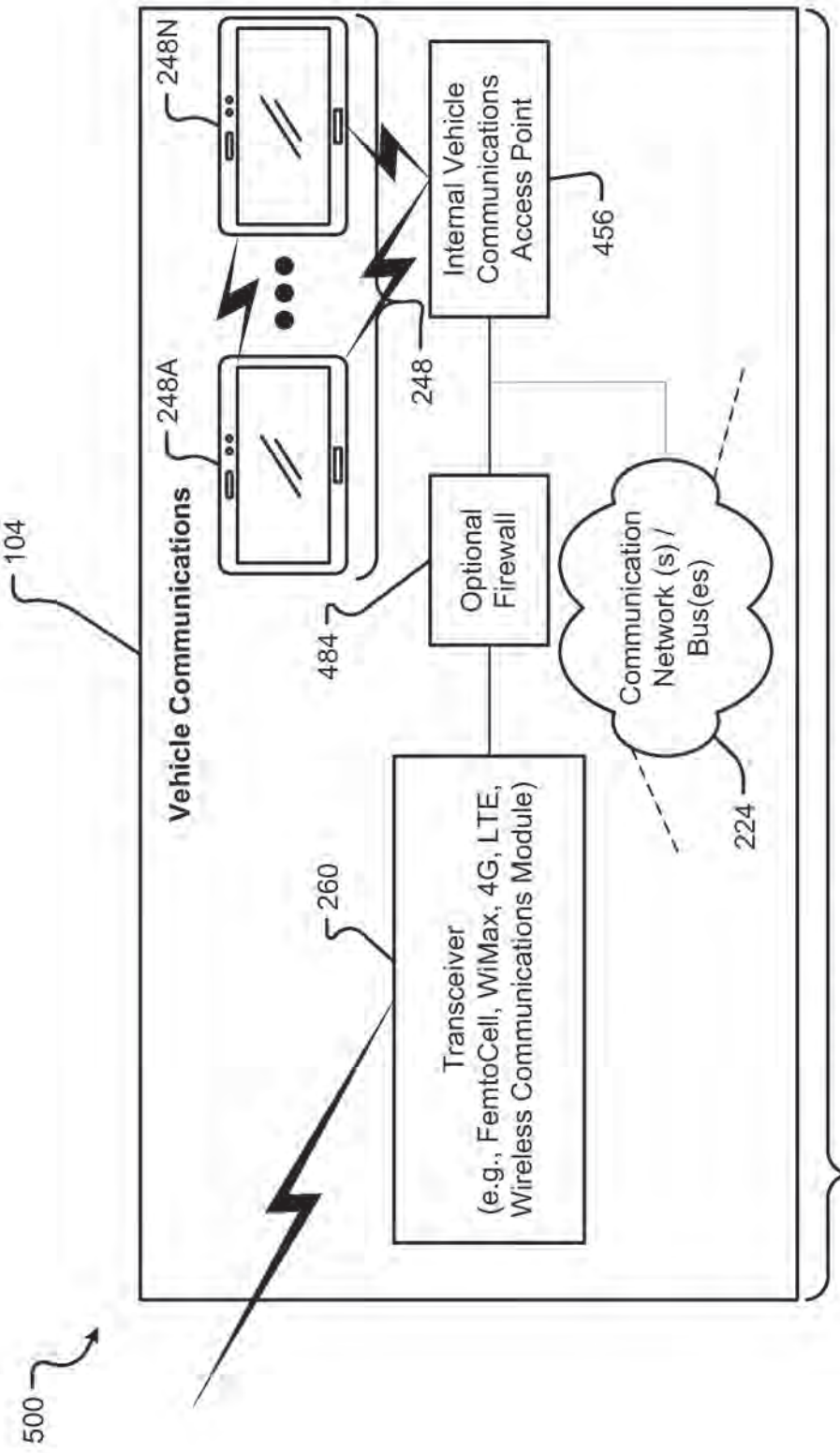
456
Access Point
508N
Area N
512N
Zone N
Vehicle Communications
508B
Area 2
512E
Zone E
512D
Zone D
512C
Zone C
508A
Area 1
Zone B
Zone A
512B
512A
Internal Vehicle Communications between Vehicle and one or more devices, or between devices
One or more of: Bluetooth®, NFC, WiFi, Mobile Hotspot, Point-to-Point, Point-to-Multiple Other Points, etc.

*Fig. 5B*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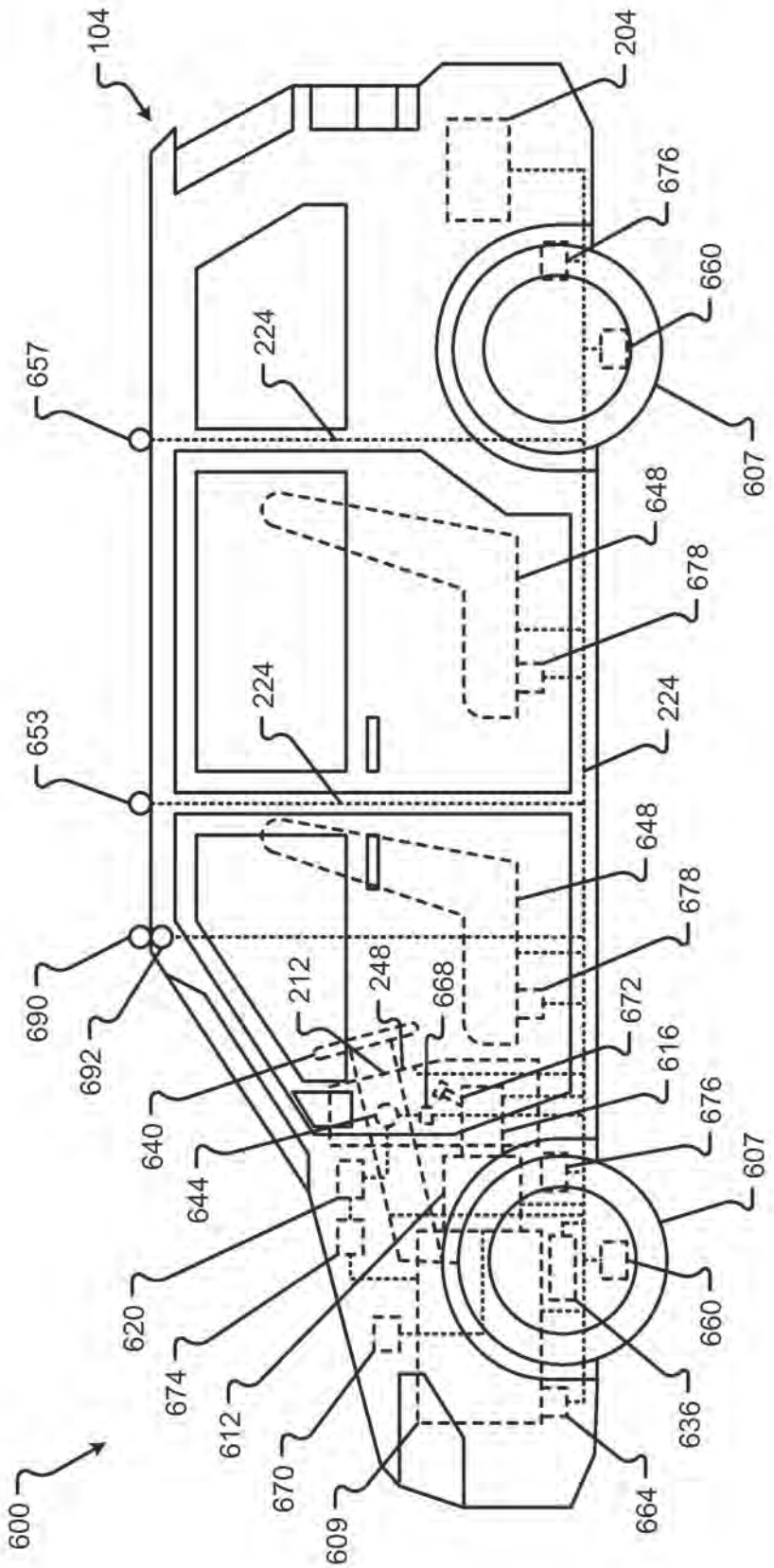
104
Vehicle Communications
248A
248N
248
Internal Vehicle Communications Access Point
456
484
Optional Firewall
Communication Network (s) / Bus(es)
224
260
Transceiver (e.g., FemtoCell, WiMax, 4G, LTE, Wireless Communications Module)
Internal Vehicle Communications between Vehicle and one or more devices, or between devices
One or more of: Bluetooth®, NFC, WiFi, Mobile Hotspot, Ethernet, 802.11(x), Point-to-Point, Point-to-Multiple Other Points, etc.

*Fig. 5C*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224
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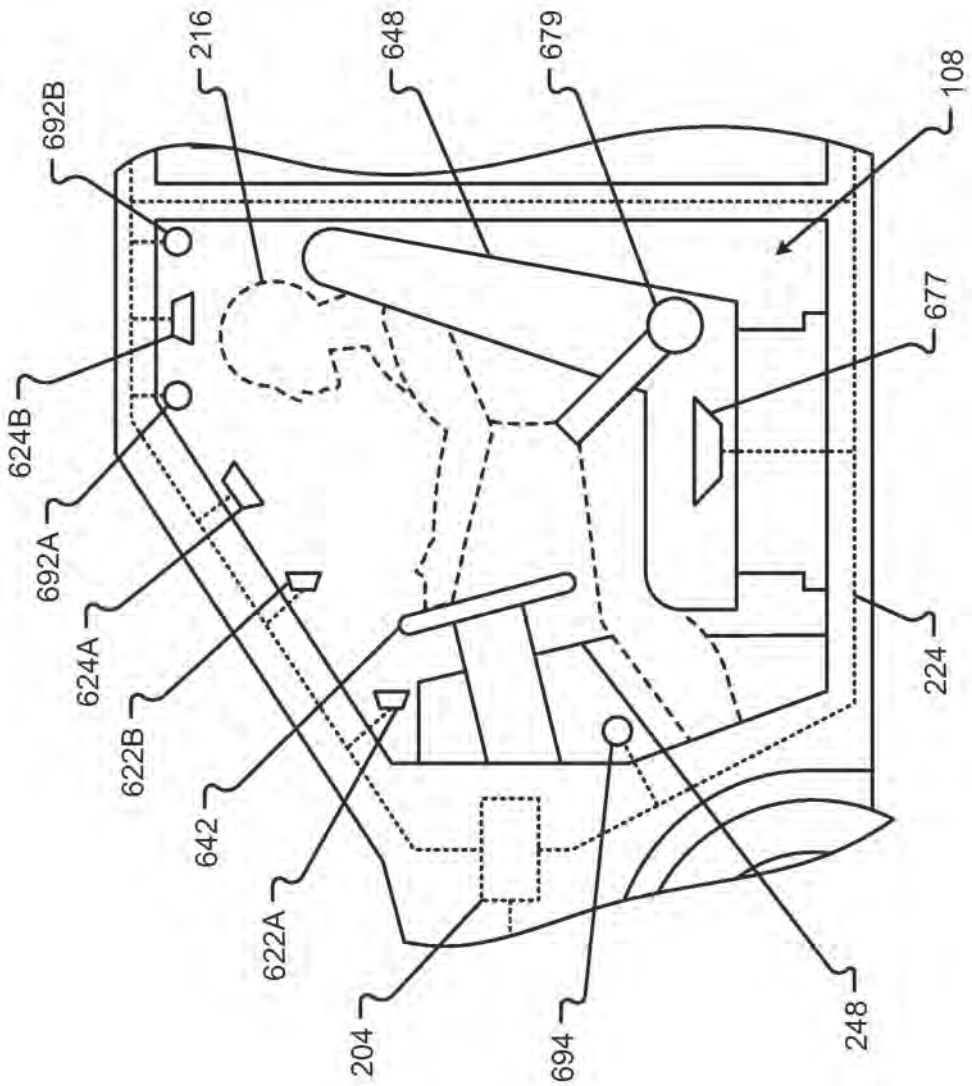
612
670
609
600
636
664

*Fig. 6A*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624B
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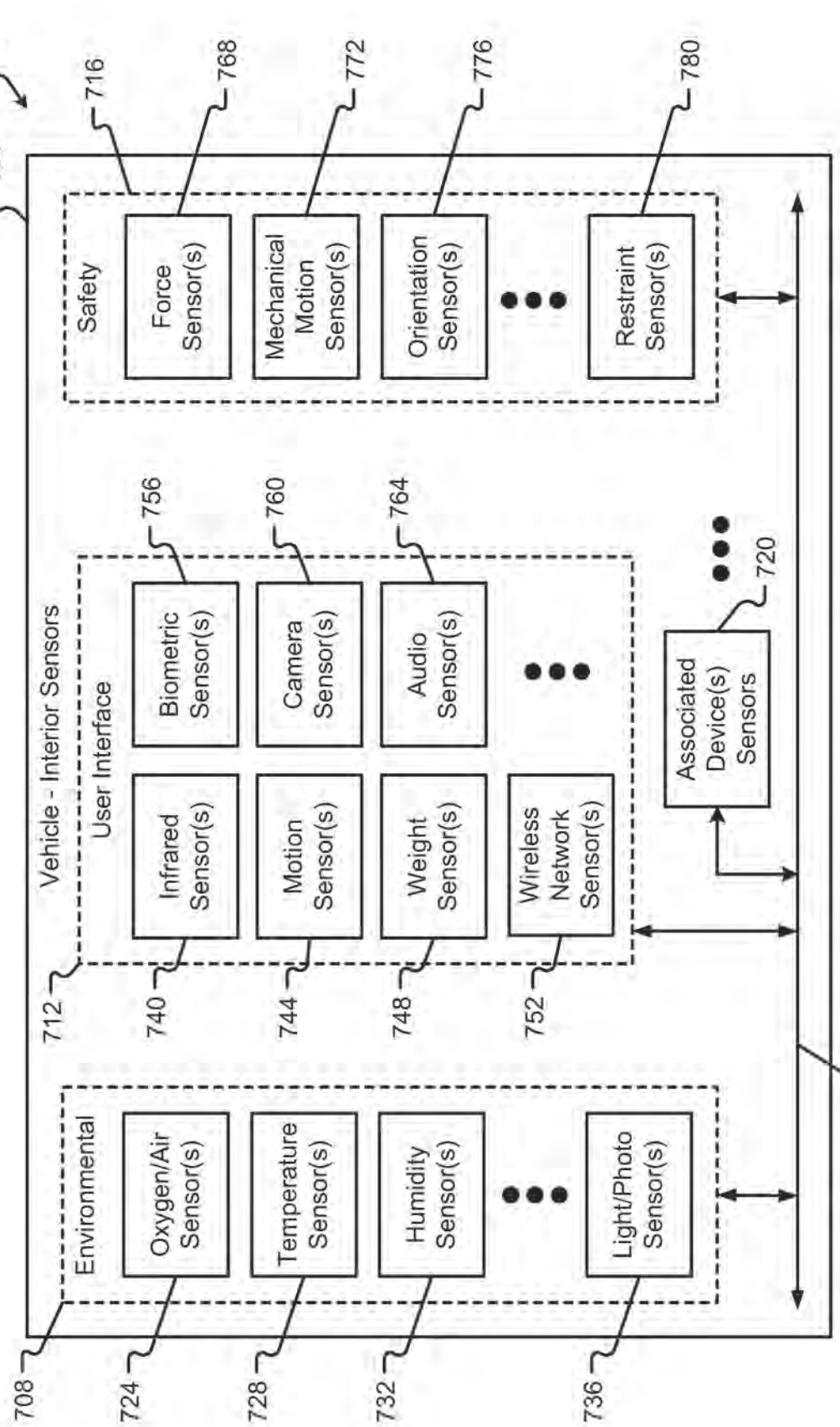
692A
624A
622B
642
622A
224
204
694
248

Fig. 6B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104
716
768
772
776
780
Safety
Force Sensor(s)
Mechanical Motion Sensor(s)
Orientation Sensor(s)
Restraint Sensor(s)
Vehicle - Interior Sensors
User Interface
712
756
760
764
Biometric Sensor(s)
Camera Sensor(s)
Audio Sensor(s)
Infrared Sensor(s)
Motion Sensor(s)
Weight Sensor(s)
Wireless Network Sensor(s)
740
744
748
752
720
Associated Device(s) Sensors
356
Environmental
708
724
728
732
736
Oxygen/Air Sensor(s)
Temperature Sensor(s)
Humidity Sensor(s)
Light/Photo Sensor(s)

*Fig. 7A*

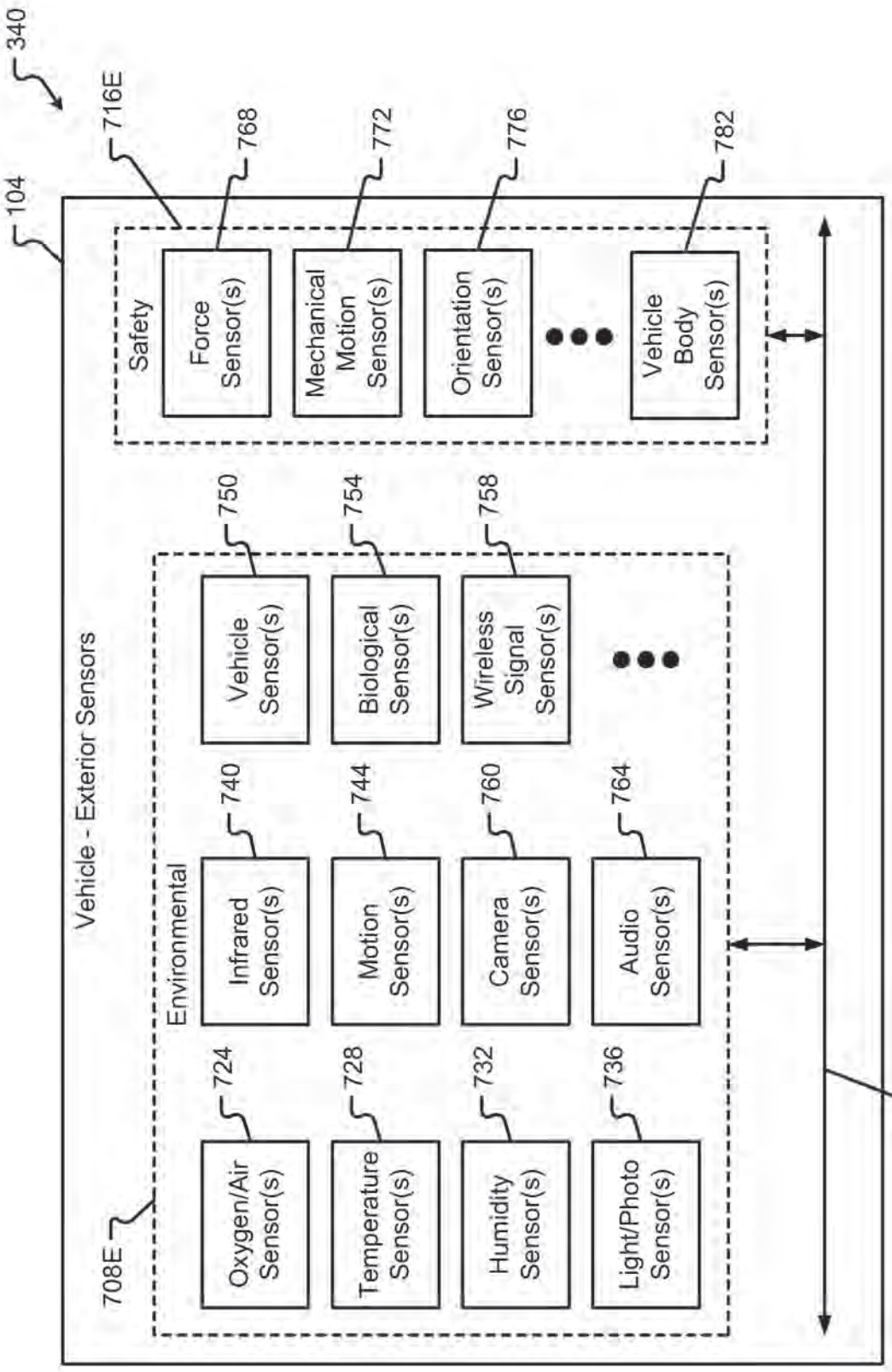

340
104
716E
768
772
776
782
Vehicle - Exterior Sensors
Safety
Force Sensor(s)
Mechanical Motion Sensor(s)
Orientation Sensor(s)
Vehicle Body Sensor(s)
750
754
758
Vehicle Sensor(s)
Biological Sensor(s)
Wireless Signal Sensor(s)
Environmental
740
744
760
764
Infrared Sensor(s)
Motion Sensor(s)
Camera Sensor(s)
Audio Sensor(s)
724
728
732
736
Oxygen/Air Sensor(s)
Temperature Sensor(s)
Humidity Sensor(s)
Light/Photo Sensor(s)
708E
356

*Fig. 7B*

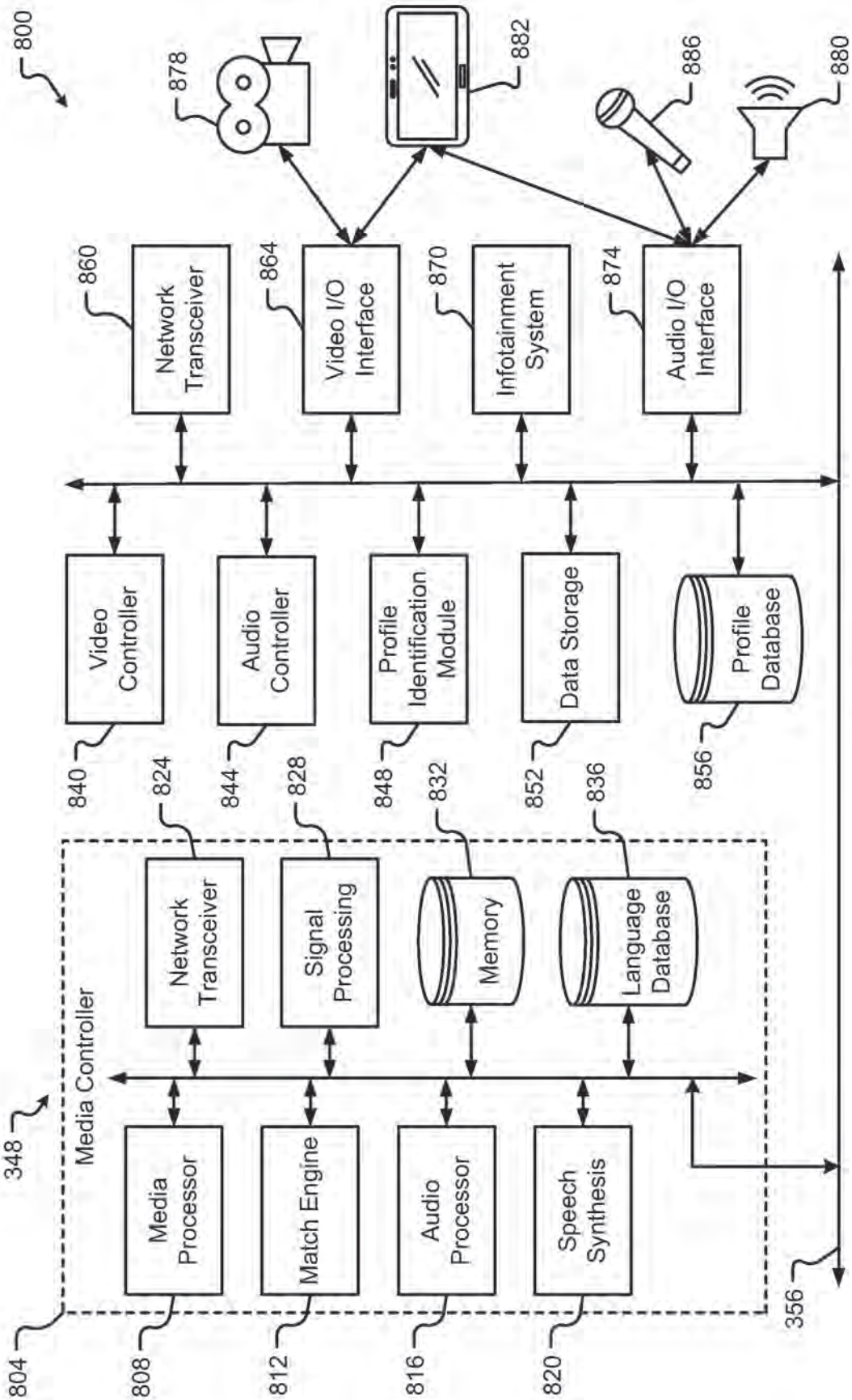

800
878
882
886
880
860
Network Transceiver
864
Video I/O Interface
870
Infotainment System
874
Audio I/O Interface
Video Controller
Audio Controller
Profile Identification Module
Data Storage
Profile Database
840
844
848
852
856
824
828
832
836
348
Media Controller
Network Transceiver
Signal Processing
Memory
Language Database
Media Processor
Match Engine
Audio Processor
Speech Synthesis
804
808
812
816
820
356

*Fig. 8A*

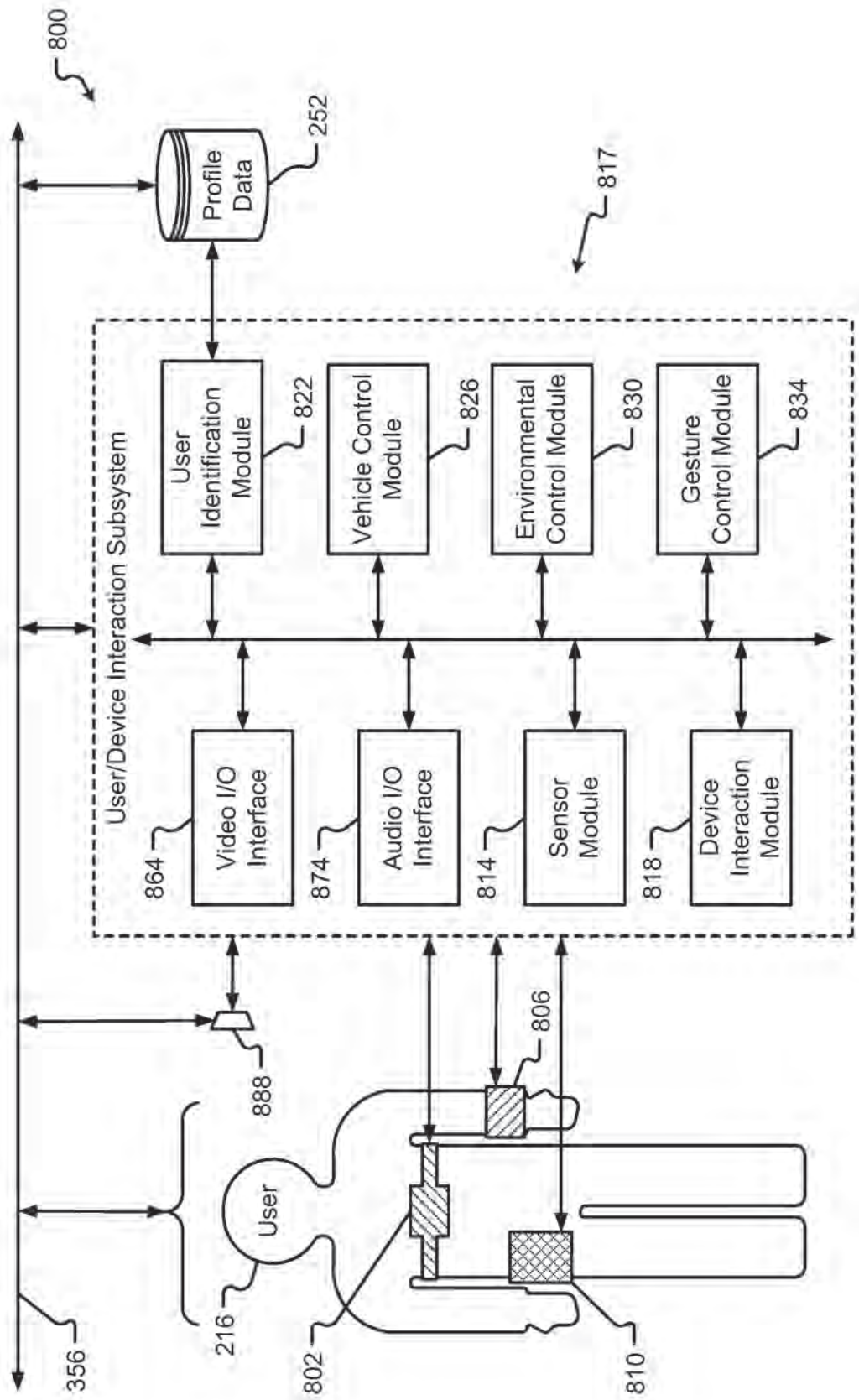

800
Profile Data
252
817
User/Device Interaction Subsystem
User Identification Module
822
Vehicle Control Module
826
Environmental Control Module
830
Gesture Control Module
834
Video I/O Interface
864
Audio I/O Interface
874
Sensor Module
814
Device Interaction Module
818
888
806
User
216
802
810
356

*Fig. 8B*

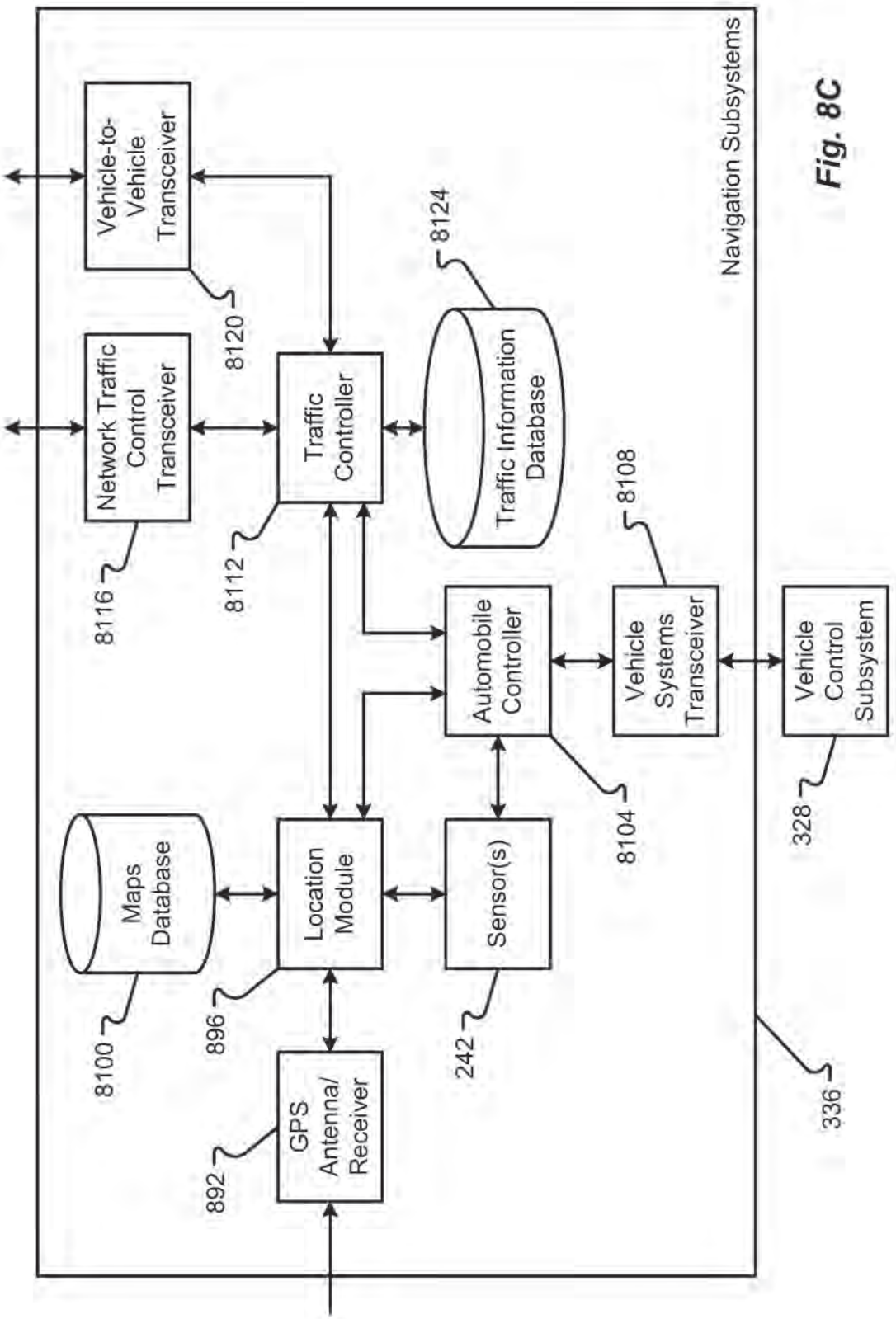

Navigation Subsystems
Vehicle-to-Vehicle Transceiver
8120
Network Traffic Control Transceiver
8116
Traffic Controller
8112
8124
Traffic Information Database
8108
Automobile Controller
8104
Vehicle Systems Transceiver
Vehicle Control Subsystem
328
Maps Database
8100
Location Module
896
Sensor(s)
242
GPS Antenna/ Receiver
892
336

Fig. 8C

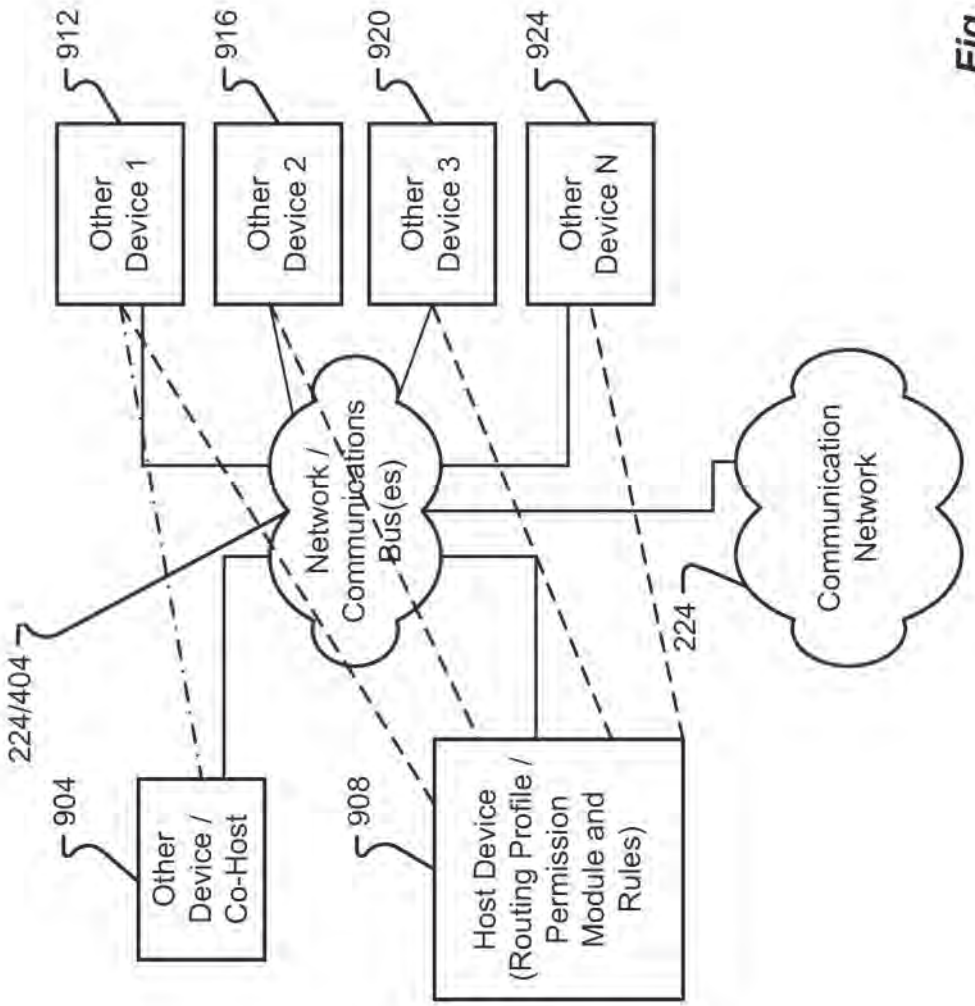

912
Other Device 1
916
Other Device 2
920
Other Device 3
924
Other Device N
Network / Communications Bus(es)
224/404
224
Communication Network
904
Other Device / Co-Host
908
Host Device (Routing Profile / Permission Module and Rules)

*Fig. 9*

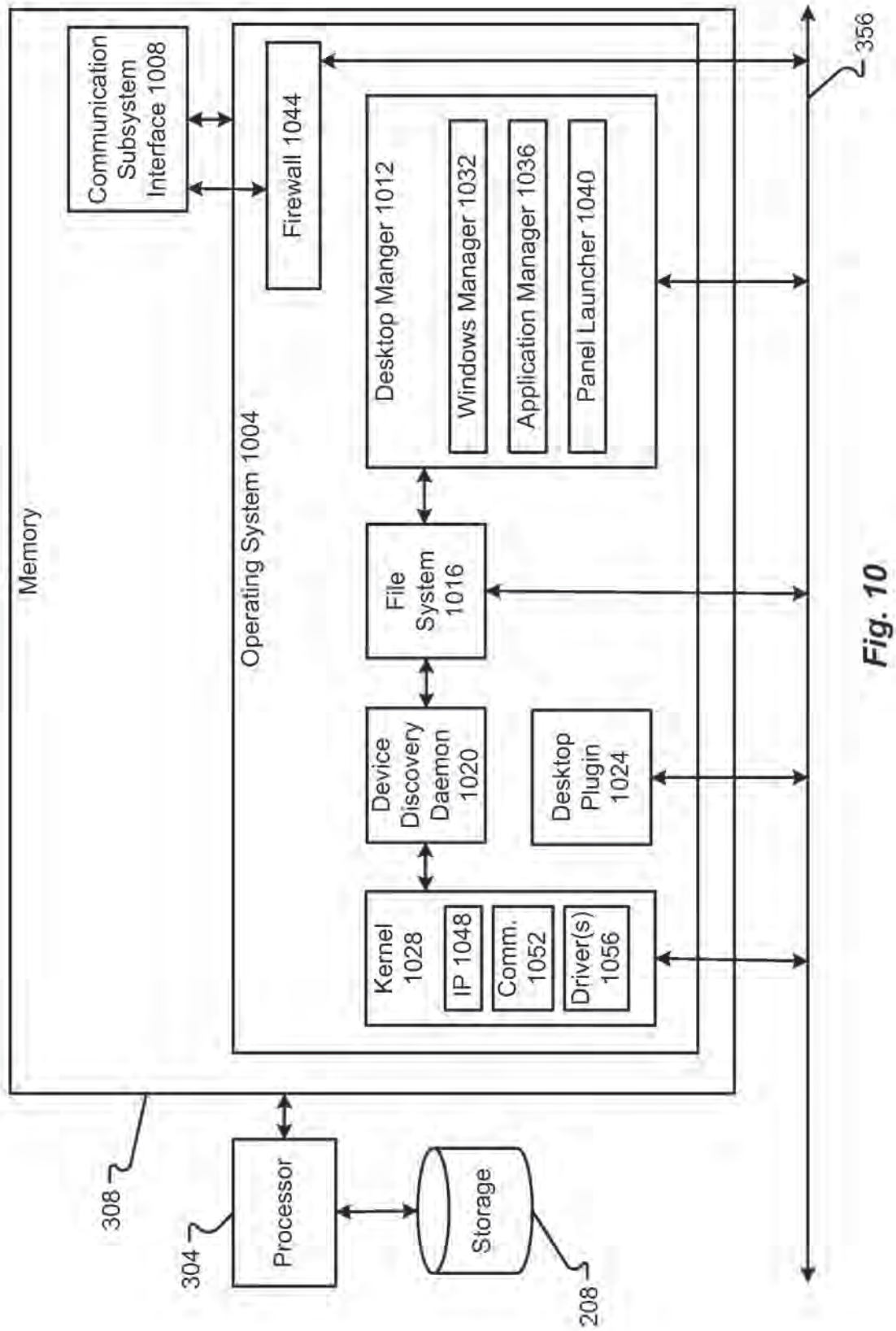

Memory
Communication Subsystem Interface 1008
Operating System 1004
Firewall 1044
Desktop Manger 1012
Windows Manager 1032
Application Manager 1036
Panel Launcher 1040
File System 1016
Device Discovery Daemon 1020
Desktop Plugin 1024
Kernel 1028
IP 1048
Comm. 1052
Driver(s) 1056
356
308
304
Processor
Storage
208

Fig. 10

Tap

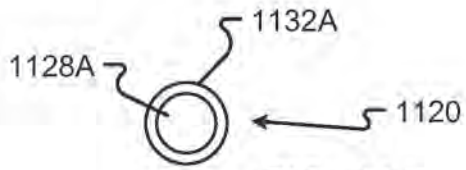



FIG. 11A

Long Press

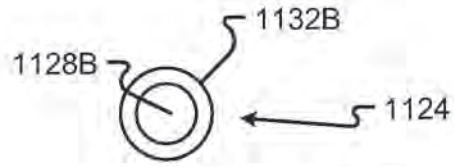



FIG. 11B

Drag

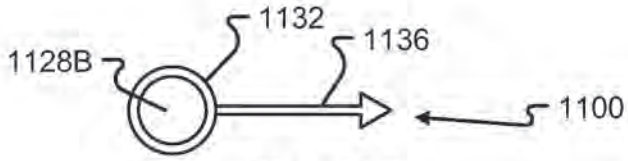



FIG. 11C

Flick

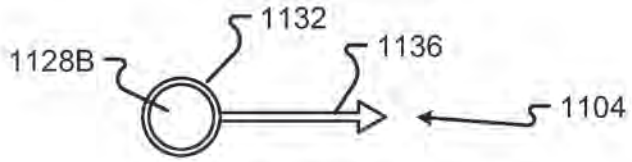



FIG. 11D

Pinch

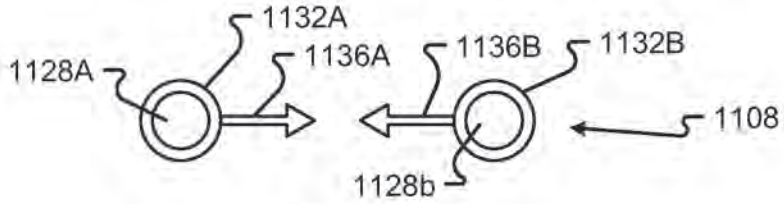



FIG. 11E

Spread

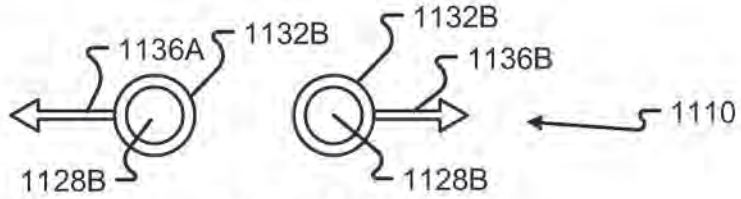



FIG. 11F

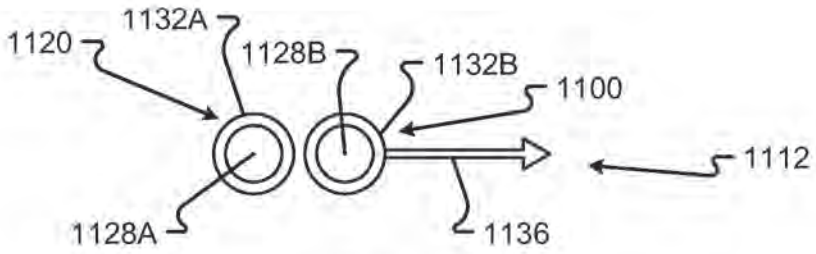



FIG. 11G

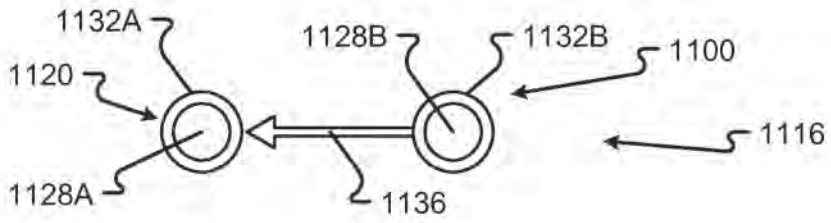



FIG. 11H

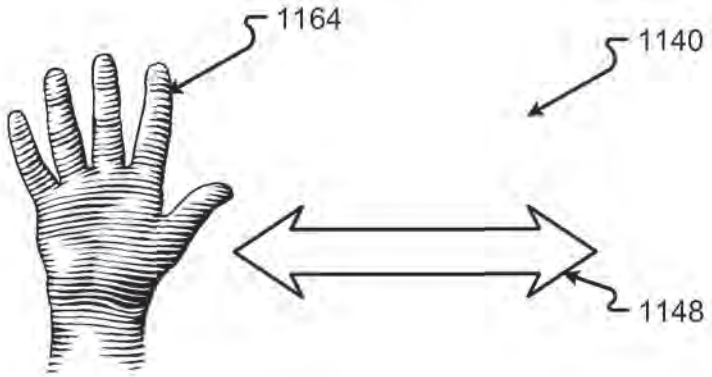



FIG. 11I

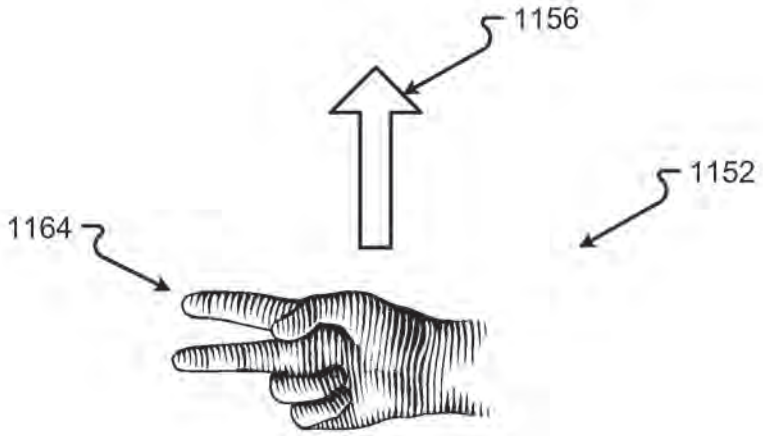



FIG. 11J

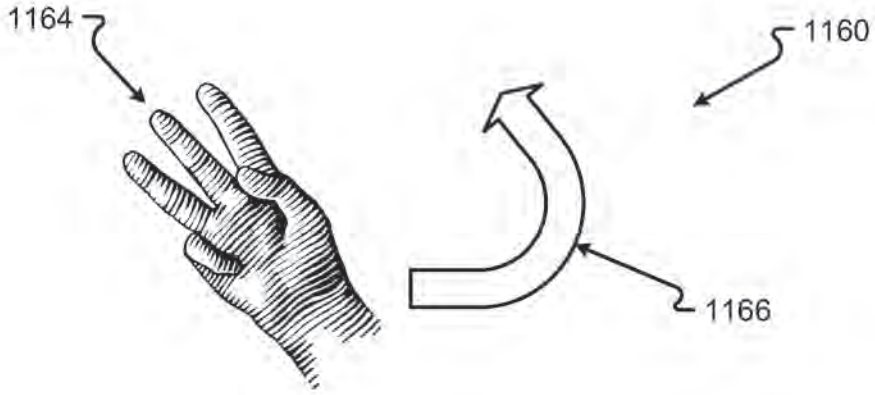



FIG. 11K

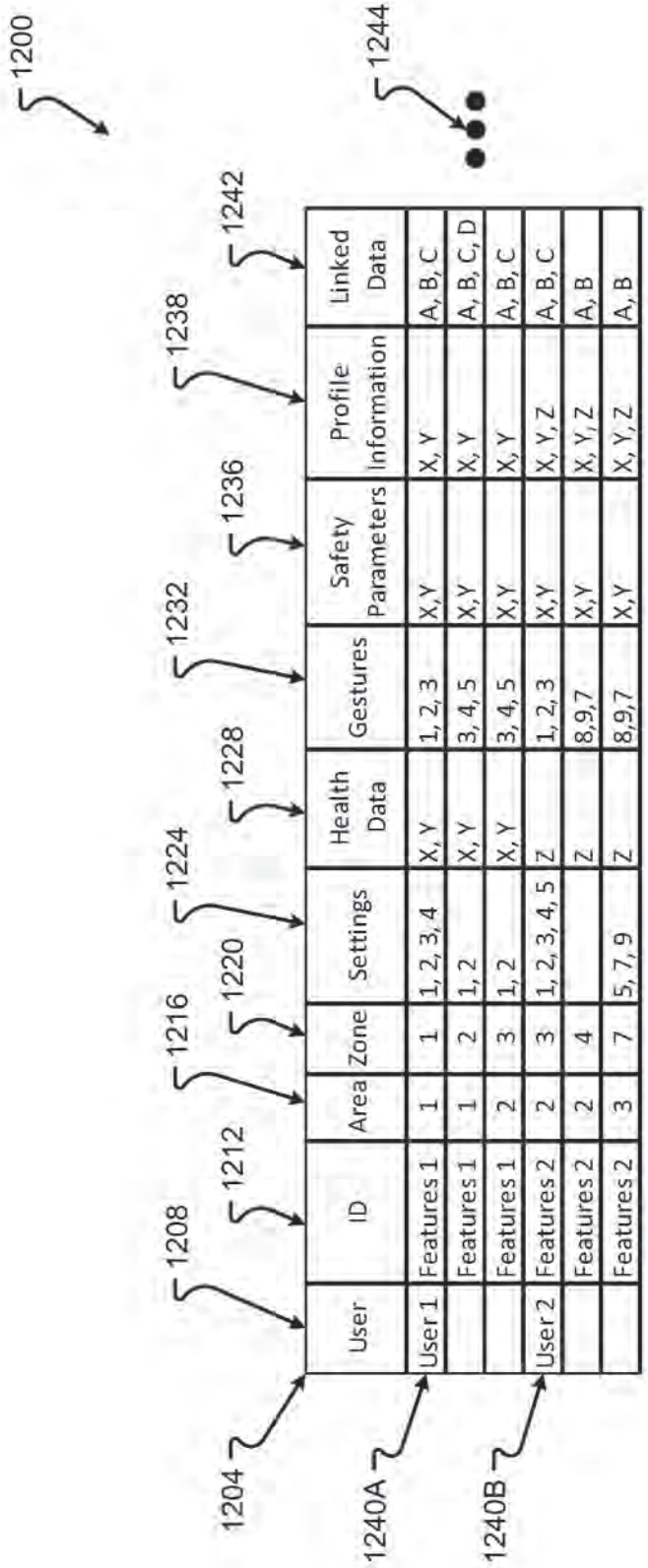
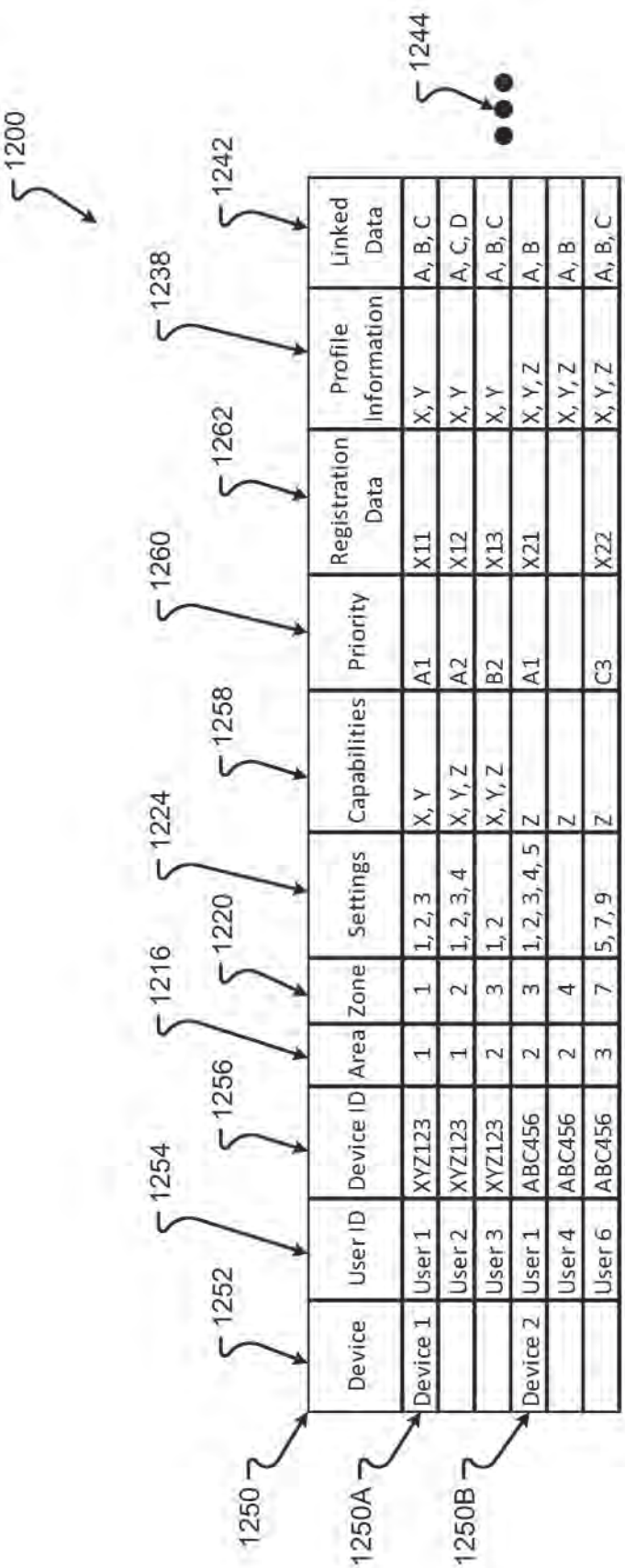
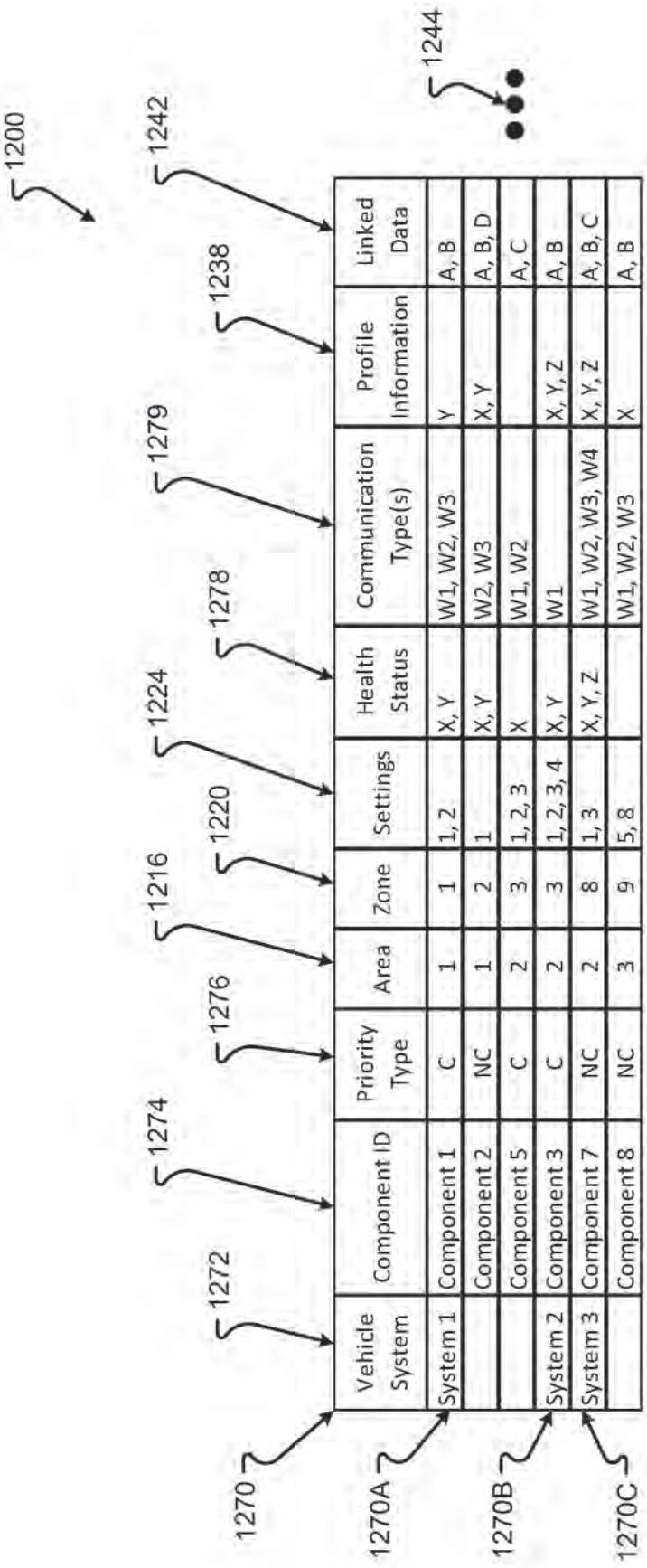

1200
1244
1208
1212
1216
1220
1224
1228
1232
1236
1238
1242
1204
1240A
1240B
1248
User
ID
Area
Zone
Settings
Health Data
Gestures
Safety Parameters
Profile Information
Linked Data
User 1
Features 1
1
1
1, 2, 3, 4
X, Y
1, 2, 3
X,Y
X, Y
A, B, C
Features 1
1
2
1, 2
X, Y
3, 4, 5
X,Y
X, Y
A, B, C, D
Features 1
2
3
1, 2
X, Y
3, 4, 5
X,Y
X, Y
A, B, C
User 2
Features 2
2
3
1, 2, 3, 4, 5
Z
1, 2, 3
X,Y
X, Y, Z
A, B, C
Features 2
2
4
Z
8,9,7
X,Y
X, Y, Z
A, B
Features 2
3
7
5, 7, 9
Z
8,9,7
X,Y
X, Y, Z
A, B

*Fig. 12A*




| Device | User ID | Device ID | Area | Zone | Settings | Capabilities | Priority | Registration Data | Profile Information | Linked Data |
|---|---|---|---|---|---|---|---|---|---|---|
| Device 1 | User 1 | XYZ123 | 1 | 1 | 1, 2, 3 | X, Y | A1 | X11 | X, Y | A, B, C |
| | User 2 | XYZ123 | 1 | 2 | 1, 2, 3, 4 | X, Y, Z | A2 | X12 | X, Y | A, C, D |
| | User 3 | XYZ123 | 2 | 3 | 1, 2 | X, Y, Z | B2 | X13 | X, Y | A, B, C |
| Device 2 | User 1 | ABC456 | 2 | 3 | 1, 2, 3, 4, 5 | Z | A1 | X21 | X, Y, Z | A, B |
| | User 4 | ABC456 | 2 | 4 | | Z | | | X, Y, Z | A, B |
| | User 6 | ABC456 | 3 | 7 | 5, 7, 9 | Z | C3 | X22 | X, Y, Z | A, B, C |

*Fig. 12B*




| Vehicle System | Component ID | Priority Type | Area | Zone | Settings | Health Status | Communication Type(s) | Profile Information | Linked Data |
|---|---|---|---|---|---|---|---|---|---|
| System 1 | Component 1 | C | 1 | 1 | 1, 2 | X, Y | W1, W2, W3 | Y | A, B |
| | Component 2 | NC | 1 | 2 | 1 | X, Y | W2, W3 | X, Y | A, B, D |
| | Component 5 | C | 2 | 3 | 1, 2, 3 | X | W1, W2 | | A, C |
| System 2 | Component 3 | C | 2 | 3 | 1, 2, 3, 4 | X, Y | W1 | X, Y, Z | A, B |
| System 3 | Component 7 | NC | 2 | 8 | 1, 3 | X, Y, Z | W1, W2, W3, W4 | X, Y, Z | A, B, C |
| | Component 8 | NC | 3 | 9 | 5, 8 | | W1, W2, W3 | X | A, B |

*Fig. 12C*

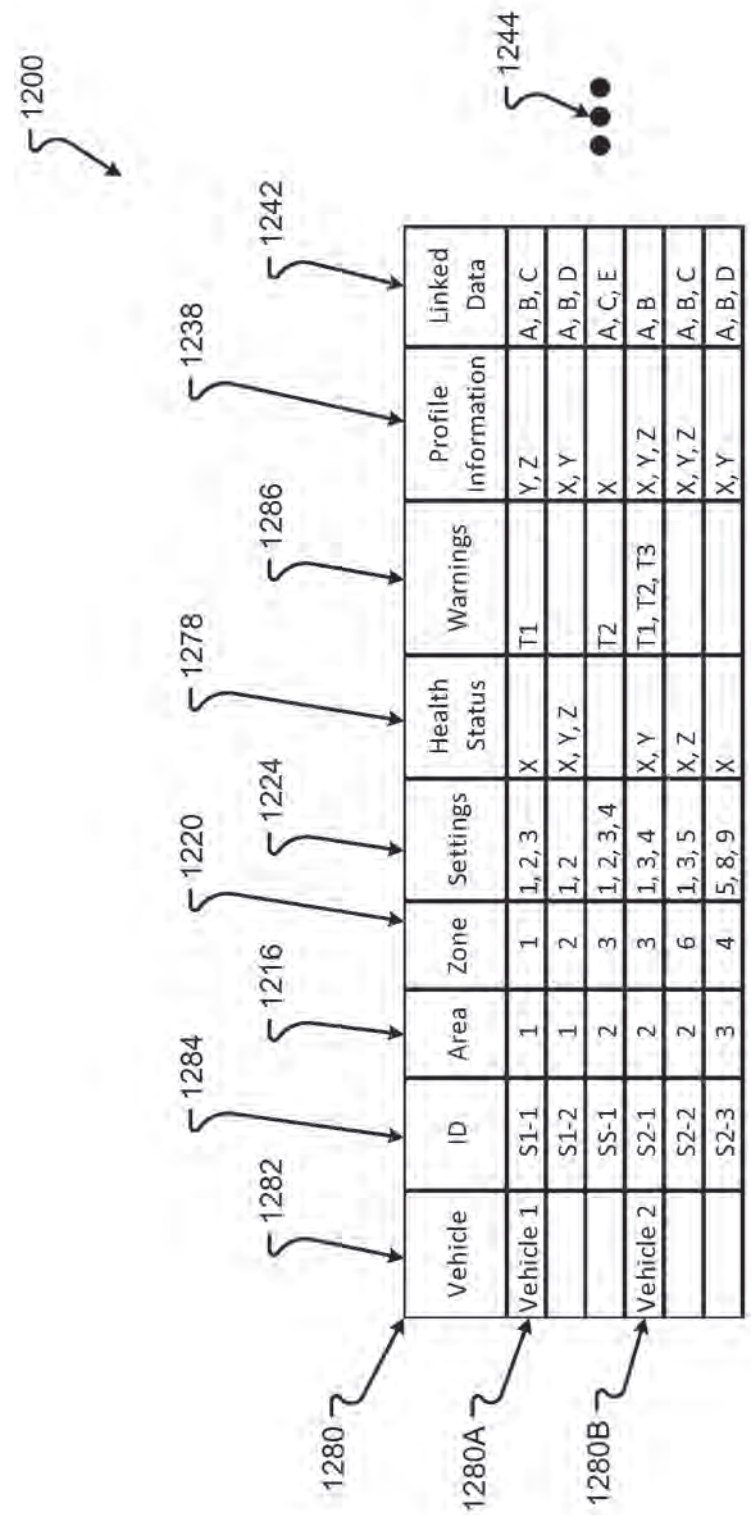

1200
1244
1242
1238
1286
1278
1224
1220
1216
1284
1282
1280
1280A
1280B
1248
Vehicle
ID
Area
Zone
Settings
Health Status
Warnings
Profile Information
Linked Data
Vehicle 1
S1-1
1
1
1, 2, 3
X
T1
Y, Z
A, B, C
S1-2
1
2
1, 2
X, Y, Z
X, Y
A, B, D
SS-1
2
3
1, 2, 3, 4
T2
X
A, C, E
Vehicle 2
S2-1
2
3
1, 3, 4
X, Y
T1, T2, T3
X, Y, Z
A, B
S2-2
2
6
1, 3, 5
X, Z
X, Y, Z
A, B, C
S2-3
3
4
5, 8, 9
X
X, Y
A, B, D

*Fig. 12D*

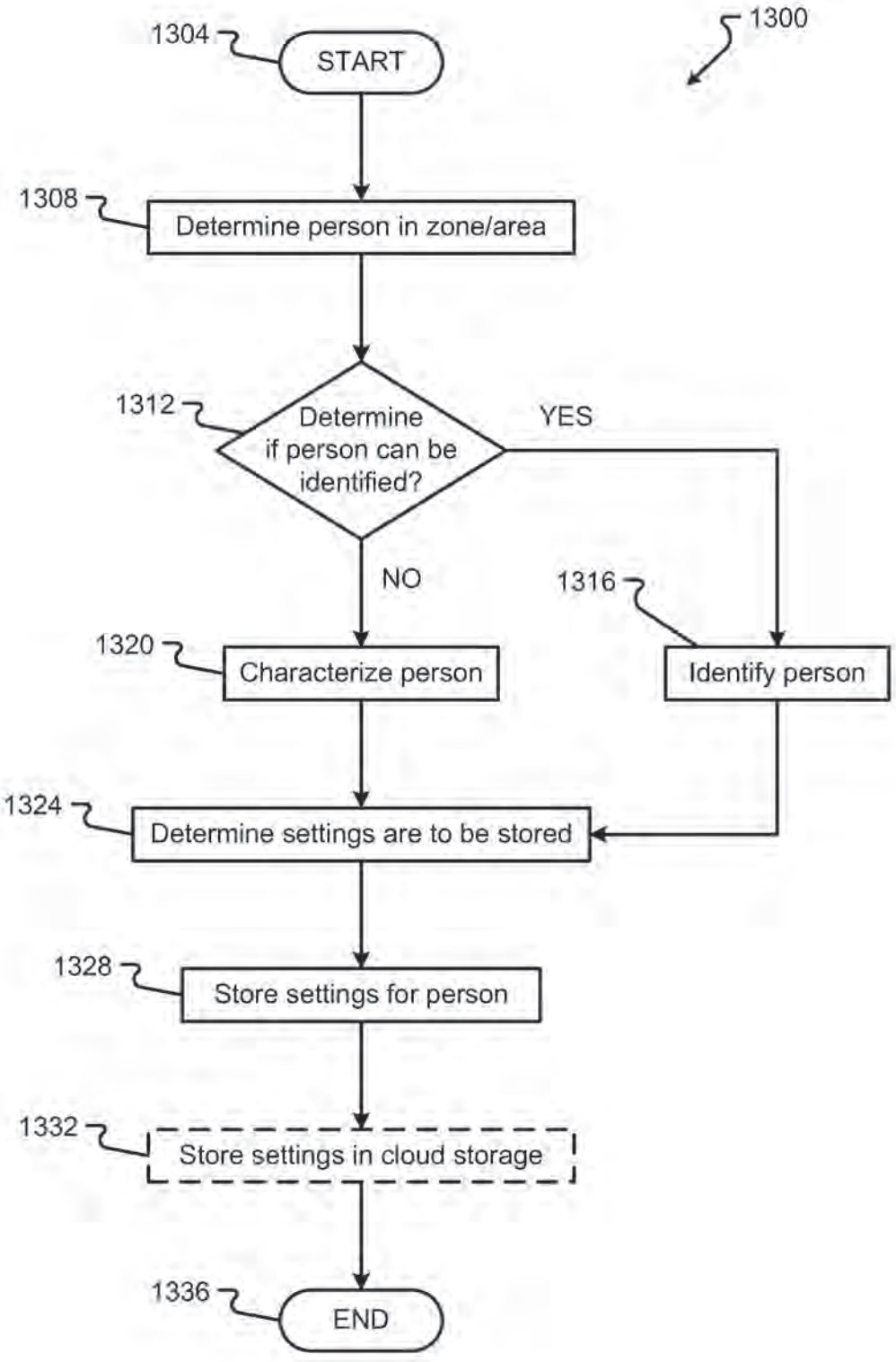

1300
1304
START
1308
Determine person in zone/area
1312
Determine if person can be identified?
YES
NO
1316
Identify person
1320
Characterize person
1324
Determine settings are to be stored
1328
Store settings for person
1332
Store settings in cloud storage
1336
END

*Fig. 13*

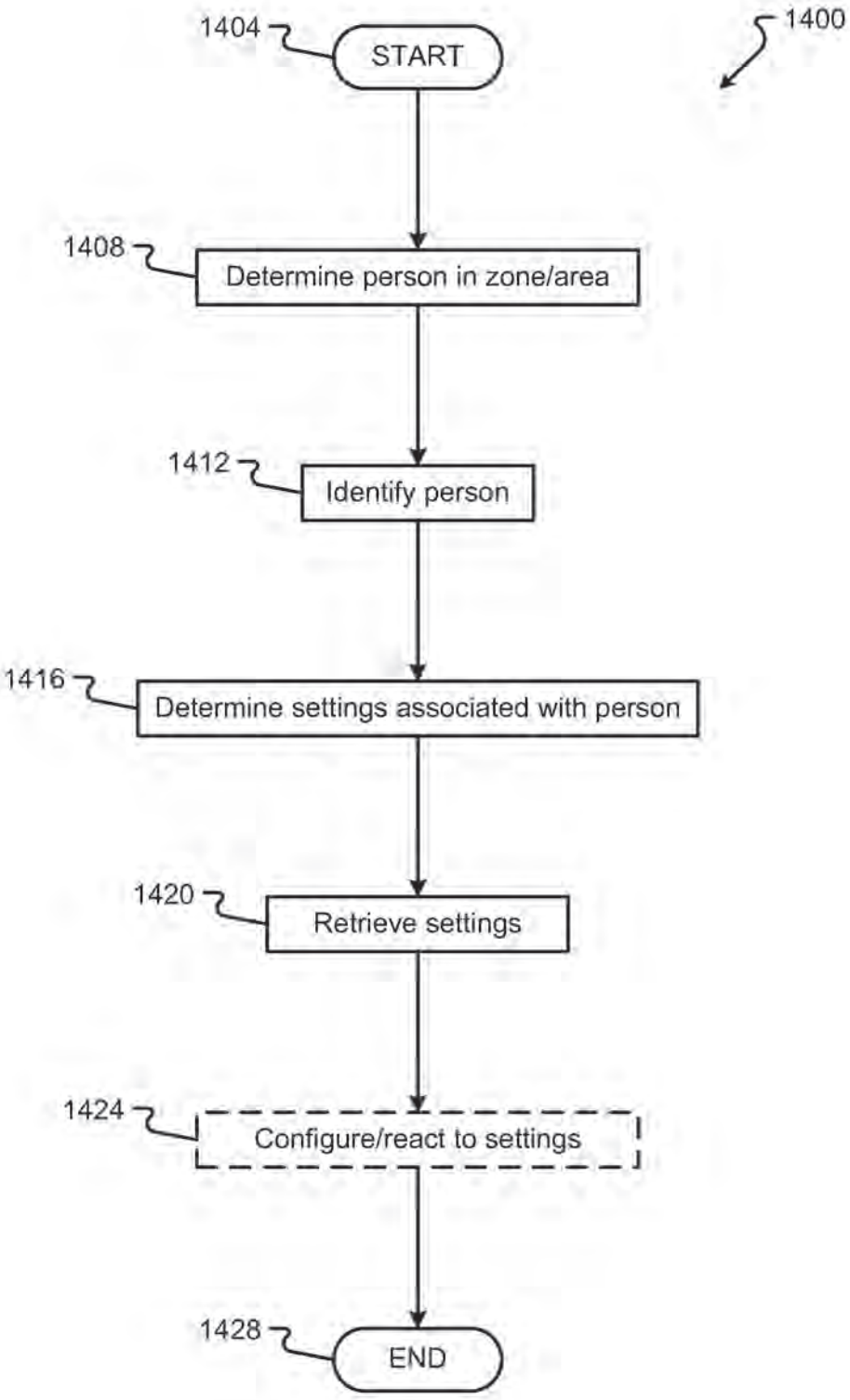

1400
1404
START
1408
Determine person in zone/area
1412
Identify person
1416
Determine settings associated with person
1420
Retrieve settings
1424
Configure/react to settings
1428
END

*Fig. 14*

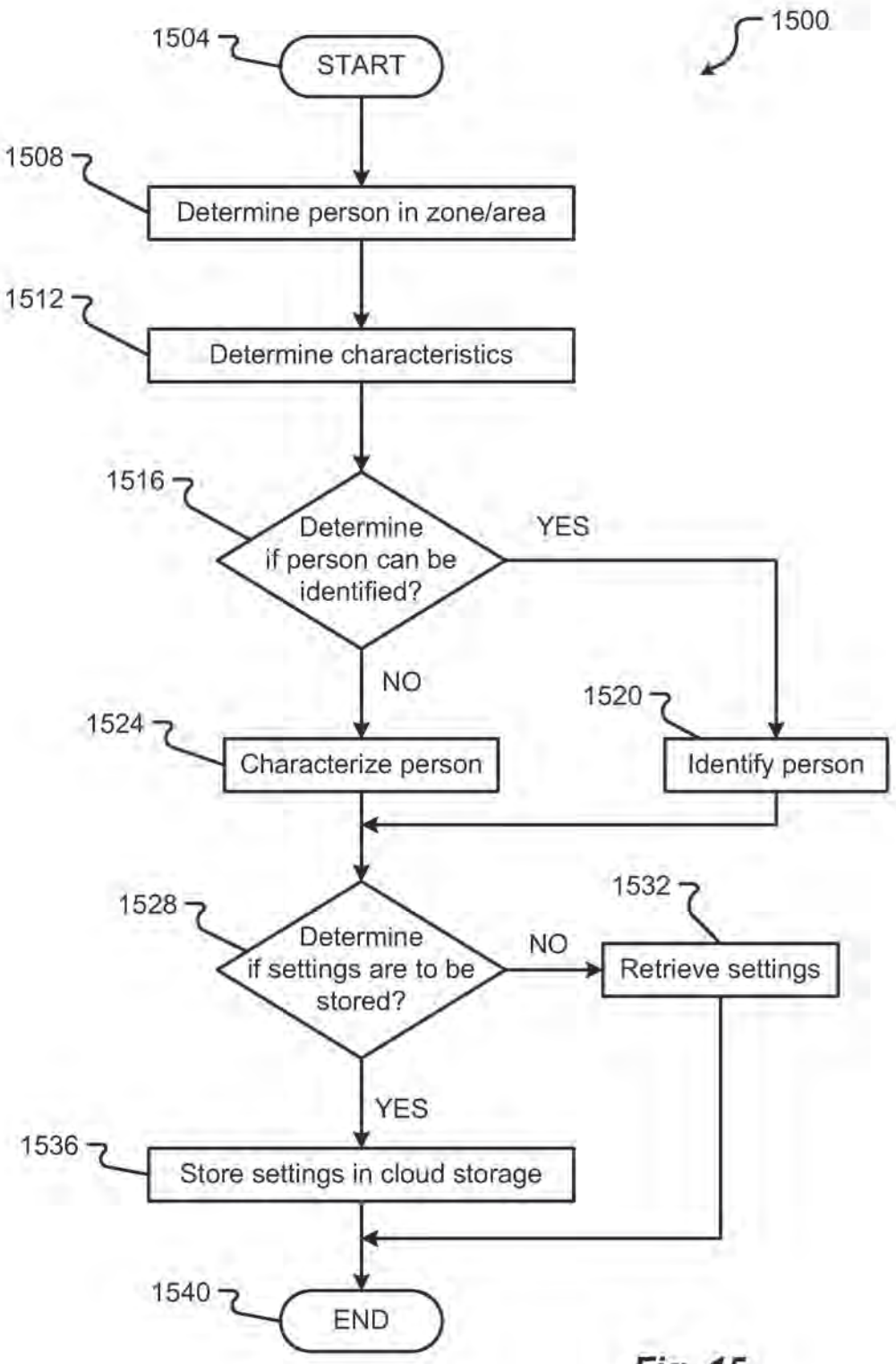

1500
1504
START
1508
Determine person in zone/area
1512
Determine characteristics
1516
Determine if person can be identified?
YES
NO
1520
Identify person
1524
Characterize person
1528
Determine if settings are to be stored?
NO
1532
Retrieve settings
YES
1536
Store settings in cloud storage
1540
END

*Fig. 15*

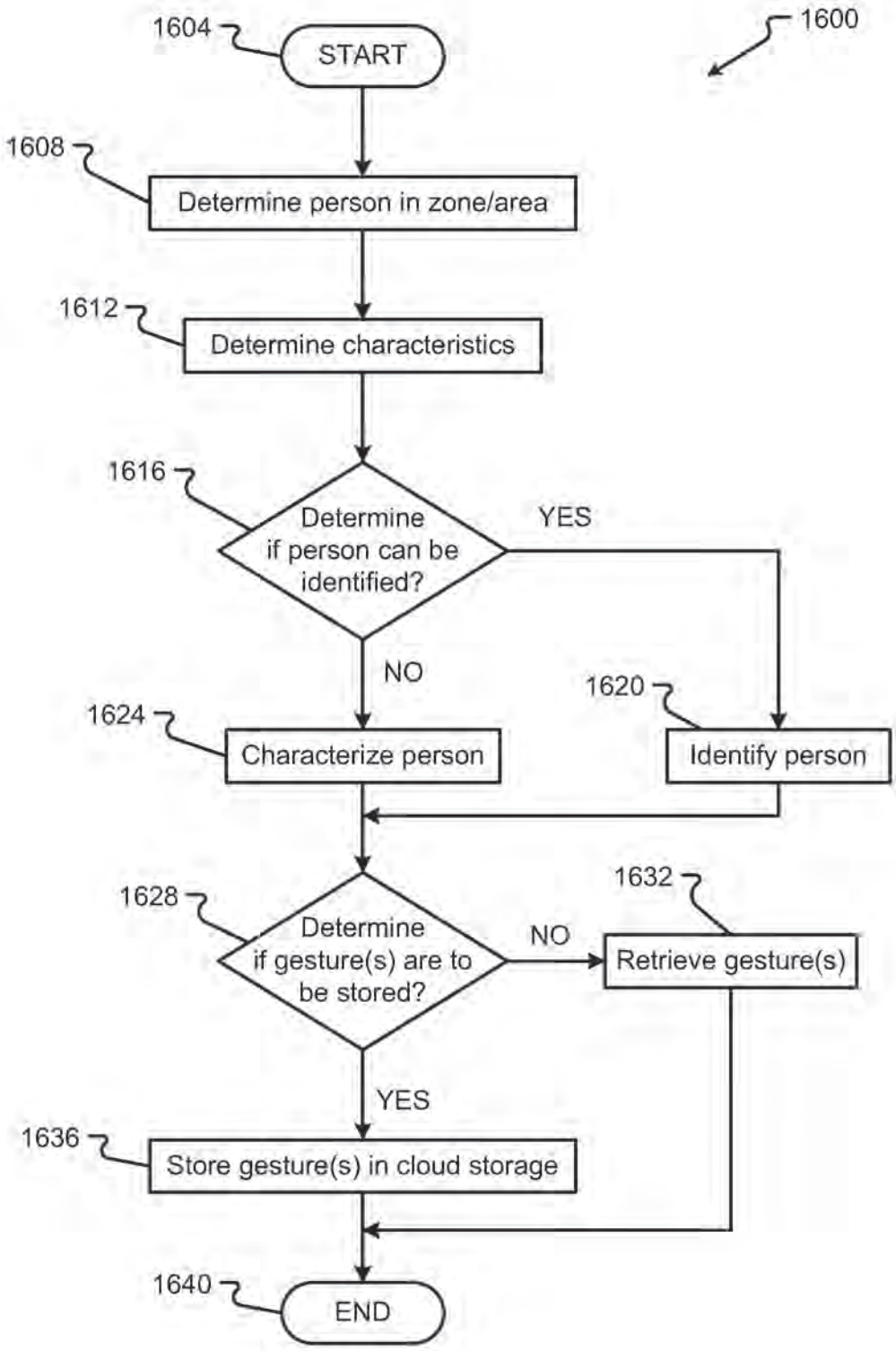

1600
1604
START
1608
Determine person in zone/area
1612
Determine characteristics
1616
Determine if person can be identified?
YES
NO
1620
Identify person
1624
Characterize person
1628
Determine if gesture(s) are to be stored?
NO
1632
Retrieve gesture(s)
YES
1636
Store gesture(s) in cloud storage
1640
END

***Fig. 16***

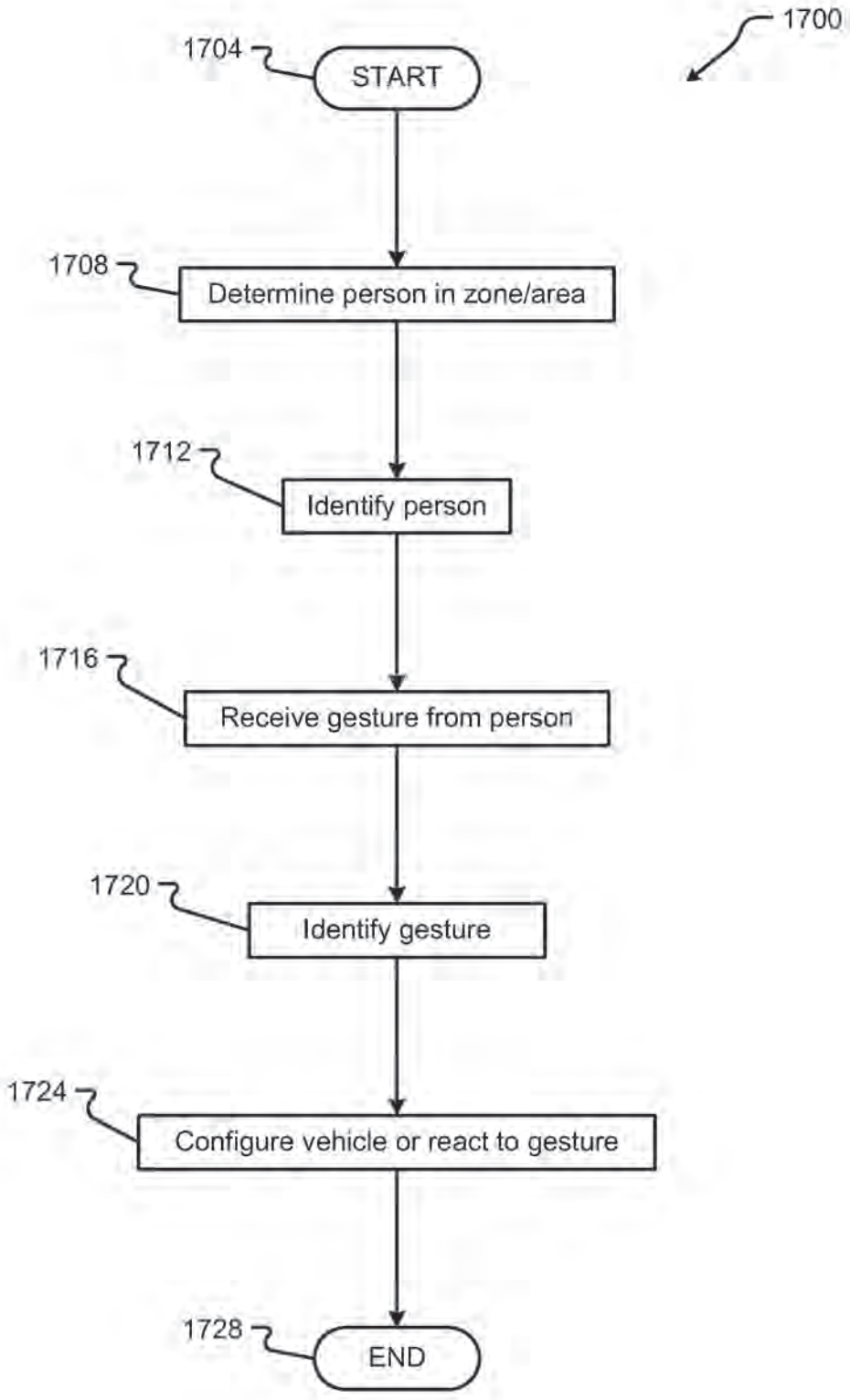

1700
1704
START
1708
Determine person in zone/area
1712
Identify person
1716
Receive gesture from person
1720
Identify gesture
1724
Configure vehicle or react to gesture
1728
END

*Fig. 17*

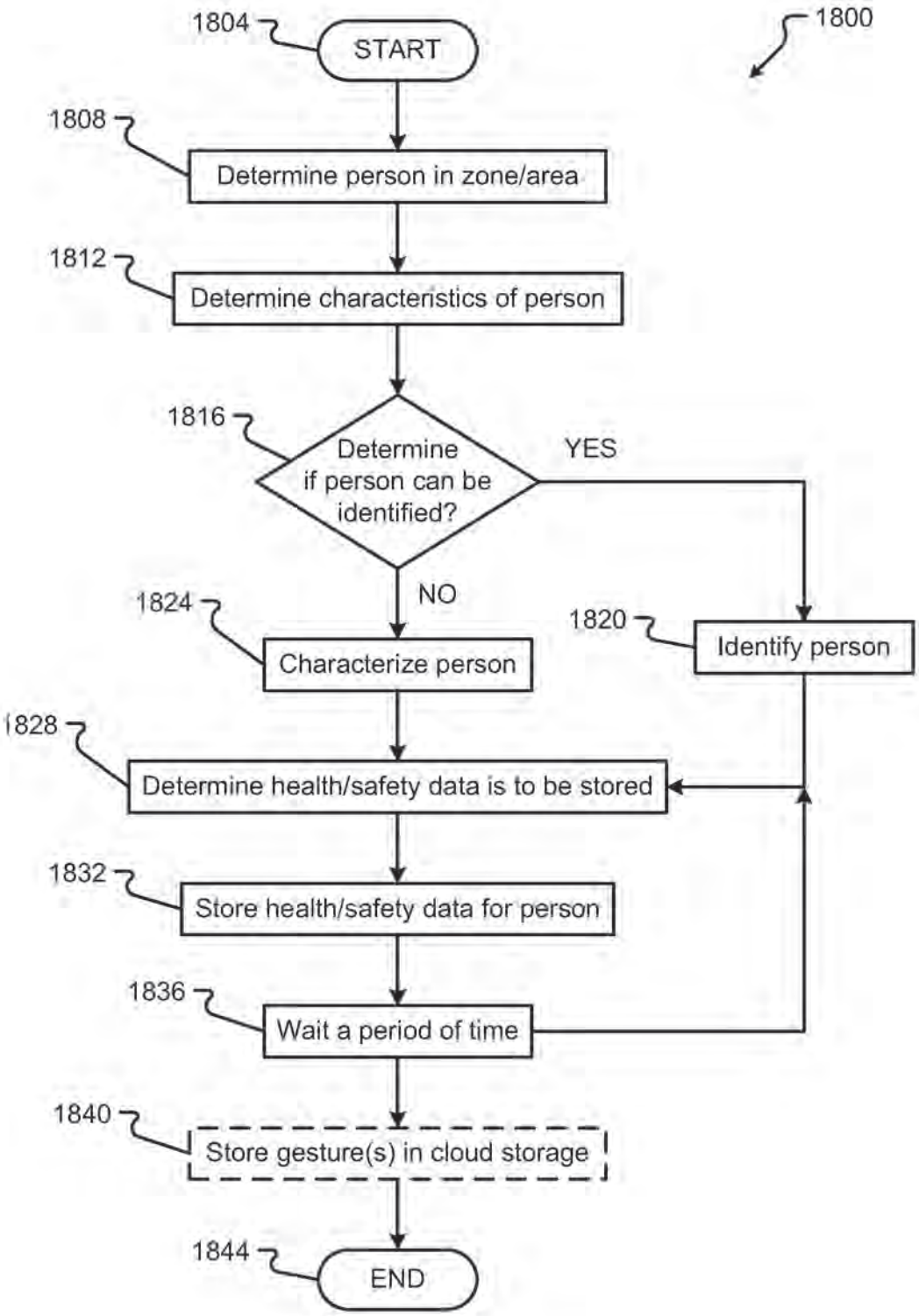

1804
START
1800
1808
Determine person in zone/area
1812
Determine characteristics of person
1816
Determine if person can be identified?
YES
NO
1824
Characterize person
1820
Identify person
1828
Determine health/safety data is to be stored
1832
Store health/safety data for person
1836
Wait a period of time
1840
Store gesture(s) in cloud storage
1844
END

***Fig. 18***

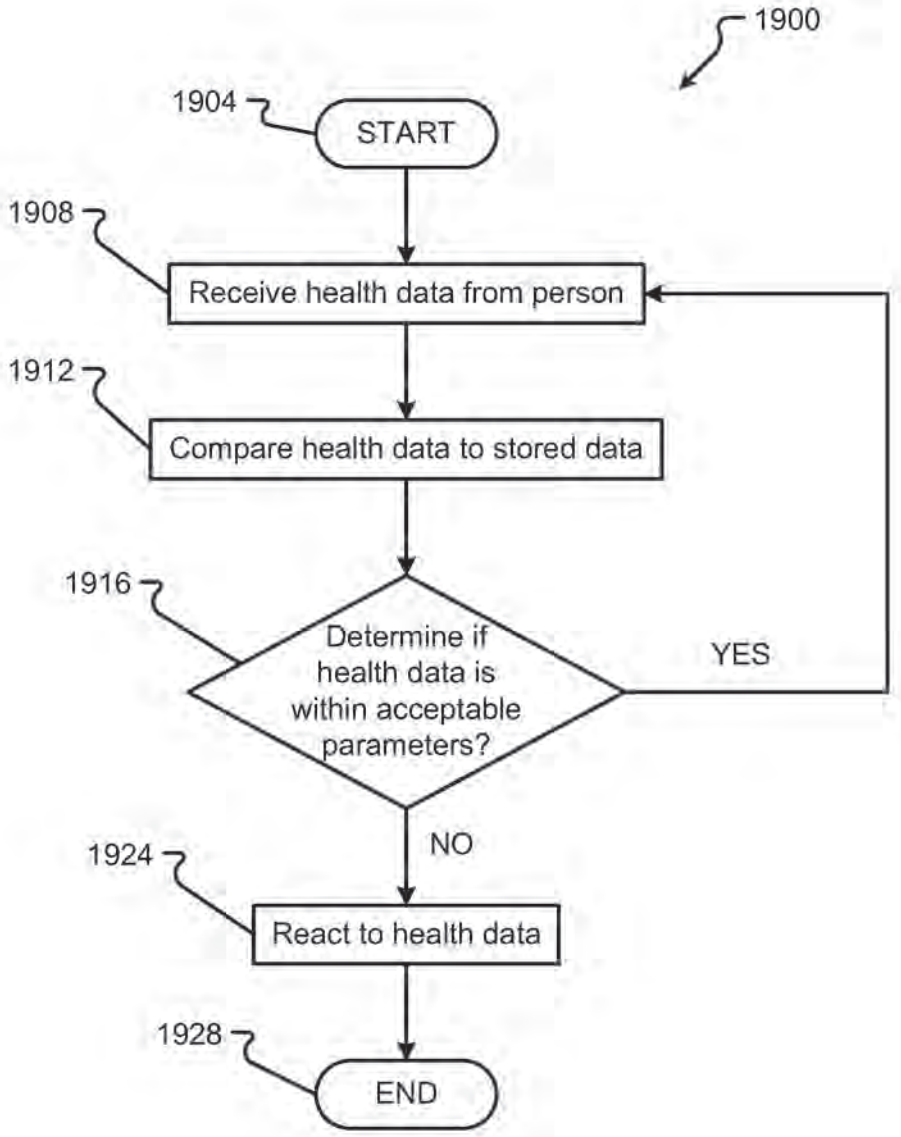

1900
1904
START
1908
Receive health data from person
1912
Compare health data to stored data
1916
Determine if health data is within acceptable parameters?
YES
NO
1924
React to health data
1928
END

*Fig. 19*

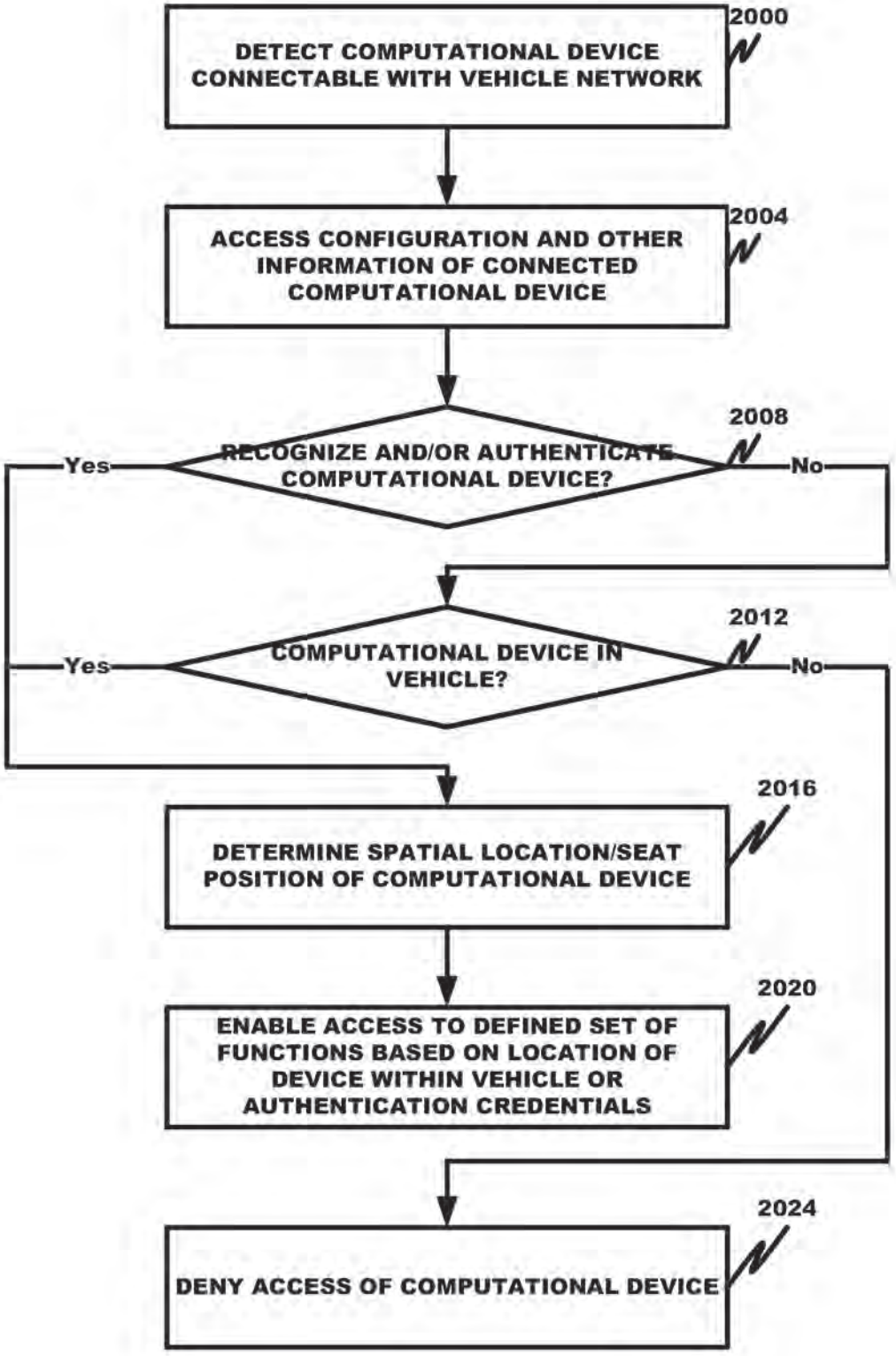

DETECT COMPUTATIONAL DEVICE CONNECTABLE WITH VEHICLE NETWORK
2000
ACCESS CONFIGURATION AND OTHER INFORMATION OF CONNECTED COMPUTATIONAL DEVICE
2004
RECOGNIZE AND/OR AUTHENTICATE COMPUTATIONAL DEVICE?
2008
Yes
No
COMPUTATIONAL DEVICE IN VEHICLE?
2012
Yes
No
DETERMINE SPATIAL LOCATION/SEAT POSITION OF COMPUTATIONAL DEVICE
2016
ENABLE ACCESS TO DEFINED SET OF FUNCTIONS BASED ON LOCATION OF DEVICE WITHIN VEHICLE OR AUTHENTICATION CREDENTIALS
2020
DENY ACCESS OF COMPUTATIONAL DEVICE
2024

*Fig. 20*

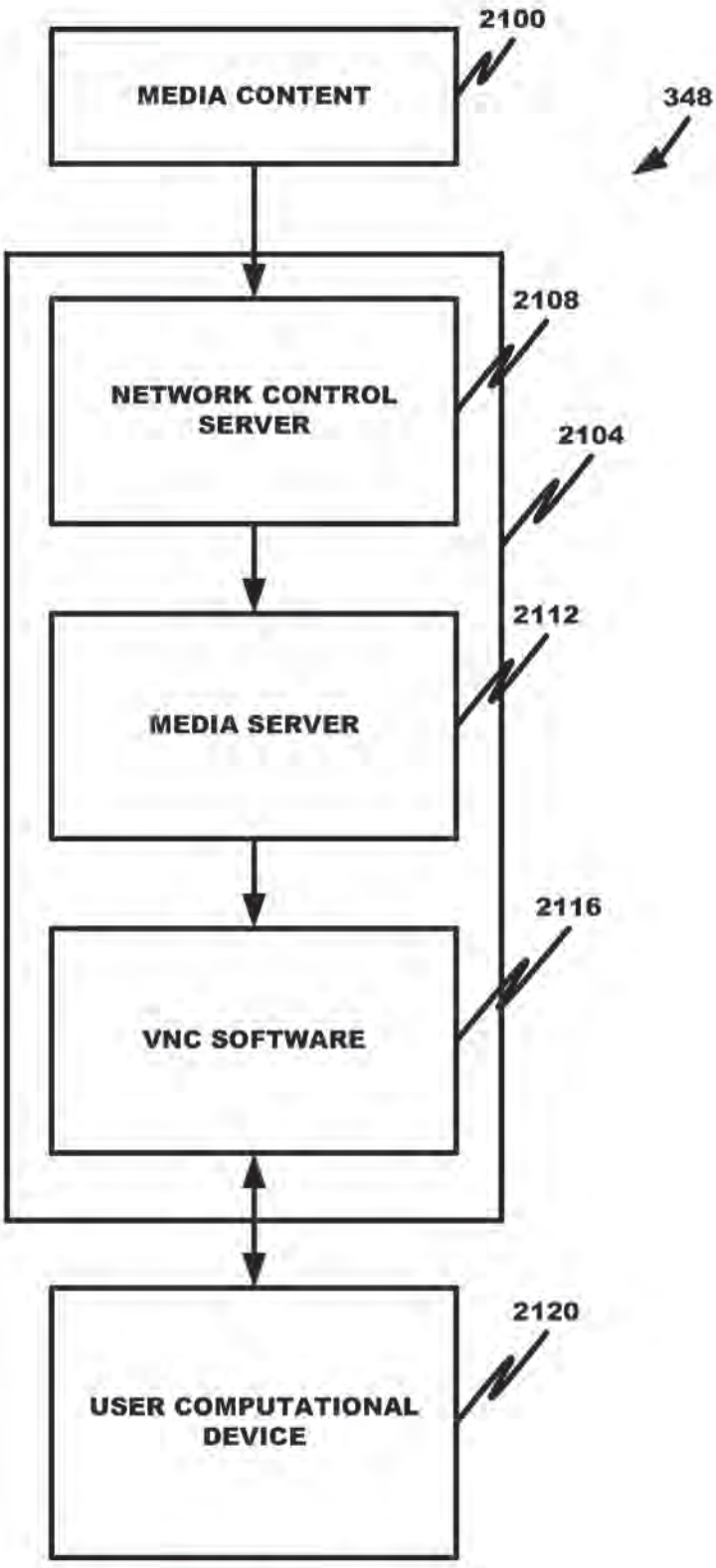

2100
MEDIA CONTENT
348
2108
NETWORK CONTROL SERVER
2104
2112
MEDIA SERVER
2116
VNC SOFTWARE
2120
USER COMPUTATIONAL DEVICE

FIG. 21

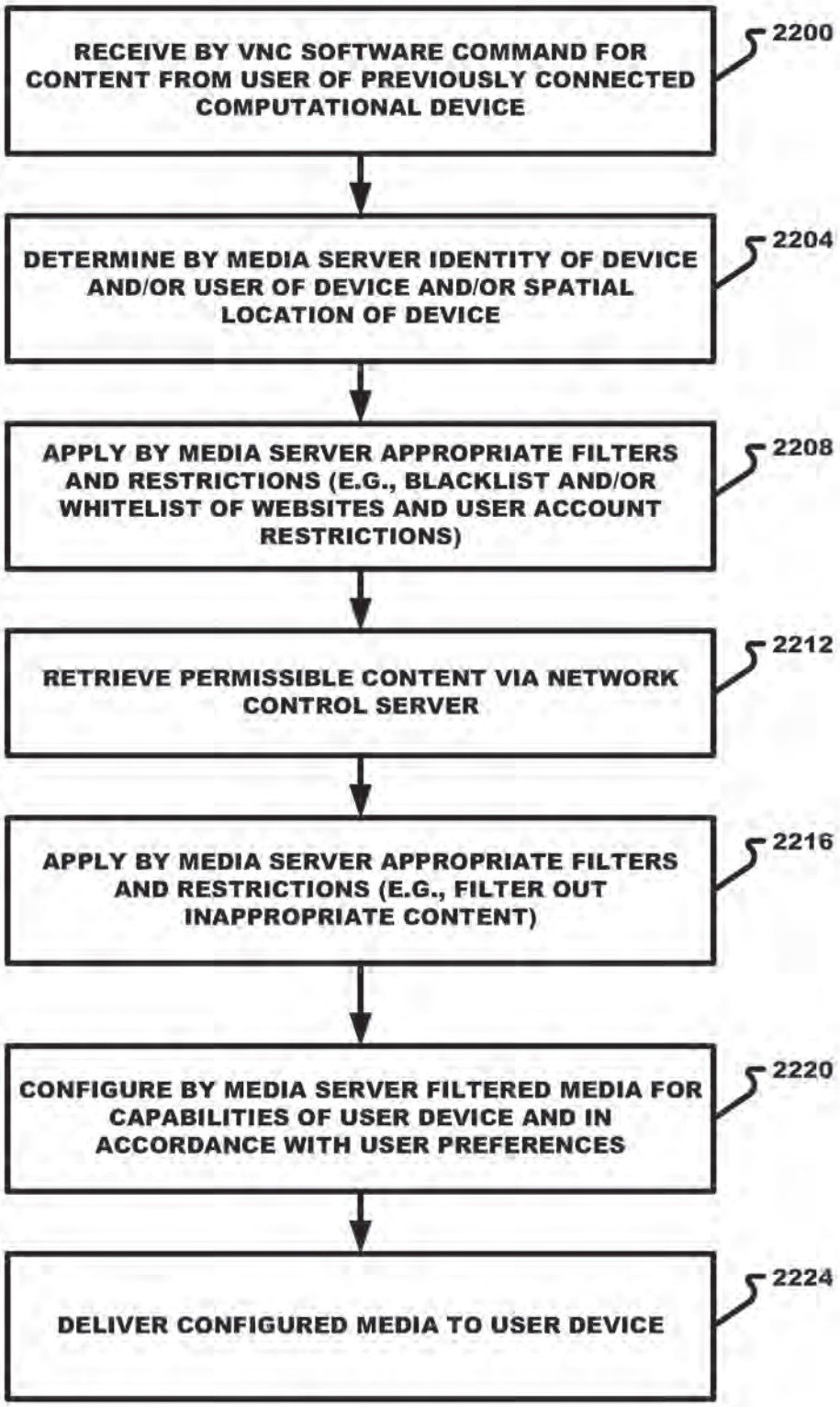

RECEIVE BY VNC SOFTWARE COMMAND FOR CONTENT FROM USER OF PREVIOUSLY CONNECTED COMPUTATIONAL DEVICE
2200
DETERMINE BY MEDIA SERVER IDENTITY OF DEVICE AND/OR USER OF DEVICE AND/OR SPATIAL LOCATION OF DEVICE
2204
APPLY BY MEDIA SERVER APPROPRIATE FILTERS AND RESTRICTIONS (E.G., BLACKLIST AND/OR WHITELIST OF WEBSITES AND USER ACCOUNT RESTRICTIONS)
2208
RETRIEVE PERMISSIBLE CONTENT VIA NETWORK CONTROL SERVER
2212
APPLY BY MEDIA SERVER APPROPRIATE FILTERS AND RESTRICTIONS (E.G., FILTER OUT INAPPROPRIATE CONTENT)
2216
CONFIGURE BY MEDIA SERVER FILTERED MEDIA FOR CAPABILITIES OF USER DEVICE AND IN ACCORDANCE WITH USER PREFERENCES
2220
DELIVER CONFIGURED MEDIA TO USER DEVICE
2224

*FIG. 22*

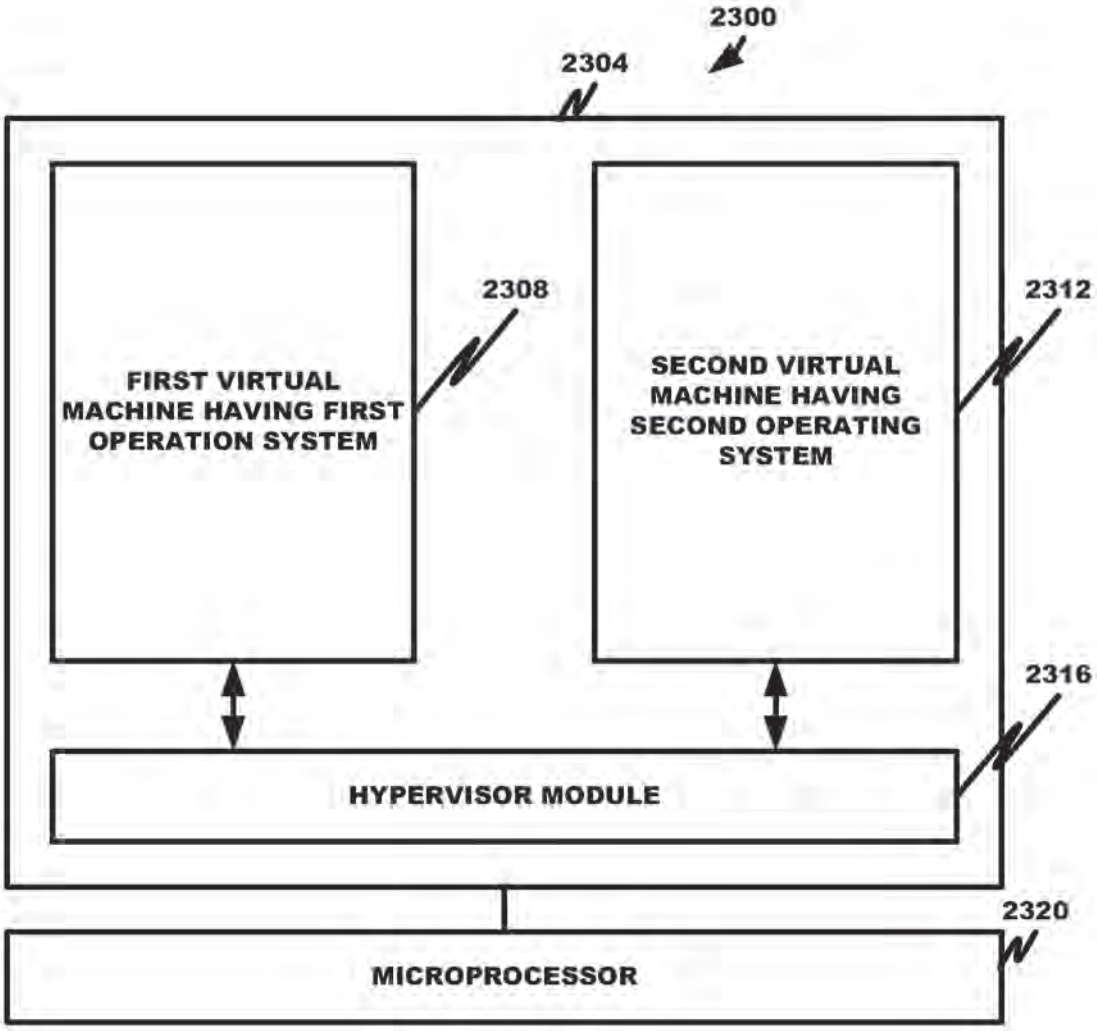

2300
2304
2308
2312
FIRST VIRTUAL MACHINE HAVING FIRST OPERATION SYSTEM
SECOND VIRTUAL MACHINE HAVING SECOND OPERATING SYSTEM
2316
HYPERVISOR MODULE
2320
MICROPROCESSOR

FIG. 23

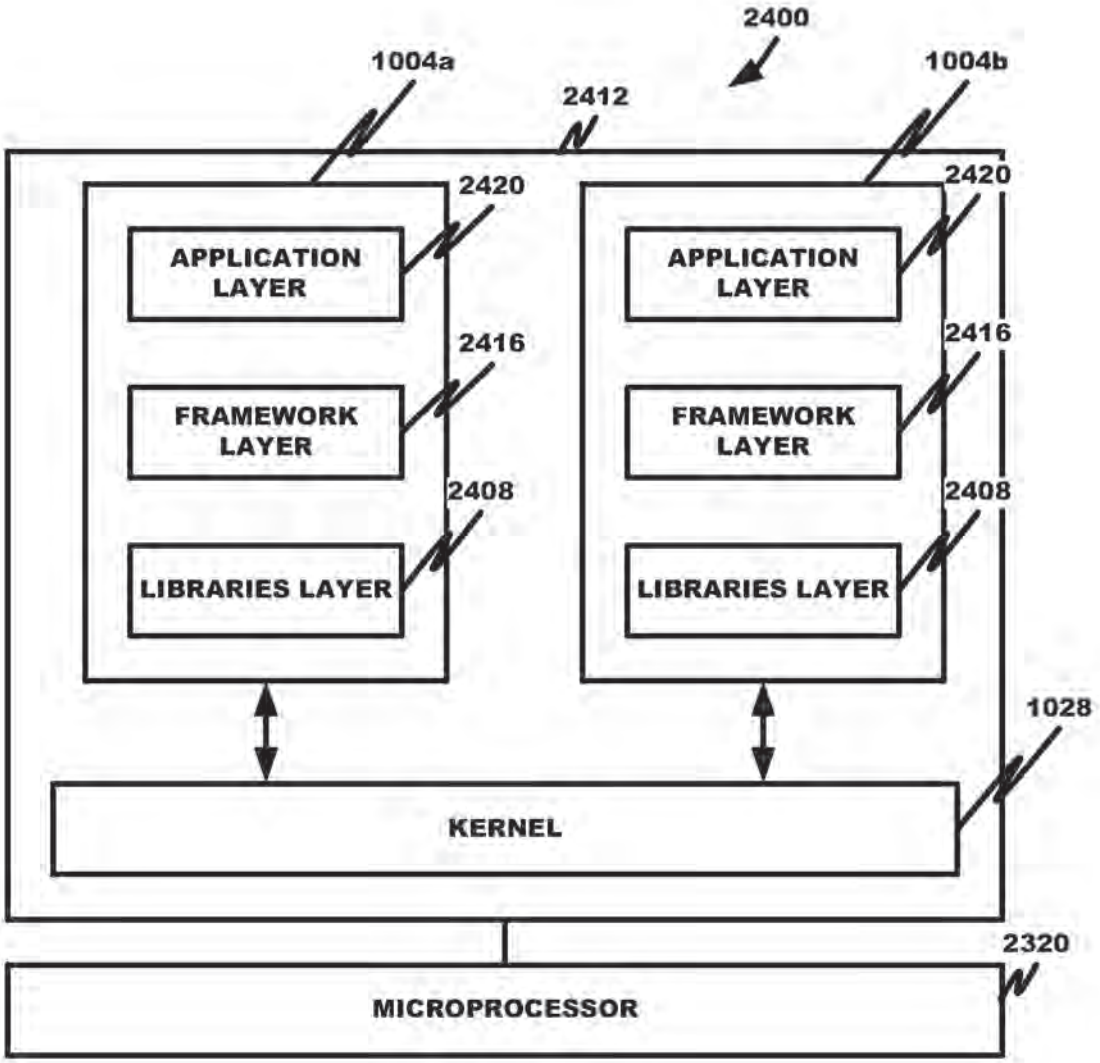

2400
1004a
1004b
2412
2420
2420
APPLICATION LAYER
APPLICATION LAYER
2416
2416
FRAMEWORK LAYER
FRAMEWORK LAYER
2408
2408
LIBRARIES LAYER
LIBRARIES LAYER
1028
KERNEL
2320
MICROPROCESSOR

FIG. 24

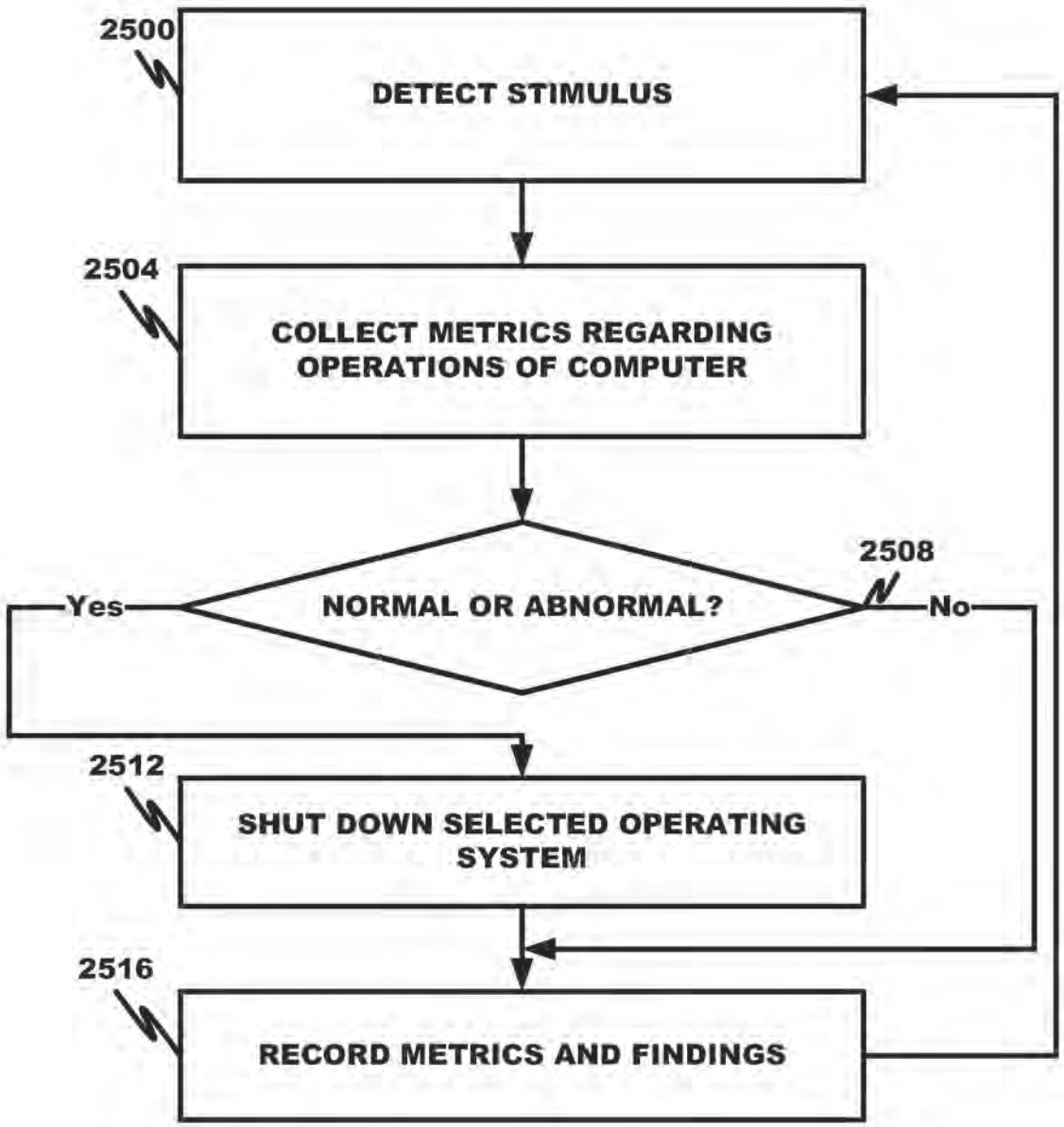

2500
DETECT STIMULUS
2504
COLLECT METRICS REGARDING OPERATIONS OF COMPUTER
2508
NORMAL OR ABNORMAL?
Yes
No
2512
SHUT DOWN SELECTED OPERATING SYSTEM
2516
RECORD METRICS AND FINDINGS

*FIG. 25*

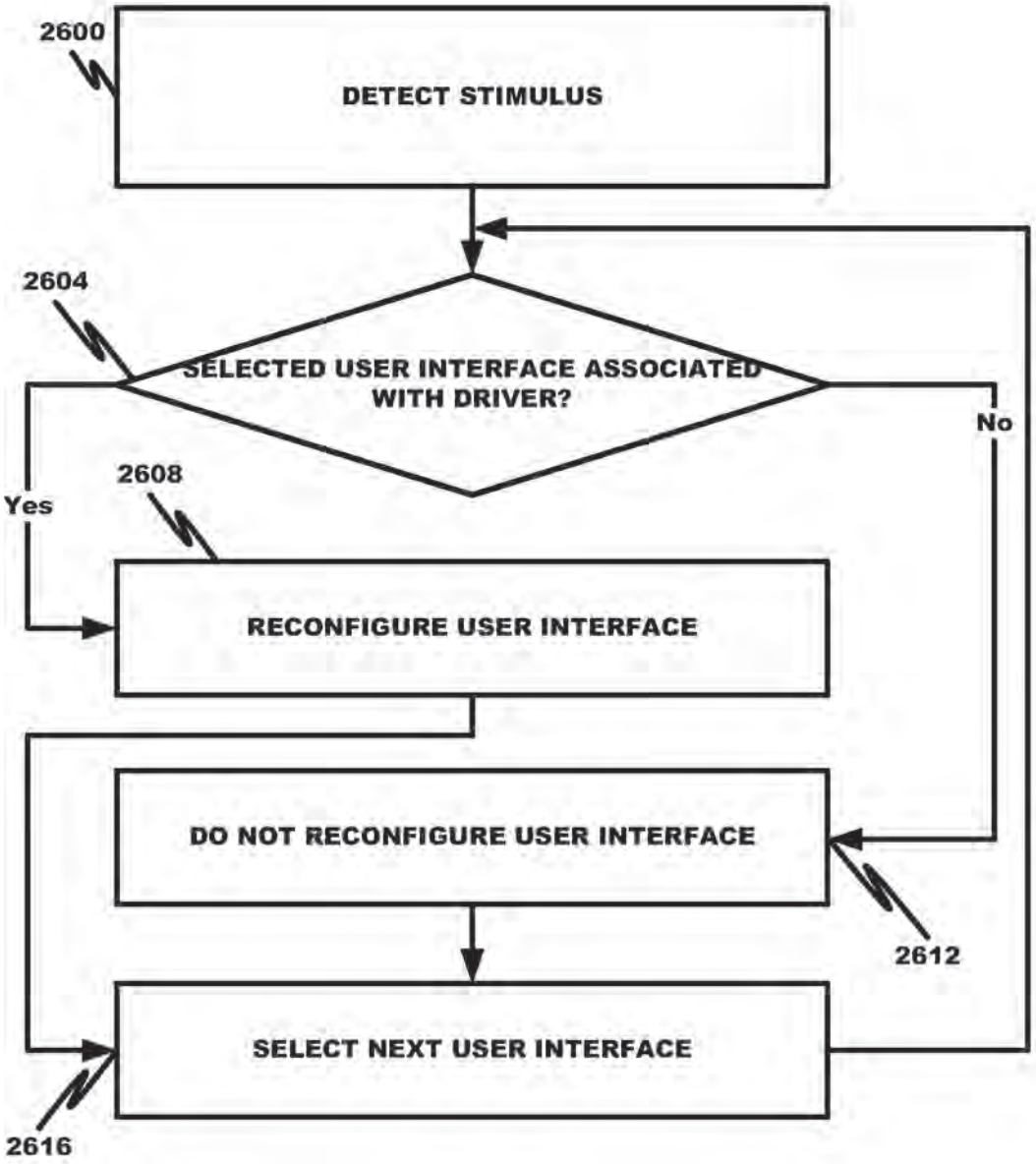

2600
DETECT STIMULUS
2604
SELECTED USER INTERFACE ASSOCIATED WITH DRIVER?
No
Yes
2608
RECONFIGURE USER INTERFACE
DO NOT RECONFIGURE USER INTERFACE
2612
SELECT NEXT USER INTERFACE
2616

*FIG. 26*

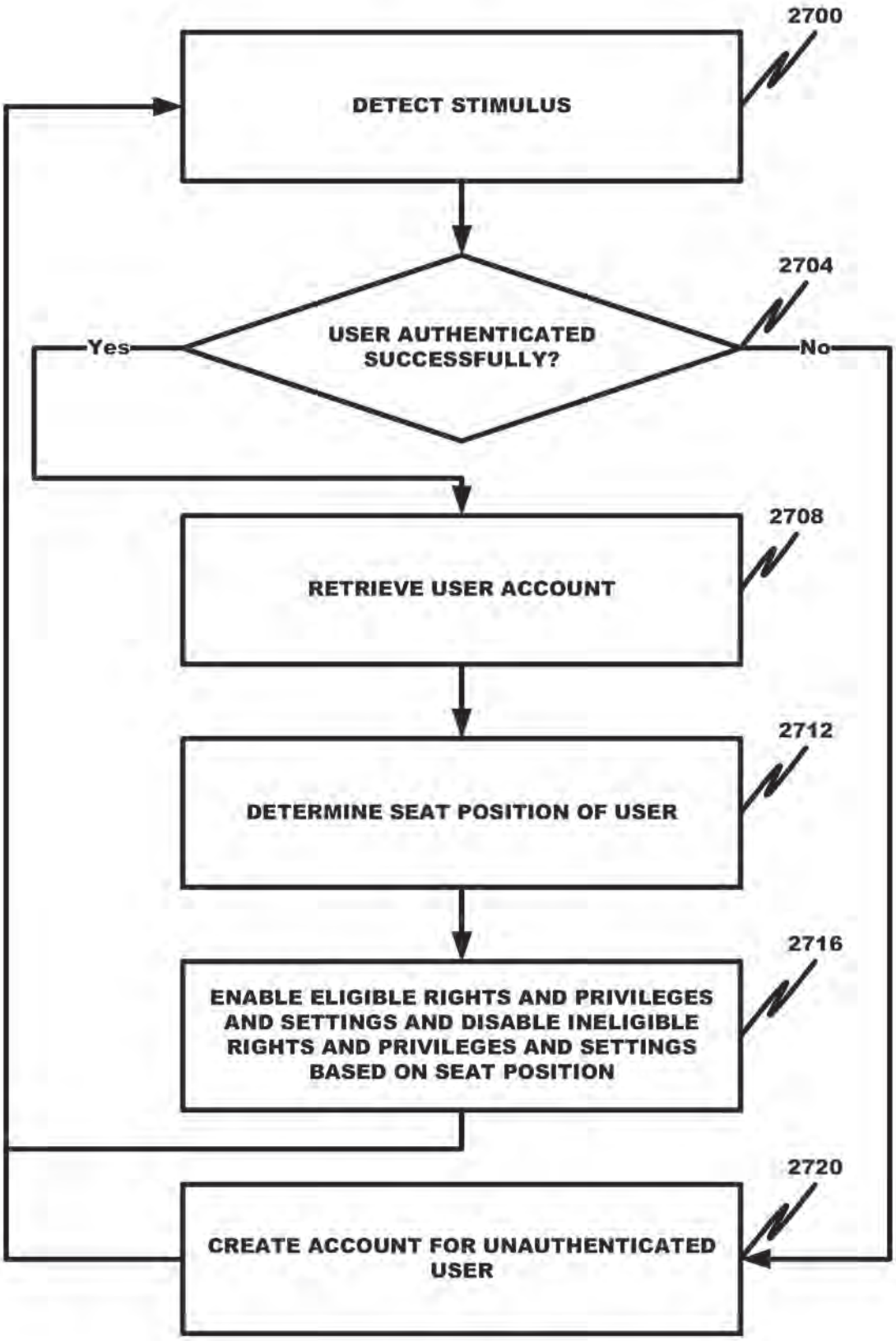

2700
DETECT STIMULUS
2704
USER AUTHENTICATED SUCCESSFULLY?
Yes
No
2708
RETRIEVE USER ACCOUNT
2712
DETERMINE SEAT POSITION OF USER
2716
ENABLE ELIGIBLE RIGHTS AND PRIVILEGES AND SETTINGS AND DISABLE INELIGIBLE RIGHTS AND PRIVILEGES AND SETTINGS BASED ON SEAT POSITION
2720
CREATE ACCOUNT FOR UNAUTHENTICATED USER

*FIG. 27*

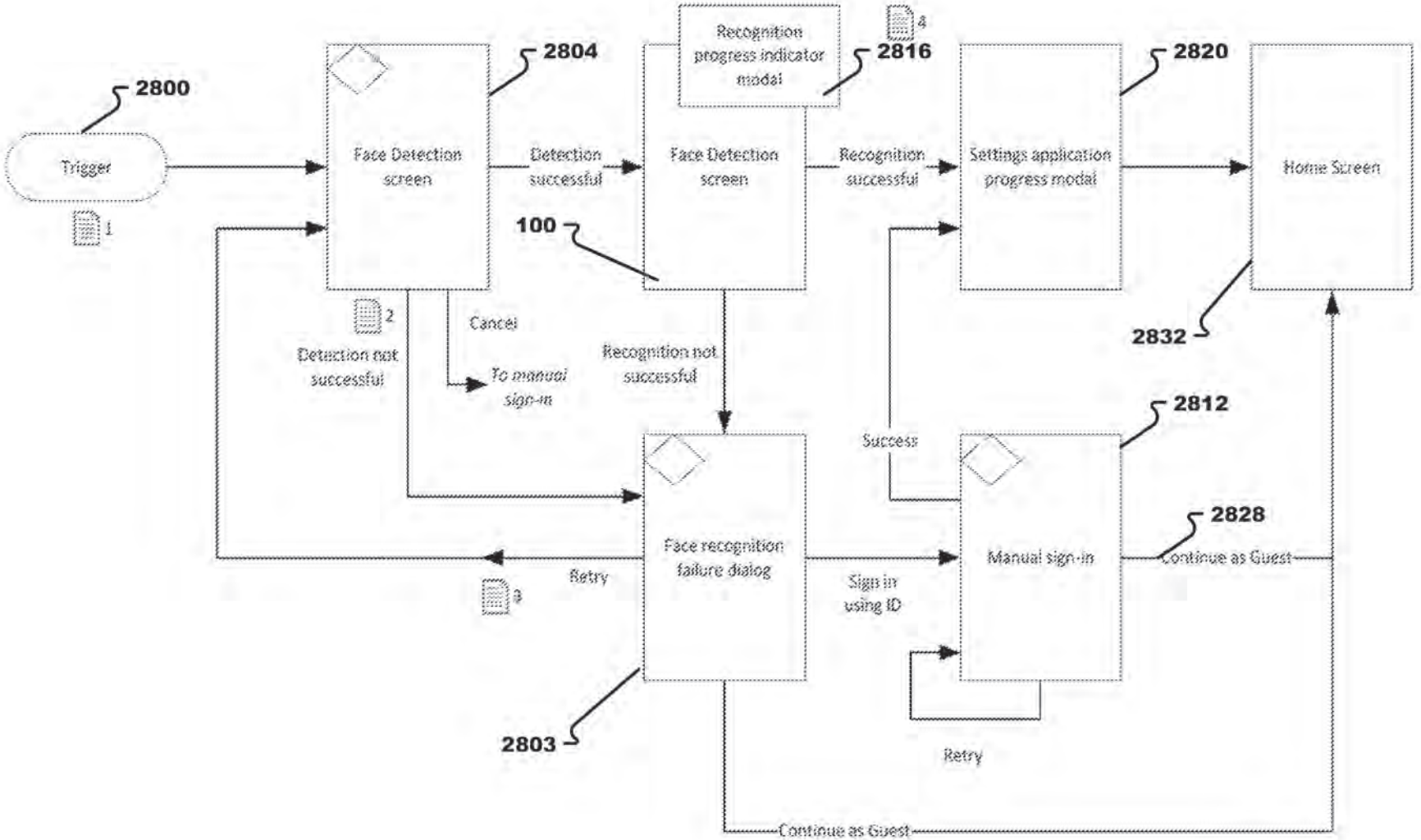

2800
Trigger
1
Face Detection screen
2804
Detection successful
Face Detection screen
Recognition progress indicator modal
4
2816
Recognition successful
Settings application progress modal
2820
Home Screen
2832
100
2
Detection not successful
Cancel
To manual sign-in
Recognition not successful
Success
2812
Face recognition failure dialog
Retry
3
Sign in using ID
Manual sign-in
2828
Continue as Guest
2803
Retry
Continue as Guest

FIG. 28

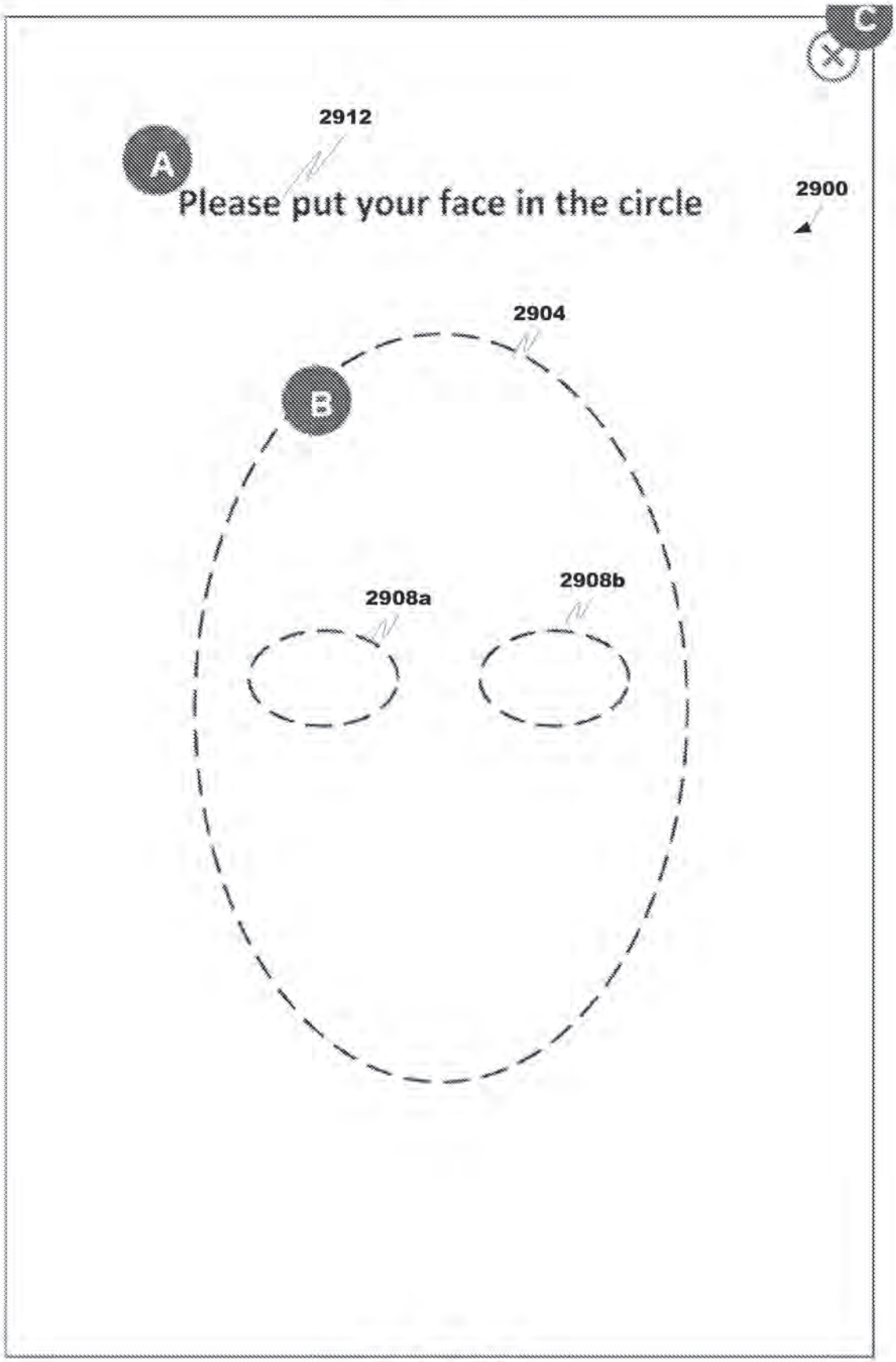

C
2912
A
Please put your face in the circle
2900
2904
B
2908a
2908b

FIG. 29

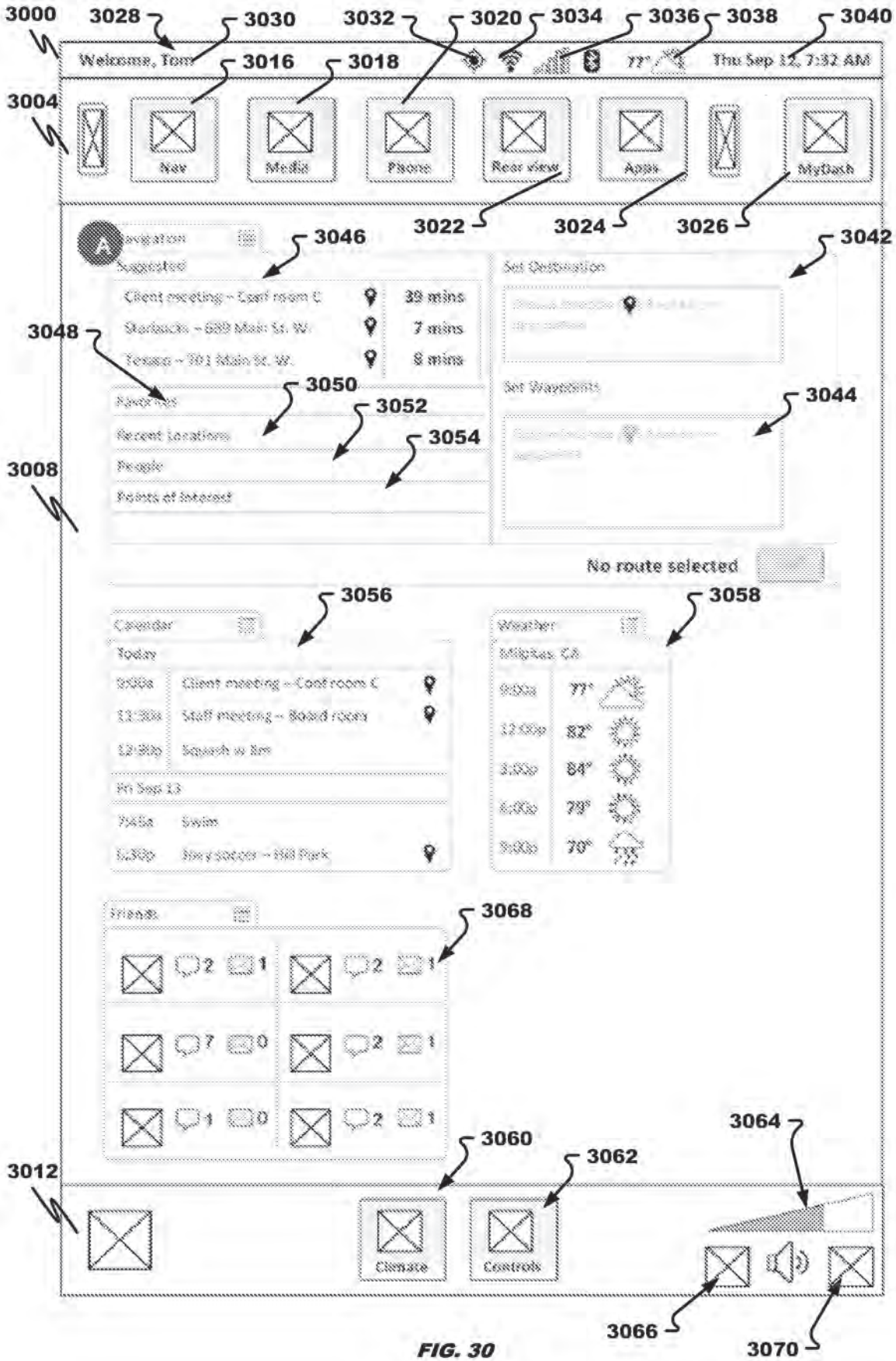

3000
3028
3030
3032
3020
3034
3036
3038
3040
Welcome, Tom
Thu Sep 12, 7:32 AM
3016
3018
3004
Nav
Media
Phone
Rear view
Apps
MyData
3022
3024
3026
3046
3042
Client meeting – Conf room C
39 mins
7 mins
8 mins
3048
3050
3052
3054
3044
3008
Recent Locations
People
Points of Interest
No route selected
3056
3058
Today
Client meeting – Conf room C
Staff meeting – Board room
Fri Sep 13
Swim
77°
82°
84°
79°
70°
3068
3060
3062
3064
3012
Climate
Controls
3066
3070

FIG. 30

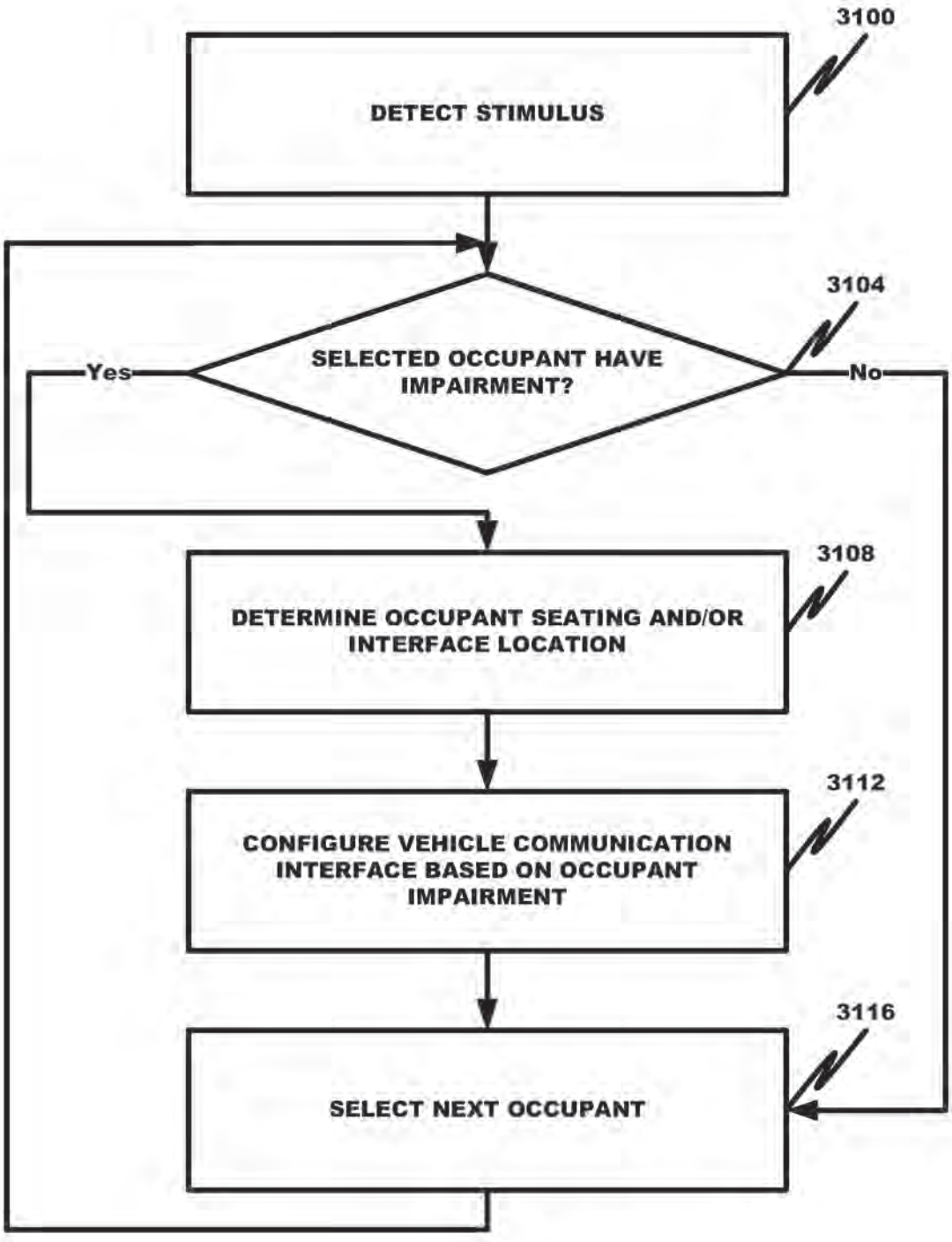

3100
DETECT STIMULUS
3104
SELECTED OCCUPANT HAVE IMPAIRMENT?
Yes
No
3108
DETERMINE OCCUPANT SEATING AND/OR INTERFACE LOCATION
3112
CONFIGURE VEHICLE COMMUNICATION INTERFACE BASED ON OCCUPANT IMPAIRMENT
3116
SELECT NEXT OCCUPANT

*FIG. 31*

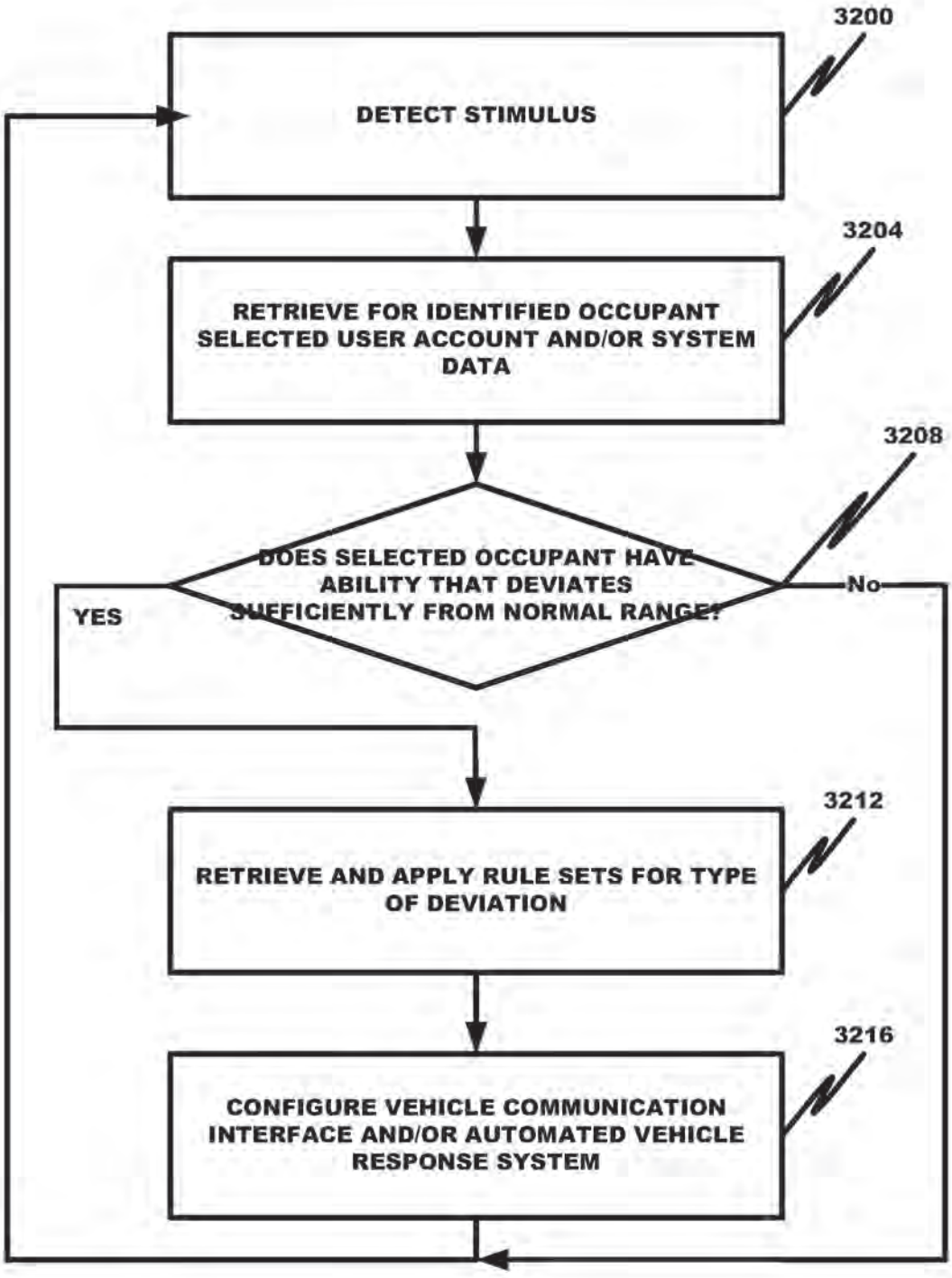

3200
DETECT STIMULUS
3204
RETRIEVE FOR IDENTIFIED OCCUPANT SELECTED USER ACCOUNT AND/OR SYSTEM DATA
3208
DOES SELECTED OCCUPANT HAVE ABILITY THAT DEVIATES SUFFICIENTLY FROM NORMAL RANGE?
YES
No
3212
RETRIEVE AND APPLY RULE SETS FOR TYPE OF DEVIATION
3216
CONFIGURE VEHICLE COMMUNICATION INTERFACE AND/OR AUTOMATED VEHICLE RESPONSE SYSTEM

*FIG. 32*

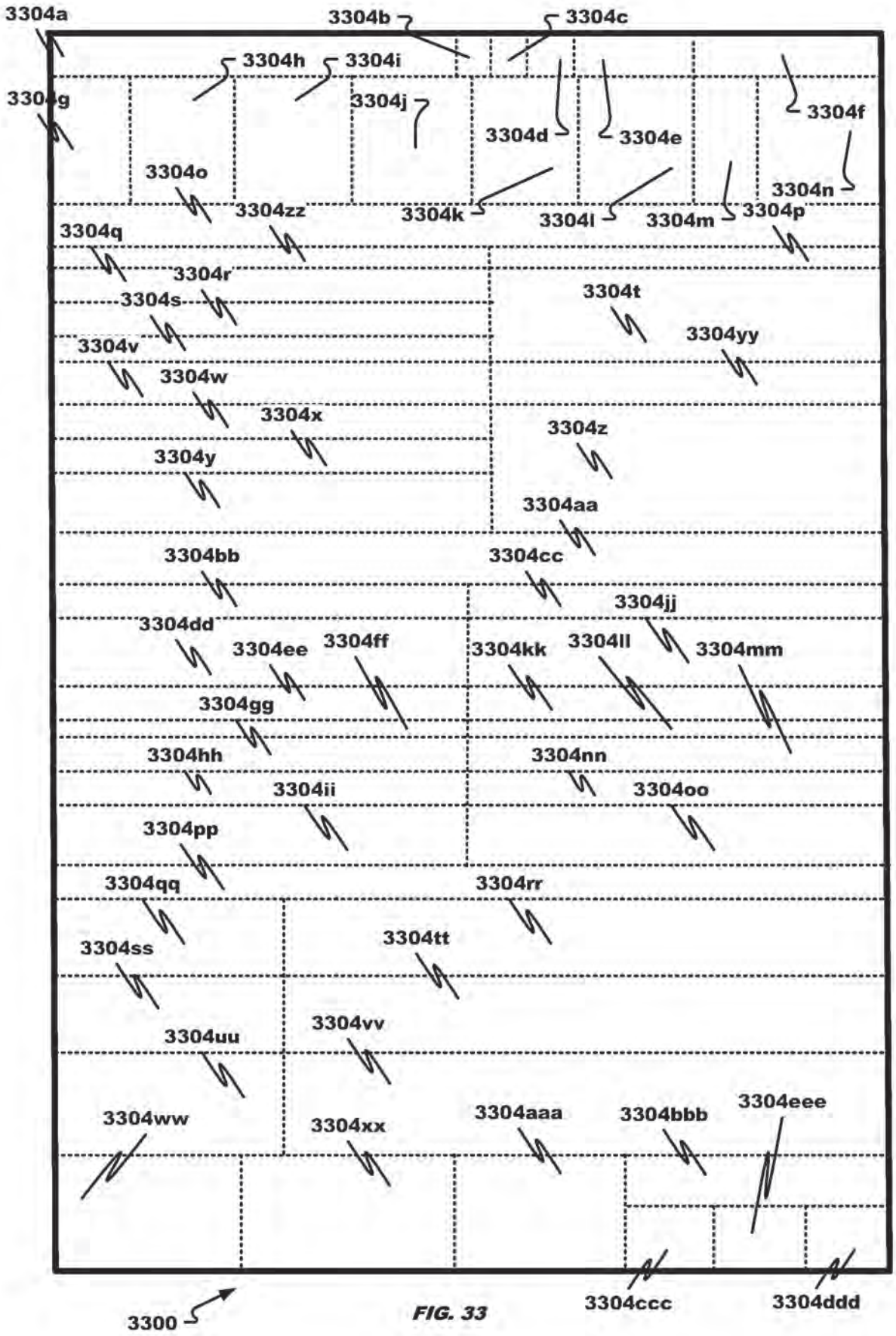

3304a
3304b
3304c
3304h
3304i
3304g
3304j
3304d
3304e
3304f
3304o
3304n
3304zz
3304k
3304l
3304m
3304p
3304q
3304r
3304s
3304t
3304yy
3304v
3304w
3304x
3304z
3304y
3304aa
3304bb
3304cc
3304jj
3304dd
3304ee
3304ff
3304kk
3304ll
3304mm
3304gg
3304hh
3304nn
3304ii
3304oo
3304pp
3304qq
3304rr
3304ss
3304tt
3304uu
3304vv
3304ww
3304xx
3304aaa
3304bbb
3304eee
3304ccc
3304ddd
3300

FIG. 33

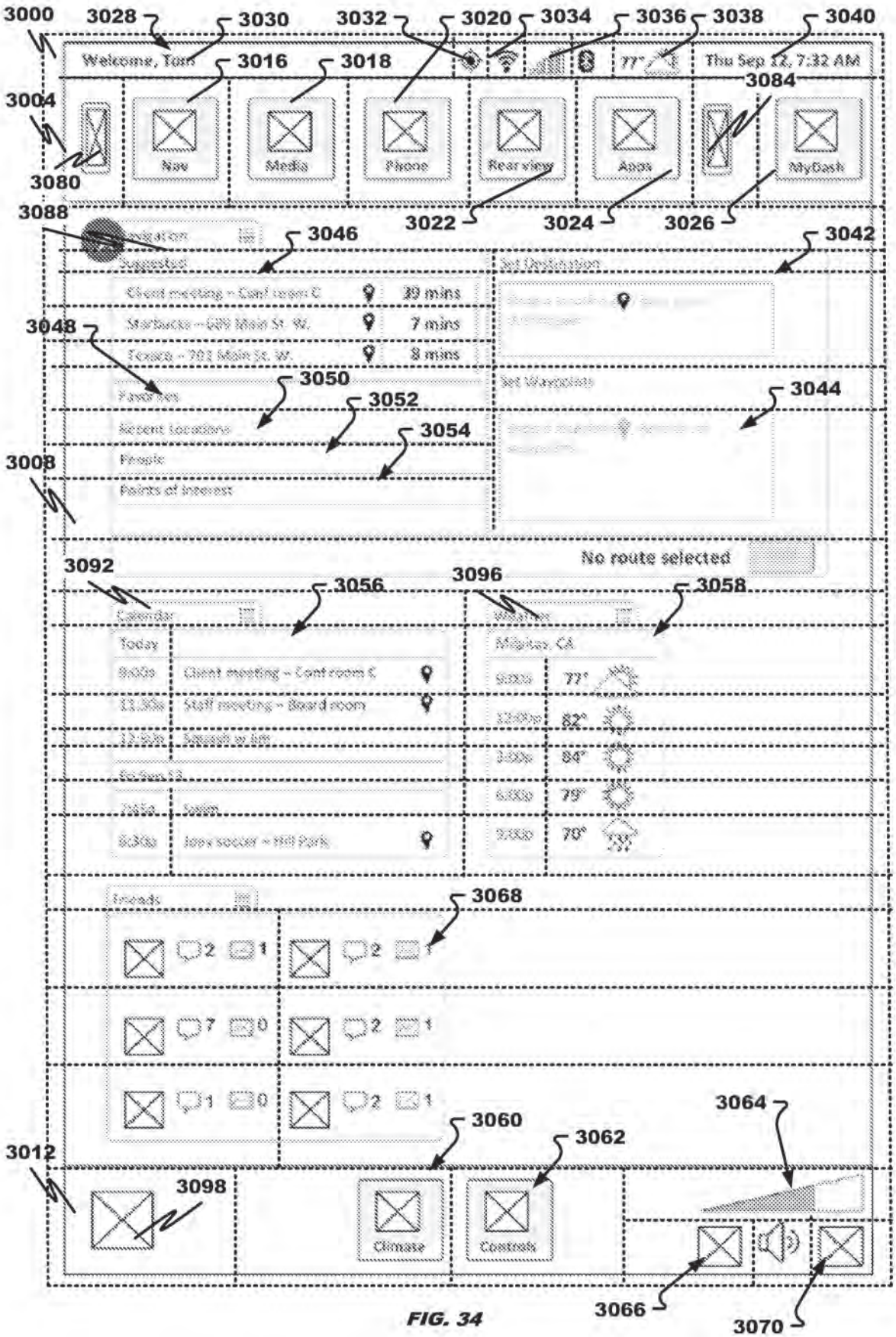

3000
3028
3030
3032
3020
3034
3036
3038
3040
Welcome, Tom
77°
Thu Sep 12, 7:32 AM
3016
3018
3084
3004
3080
Nav
Media
Phone
Rearview
Apps
MyDash
3088
3022
3024
3026
3046
3042
Suggested
Set Destination
Client meeting – Conf room C
39 mins
Starbucks – 689 Main St. W.
7 mins
Tosaka – 701 Main St. W.
8 mins
3048
3050
3052
3054
3044
Favorites
Recent Locations
People
Points of Interest
Set Waypoints
3008
No route selected
3092
3056
3096
3058
Calendar
Today
Client meeting – Conf room C
Staff meeting – Board room
Soccer – Hill Park
Milpitas, CA
77°
82°
84°
79°
70°
Friends
3068
3060
3062
3064
3012
3098
Climate
Controls
3066
3070

FIG. 34

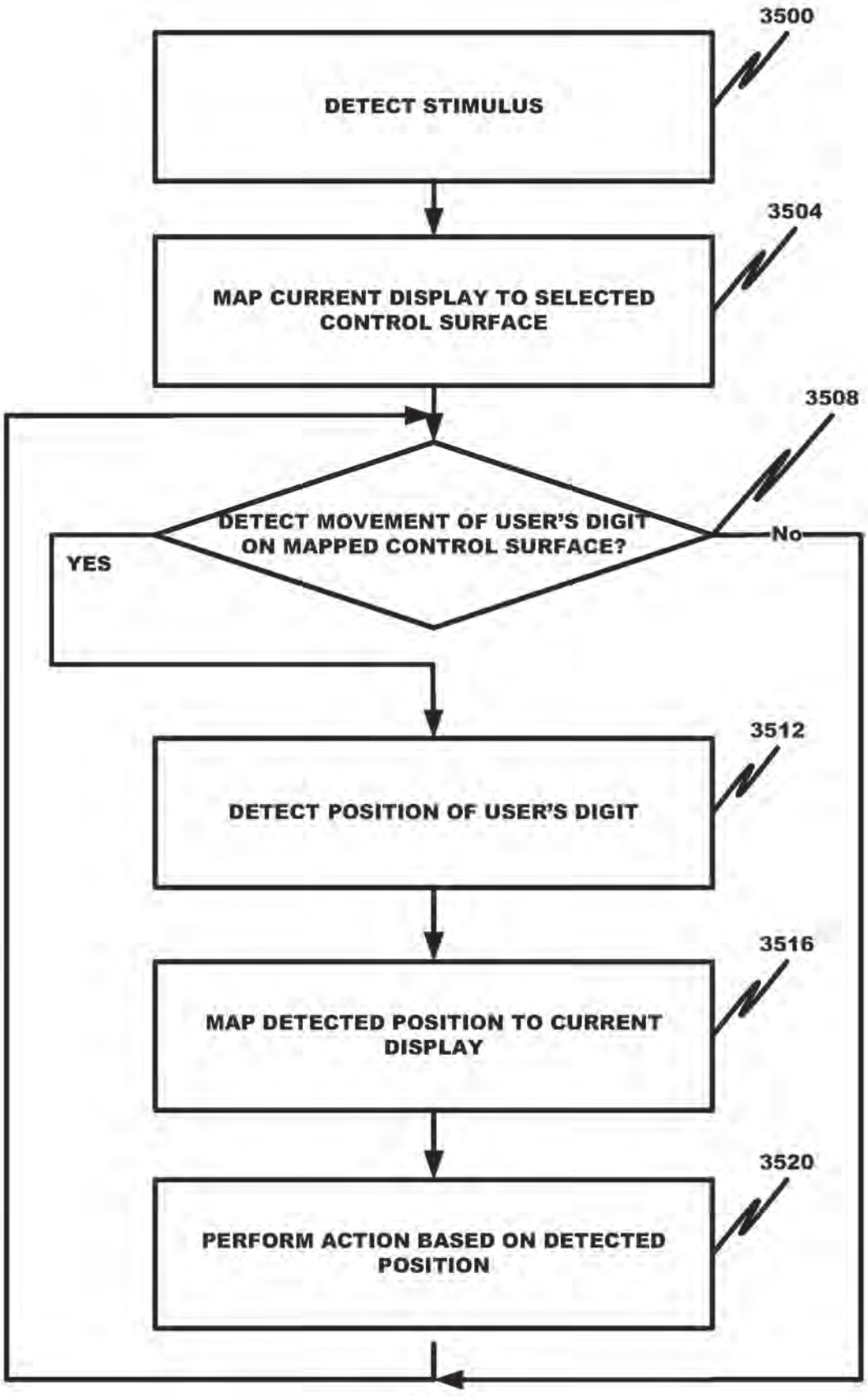

3500
DETECT STIMULUS
3504
MAP CURRENT DISPLAY TO SELECTED CONTROL SURFACE
3508
DETECT MOVEMENT OF USER'S DIGIT ON MAPPED CONTROL SURFACE?
YES
No
3512
DETECT POSITION OF USER'S DIGIT
3516
MAP DETECTED POSITION TO CURRENT DISPLAY
3520
PERFORM ACTION BASED ON DETECTED POSITION

*FIG. 35*

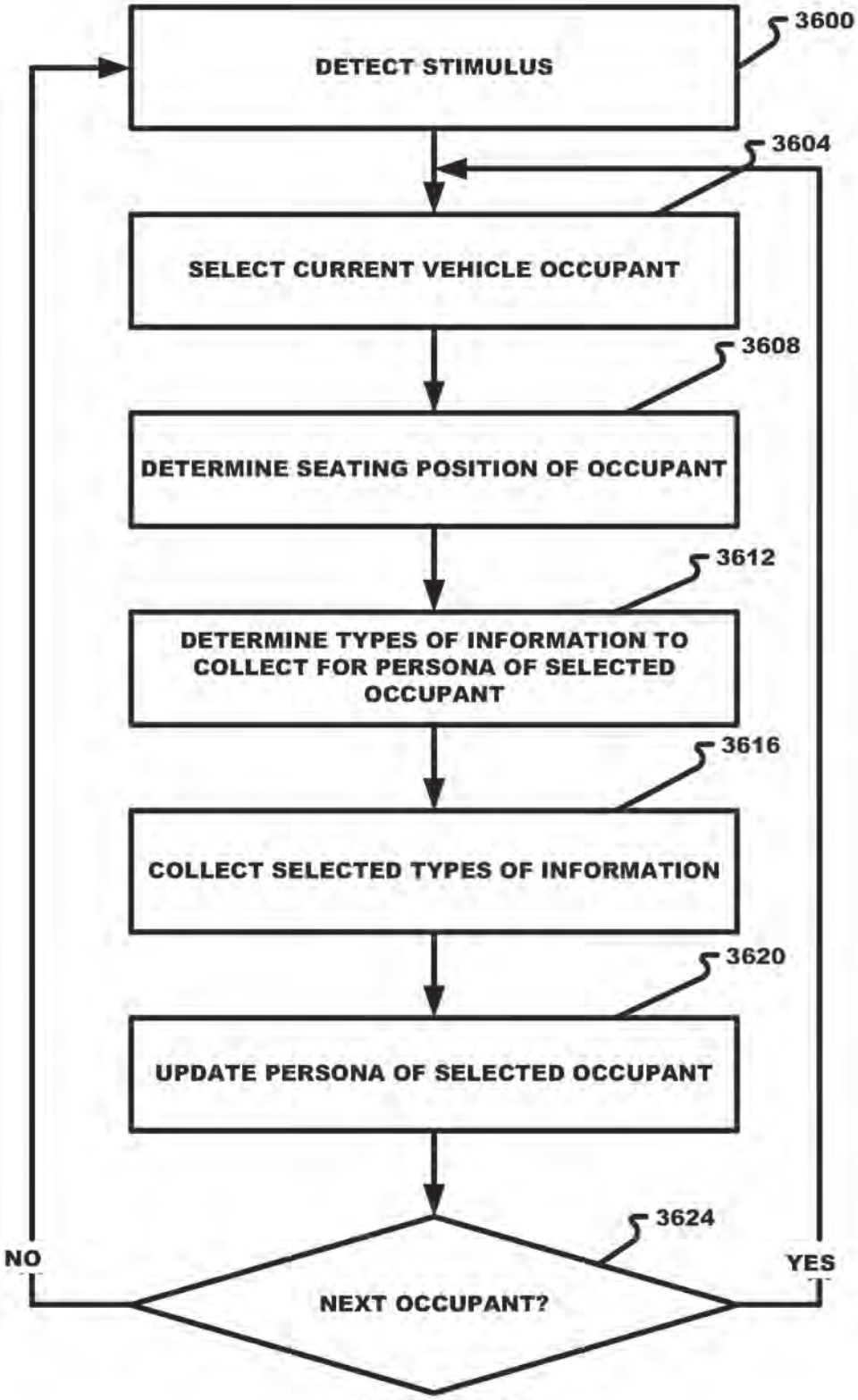

DETECT STIMULUS
3600
3604
SELECT CURRENT VEHICLE OCCUPANT
3608
DETERMINE SEATING POSITION OF OCCUPANT
3612
DETERMINE TYPES OF INFORMATION TO COLLECT FOR PERSONA OF SELECTED OCCUPANT
3616
COLLECT SELECTED TYPES OF INFORMATION
3620
UPDATE PERSONA OF SELECTED OCCUPANT
3624
NEXT OCCUPANT?
NO
YES

FIG. 36

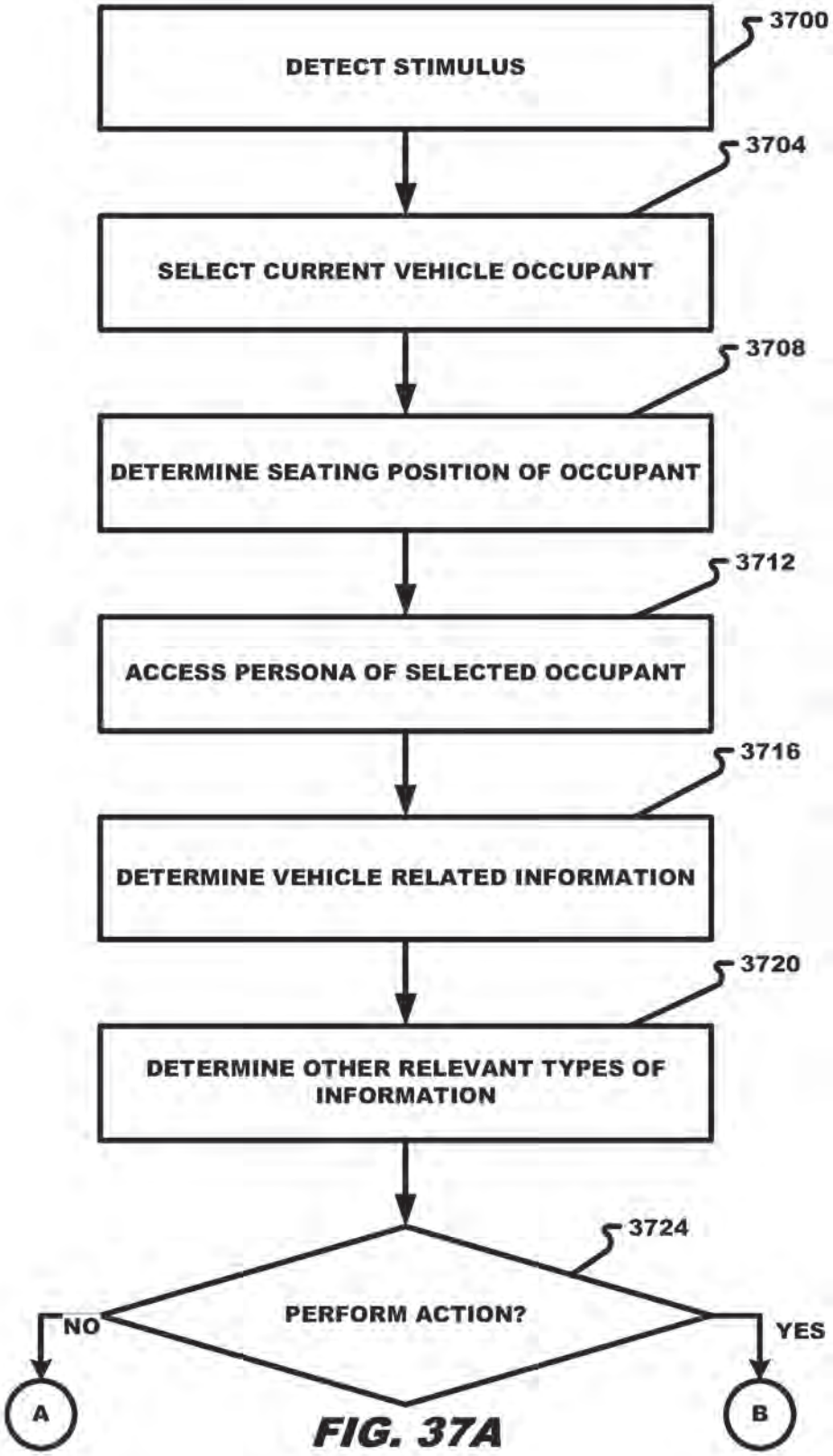

DETECT STIMULUS
3700
SELECT CURRENT VEHICLE OCCUPANT
3704
DETERMINE SEATING POSITION OF OCCUPANT
3708
ACCESS PERSONA OF SELECTED OCCUPANT
3712
DETERMINE VEHICLE RELATED INFORMATION
3716
DETERMINE OTHER RELEVANT TYPES OF INFORMATION
3720
PERFORM ACTION?
3724
NO
YES
A
B

FIG. 37A

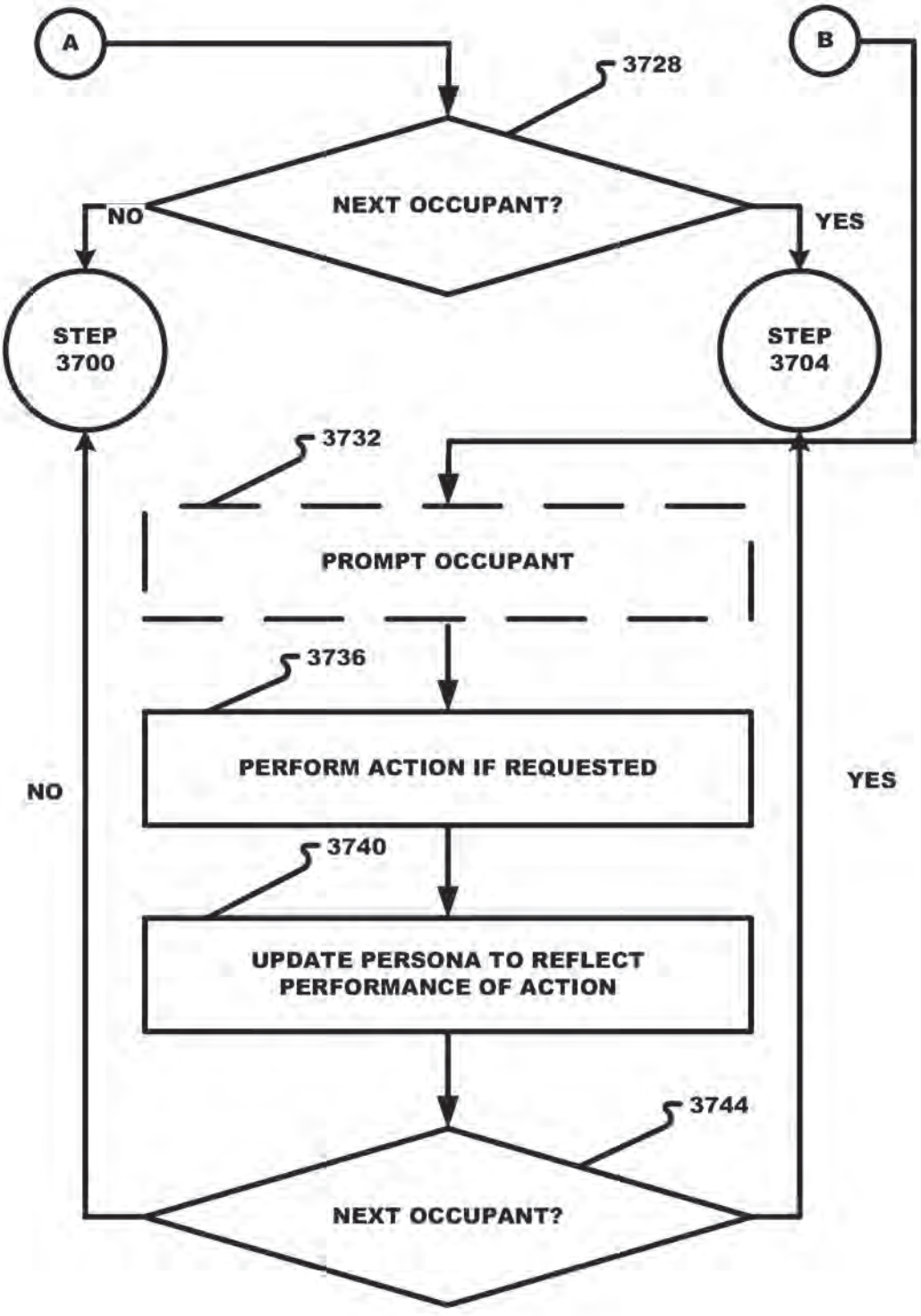

A
B
3728
NEXT OCCUPANT?
NO
YES
STEP 3700
STEP 3704
3732
PROMPT OCCUPANT
3736
PERFORM ACTION IF REQUESTED
NO
YES
3740
UPDATE PERSONA TO REFLECT PERFORMANCE OF ACTION
3744
NEXT OCCUPANT?

FIG. 37B

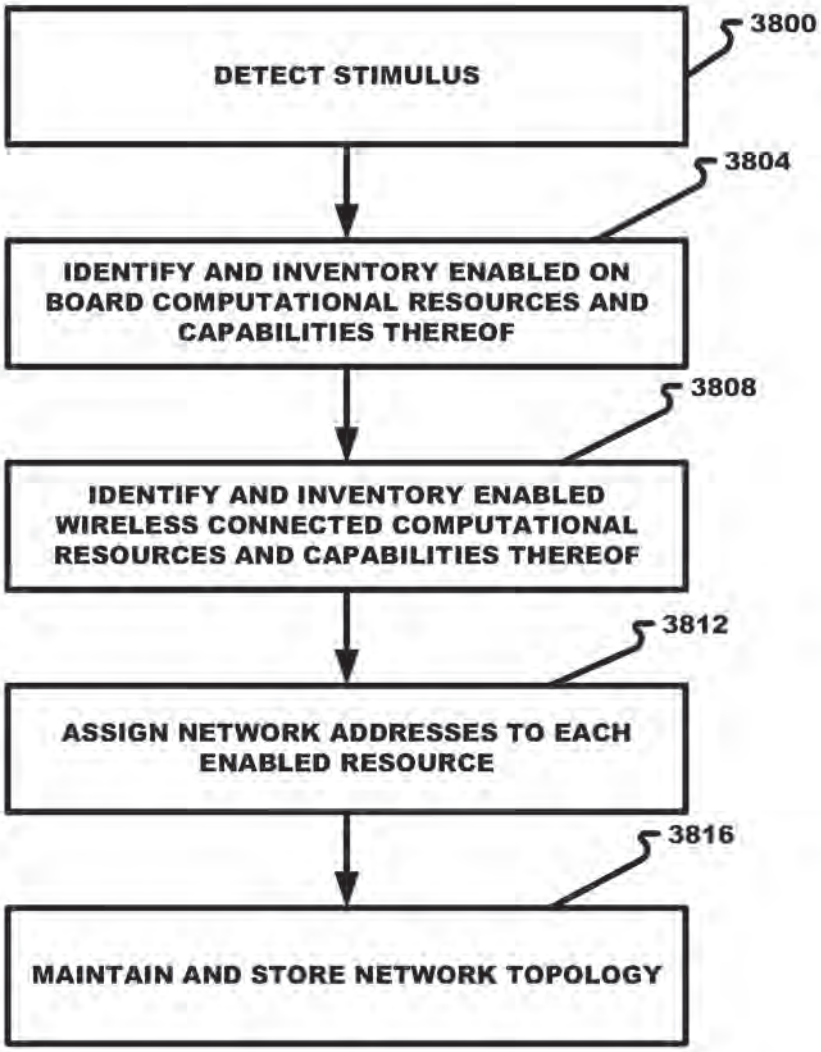

DETECT STIMULUS
3800
IDENTIFY AND INVENTORY ENABLED ON BOARD COMPUTATIONAL RESOURCES AND CAPABILITIES THEREOF
3804
IDENTIFY AND INVENTORY ENABLED WIRELESS CONNECTED COMPUTATIONAL RESOURCES AND CAPABILITIES THEREOF
3808
ASSIGN NETWORK ADDRESSES TO EACH ENABLED RESOURCE
3812
MAINTAIN AND STORE NETWORK TOPOLOGY
3816

*FIG. 38*

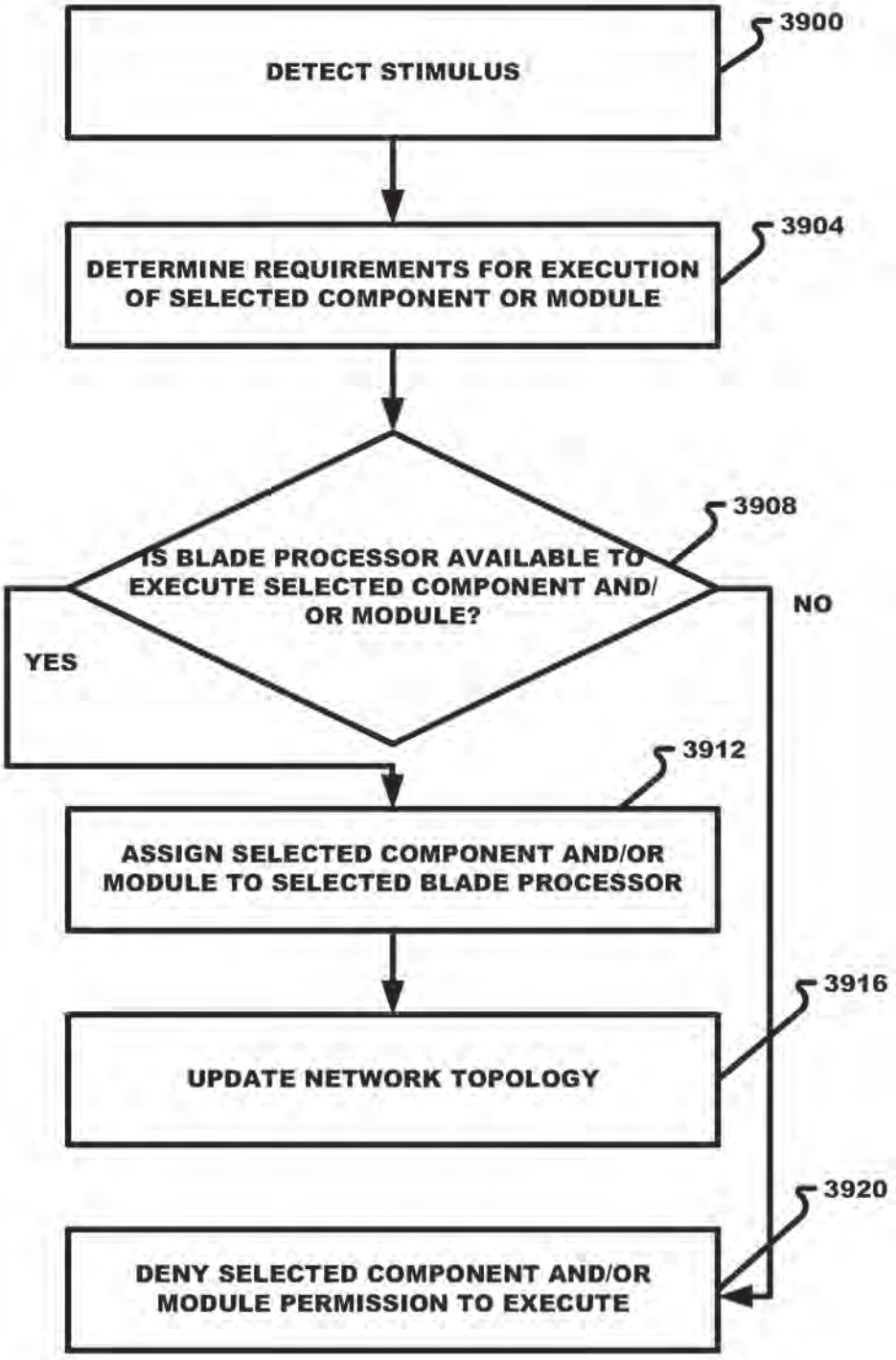

DETECT STIMULUS
3900
DETERMINE REQUIREMENTS FOR EXECUTION OF SELECTED COMPONENT OR MODULE
3904
IS BLADE PROCESSOR AVAILABLE TO EXECUTE SELECTED COMPONENT AND/ OR MODULE?
3908
NO
YES
ASSIGN SELECTED COMPONENT AND/OR MODULE TO SELECTED BLADE PROCESSOR
3912
UPDATE NETWORK TOPOLOGY
3916
DENY SELECTED COMPONENT AND/OR MODULE PERMISSION TO EXECUTE
3920

FIG. 39

# Electronic Patent Application Fee Transmittal

| | |
|---|---|
| **Application Number:** | |
| **Filing Date:** | |
| **Title of Invention:** | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES |
| **First Named Inventor/Applicant Name:** | Christopher P. Ricci |
| **Filer:** | Douglas W. Swartz/Christine Jacquet |
| **Attorney Docket Number:** | 6583-588 |

Filed as Large Entity

## Utility under 35 USC 111(a) Filing Fees

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| **Basic Filing:** | | | | |
| Utility application filing | 1011 | 1 | 280 | 280 |
| Utility Search Fee | 1111 | 1 | 600 | 600 |
| Utility Examination Fee | 1311 | 1 | 720 | 720 |
| **Pages:** | | | | |
| Utility Appl Size fee per 50 sheets >100 | 1081 | 2 | 400 | 800 |
| **Claims:** | | | | |
| Claims in Excess of 20 | 1202 | 1 | 80 | 80 |
| **Miscellaneous-Filing:** | | | | |

| Description | Fee Code | Quantity | Amount | Sub-Total in USD($) |
|---|---|---|---|---|
| Late Filing Fee for Oath or Declaration | 1051 | 1 | 140 | 140 |
| **Petition:** | | | | |
| **Patent-Appeals-and-Interference:** | | | | |
| **Post-Allowance-and-Post-Issuance:** | | | | |
| **Extension-of-Time:** | | | | |
| **Miscellaneous:** | | | | |
| | | | **Total in USD ($)** | **2620** |

# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 18769713 |
| **Application Number:** | 14253371 |
| **International Application Number:** | |
| **Confirmation Number:** | 2967 |
| **Title of Invention:** | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES |
| **First Named Inventor/Applicant Name:** | Christopher P. Ricci |
| **Customer Number:** | 111285 |
| **Filer:** | Douglas W. Swartz/Christine Jacquet |
| **Filer Authorized By:** | Douglas W. Swartz |
| **Attorney Docket Number:** | 6583-588 |
| **Receipt Date:** | 15-APR-2014 |
| **Filing Date:** | |
| **Time Stamp:** | 16:24:28 |
| **Application Type:** | Utility under 35 USC 111(a) |

## Payment information:

| | |
|---|---|
| Submitted with Payment | yes |
| Payment Type | Deposit Account |
| Payment was successfully received in RAM | $2620 |
| RAM confirmation Number | 2899 |
| Deposit Account | 191970 |
| Authorized User | |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 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 | 6583-588-ADS.pdf | 1561396<br>fb7f6189d8ac282565be72df2f44c2165106 4862 | no | 7 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 2 | | 6583-588-PatentAppFinal.pdf | 809734<br>a8bb5090ea3a8b3c63be6192623e7b8e967 09fe5 | yes | 179 |

**Multipart Description/PDF files in .zip description**

| Document Description | Start | End |
|---|---|---|
| Specification | 1 | 173 |
| Claims | 174 | 178 |
| Abstract | 179 | 179 |

| | | | | | |
|---|---|---|---|---|---|
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Drawings-only black and white line drawings | 6583-588-FINAL-DRAWINGS.pdf | 655120<br>82132a19ff67664cb02118101df67bbadc28 9810 | no | 51 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 4 | Fee Worksheet (SB06) | fee-info.pdf | 40075<br>4b90d0e516a28ec732697f9a9d4cf6349755 fd7b | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| | | **Total Files Size (in bytes):** | 3066325 | | |

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.

# SCORE Placeholder Sheet for IFW Content

Application Number: 14253371 Document Date: 04/15/2014

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

- Drawings – Other than Black and White Line Drawings

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

To access the documents in the SCORE database, refer to instructions below.

At the time of document entry (noted above):

- Examiners may access SCORE content via the eDAN interface.
- Other USPTO employees can bookmark the current SCORE URL (http://Score.uspto.gov/ScoreAccessWeb/).
- External customers may access SCORE content via the Public and Private PAIR interfaces.

Form Revision Date: September 30, 2013

## PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 14/253,371

### 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 | | | N/A | 280 |
| SEARCH FEE (37 CFR 1.16(k), (l), or (m)) | N/A | N/A | N/A | | | N/A | 600 |
| EXAMINATION FEE (37 CFR 1.16(o), (p), or (q)) | N/A | N/A | N/A | | | N/A | 720 |
| TOTAL CLAIMS (37 CFR 1.16(i)) | 21 minus 20 = | * 1 | | | OR | x 80 = | 80 |
| INDEPENDENT CLAIMS (37 CFR 1.16(h)) | 3 minus 3 = | * | | | | x 420 = | 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). | | | | | | 800 |
| 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 | | | TOTAL | 2480 |

### APPLICATION AS AMENDED - PART II

| | | (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($) | OTHER THAN SMALL ENTITY ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT A | 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 | |

| | | (Column 1) CLAIMS REMAINING AFTER AMENDMENT | | (Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR | (Column 3) PRESENT EXTRA | RATE($) | ADDITIONAL FEE($) | | RATE($) | ADDITIONAL FEE($) |
|---|---|---|---|---|---|---|---|---|---|---|
| AMENDMENT B | 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.

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 |
|---|---|---|---|---|---|---|
| 14/253,371 | 04/15/2014 | 2858 | 2620 | 6583-588 | 21 | 3 |

**CONFIRMATION NO. 2967**

111285
Sheridan Ross P.C.
1560 Broadway
Suite 1200
Denver, CO 80202

**FILING RECEIPT**

*OC000000068212346*

Date Mailed: 05/06/2014

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

**Inventor(s)**

Christopher P. Ricci, Saratoga, CA;

**Applicant(s)**

Flextronics AP, LLC, San Jose, CA

**Assignment For Published Patent Application**

Flextronics AP, LLC, San Jose, CA

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This appln claims benefit of 61/811,981 04/15/2013
and claims benefit of 61/865,954 08/14/2013
and claims benefit of 61/870,698 08/27/2013
and claims benefit of 61/891,217 10/15/2013
and claims benefit of 61/904,205 11/14/2013
and claims benefit of 61/924,572 01/07/2014
and claims benefit of 61/926,749 01/13/2014

**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 - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

**If Required, Foreign Filing License Granted:** 05/02/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/253,371**

**Projected Publication Date:** 10/16/2014

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES

**Preliminary Class**

324

**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.

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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.

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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 |
|---|---|---|---|
| 14/253,371 | 04/15/2014 | Christopher P. Ricci | 6583-588 |

**CONFIRMATION NO. 2967**

111285
Sheridan Ross P.C.
1560 Broadway
Suite 1200
Denver, CO 80202

**NOTICE**

*OC000000068212347*

Date Mailed: 05/06/2014

## INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Christopher P. Ricci

**To:** flexpatents@sheridanross.com,,
**From:** PAIR_eOfficeAction@uspto.gov
**Cc:** PAIR_eOfficeAction@uspto.gov
**Subject:** Private PAIR Correspondence Notification for Customer Number 111285

May 06, 2014 05:29:13 AM

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1560 Broadway
Suite 1200
Denver, CO 80202
UNITED STATES

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The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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| Application | Document | Mailroom Date | Attorney Docket No. |
|---|---|---|---|
| 14253371 | APP.FILE.REC | 05/06/2014 | 6583-588 |
| | M327 | 05/06/2014 | 6583-588 |

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

PLUS Search Results for S/N 14253371, Searched Tue Sep 09 10:10:48 EDT 2014

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.

4547166 99
5838251 99
5897168 99
5940007 99
6115652 99
6161419 99
4320639 97
4568099 97
4589514 97
4965915 97
5176234 97
5222110 97
5285942 97
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5710702 97
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5815823 97
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5933080 97
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4337003 94
4341488 94
4344032 94
4347573 94
4355841 94
4357815 94
4358090 94
4373561 94
4379539 94
4387752 94
4409832 94

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | |
|---|---|
| In Re the Application of: | Group Art Unit: 3663 |
| RICCI, Christopher P. | Confirmation No.: 2967 |
| Serial No.: 14/253,371 | Examiner: DUNN, Alex C. |
| Filed: April 15, 2014 | |
| Atty. File No.: 6583-588 | |
| Entitled: "REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES" | ***Submitted Via EFS-Web*** |

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

**RESPONSE TO INFORMATIONAL NOTICE TO APPLICANT**

Dear Sir/Madam:

In response to the Informational Notice to Applicant mailed May 6, 2014, in connection with the above-identified application, submitted herewith is an executed Declaration by the inventor. Also filed concurrently herewith is a Power of Attorney.

Although no fees are believed to be due with this submission, please charge any underpayment or credit any overpayment to Deposit Account No. 19-1970.

Respectfully submitted,

SHERIDAN ROSS P.C.

By: /Tadd F. Wilson/
Tadd F. Wilson
Registration No. 54544
1560 Broadway, Suite 1200
Denver, Colorado 80202-5141
(303) 863-9700

Date: October 3, 2014

PTO/AIA/01 (06-12)
Approved for use through 01/31/2014. OMB 0651-0032
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# DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

| Title of Invention | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES |
|---|---|

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 14/253,371 filed on April 15, 2014.

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

## WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Christopher R. Ricci Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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.**

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Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-12)

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| | |
|---|---|
| Application Number | 14/253,371 |
| Filing Date | April 15, 2014 |
| First Named Inventor | RICCI, Christopher P. |
| Title | Remote Control of Associated Vehicle Devices |
| Art Unit | 3663 |
| Examiner Name | DUNN, Alex C. |
| Attorney Docket Number | 6583-588 |

**SIGNATURE of Applicant or Patent Practitioner**

| | | | |
|---|---|---|---|
| Signature | /Tadd F. Wilson/ | Date | 2014-10-03 |
| Name | Tadd F. Wilson | Telephone | 303-863-9700 |
| Registration Number | 54,544 | | |

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

■ *Total of 2 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.**

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# 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):

111285

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 |
|---|---|---|---|
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|---|---|---|---|---|---|
| ☐ 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 | Timothy L. Stewart | Date | 03/26/2013 |
| Name | Timothy L. Stewart | Telephone | 408-576-7746 |
| Title and Company | Secretary, Flextronics AP, LLC | | |

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 _____ 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.**

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# Electronic Acknowledgement Receipt

| | |
|---|---|
| **EFS ID:** | 20328185 |
| **Application Number:** | 14253371 |
| **International Application Number:** | |
| **Confirmation Number:** | 2967 |
| **Title of Invention:** | REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES |
| **First Named Inventor/Applicant Name:** | Christopher P. Ricci |
| **Customer Number:** | 111285 |
| **Filer:** | Tadd Fjelp Wilson/Amy Duarte |
| **Filer Authorized By:** | Tadd Fjelp Wilson |
| **Attorney Docket Number:** | 6583-588 |
| **Receipt Date:** | 03-OCT-2014 |
| **Filing Date:** | 15-APR-2014 |
| **Time Stamp:** | 17:33:52 |
| **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 | Applicant Response to Pre-Exam Formalities Notice | Response_Informational_Notice_588.pdf | 110447<br>7d0d3e32dca092de17d4ae6eca520ad8533 20e9a | no | 1 |

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| **Warnings:** | |
| **Information:** | |

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| 2 | Oath or Declaration filed | Executed_Declaration_588.pdf | 149488<br>7e491adcb3d88f10941f2d4319f134f99e737c21e | no | 1 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
| 3 | Power of Attorney | FlexAP_GenPOA.pdf | 451163<br>03e9f5e986d2ea30e4f306cbe203a1fe4111ecddc | no | 2 |
| **Warnings:** | | | | | |
| **Information:** | | | | | |
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**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.**

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 14/253,371 | 04/15/2014 | Christopher P. Ricci | 6583-588 |

**CONFIRMATION NO. 2967**

**POA ACCEPTANCE LETTER**

111285
Sheridan Ross P.C.
1560 Broadway
Suite 1200
Denver, CO 80202

*OC000000071256148*

Date Mailed: 10/15/2014

## NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/03/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/dulu/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

**To:** flexpatents@sheridanross.com,edocket@sheridanross.com,
**From:** PAIR_eOfficeAction@uspto.gov
**Cc:** PAIR_eOfficeAction@uspto.gov
**Subject:** Private PAIR Correspondence Notification for Customer Number 111285

Oct 15, 2014 05:30:04 AM

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UNITED STATES

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| Application | Document | Mailroom Date | Attorney Docket No. |
|---|---|---|---|
| 14253371 | N570 | 10/15/2014 | 6583-588 |

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PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|---|---|---|---|
| 14/253,371 | 04/15/2014 | Christopher P. Ricci | 6583-588 |

CONFIRMATION NO. 2967

111285
Sheridan Ross P.C.
1560 Broadway
Suite 1200
Denver, CO 80202

PUBLICATION NOTICE

*OC000000071382314*

**Title:**REMOTE CONTROL OF ASSOCIATED VEHICLE DEVICES

**Publication No.**US-2014-0309891-A1
**Publication Date:**10/16/2014

## 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/.

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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 http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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**To:** flexpatents@sheridanross.com,edocket@sheridanross.com,
**From:** PAIR_eOfficeAction@uspto.gov
**Cc:** PAIR_eOfficeAction@uspto.gov
**Subject:** Private PAIR Correspondence Notification for Customer Number 111285

Oct 17, 2014 05:23:14 AM

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Denver, CO 80202
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| 14253371 | NTC.PUB | 10/16/2014 | 6583-588 |

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# INFORMATION DISCLOSURE STATEMENT BY APPLICANT

*(Use as many sheets as necessary)*

| Sheet | 1 | of | 8 |
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| *Complete if Known* | |
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| Application Number | 14/253,371 |
| Filing Date | April 15, 2014 |
| First Named Inventor | Christopher P. Ricci |
| Art Unit | 3663 |
| Examiner Name | DUNN, ALEX C |
| Attorney Docket Number | 6583-588 |

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|---|---|---|---|---|---|
| **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** | | | | Application Number | 14/253,371 |
| | | | | Filing Date | April 15, 2014 |
| | | | | First Named Inventor | Christopher P. Ricci |
| *(Use as many sheets as necessary)* | | | | Art Unit | 3663 |
| | | | | Examiner Name | DUNN, ALEX C |
| Sheet | 8 | of | 8 | Attorney Docket Number | 6583-588 |

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|---|---|---|
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| | 217 | International Search Report and Written Opinion for International (PCT) Patent Application No. PCT/US2014/034103, mailed Sep. 03, 2014 (Attorney's Ref. No. 6583-565-PCT) 7 pages |
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| | 221 | Official Action for U.S. Patent Application No. 14/253,729, mailed Nov. 19, 2014 (Attorney's Ref. No. 6583-555) 8 pages |
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| | 223 | Official Action for U.S. Patent Application No. 14/253,838, mailed Nov. 20, 2014 (Attorney's Ref. No. 6583-574) 31 pages |
| | 224 | Official Action for U.S. Patent Application No. 14/253,506, mailed Nov. 14, 2014 (Attorney's Ref. No. 6583-637) 9 pages |
| | 225 | Background of the Invention for the above-captioned application (previously provided) |

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|---|---|---|---|

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

(11) EP 1 909 069 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**08.12.2010 Bulletin 2010/49**

(51) Int Cl.:
***G01C 21/36*** *(2006.01)* ***G06Q 10/00*** *(2006.01)*
*G08G 1/0968* *(2006.01)*

(21) Application number: **06020734.7**

(22) Date of filing: **02.10.2006**

(54) **Intelligent destination setting for navigation systems**

Intelligente Zieleinstellung für Navigationssysteme

Paramétrage de destination intelligent pour systèmes de navigation

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**

(43) Date of publication of application:
**09.04.2008 Bulletin 2008/15**

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**WO-A-02/42718**
**DE-A1- 10 134 108**
**US-A1- 2002 030 698**

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Printed by Jouve, 75001 PARIS (FR)

EP 1 909 069 B1

## Description

### Field of Invention

**[0001]** The present invention relates to vehicle navigation systems. In particular, the invention relates to an automatic input of the destination for route guidance by the navigation system.

### Background of the Invention

**[0002]** The use of navigation systems in vehicles becomes increasingly prevalent. Usually on board navigation computer systems analyze the combined data provided by GPS (Global Positioning System), motion sensors as ABS wheel sensors as well as a digital map and thereby determine the actual position and velocity of a vehicle with increasing preciseness.

**[0003]** Known navigation systems typically use electronic maps to represent cartographic features, as streets, buildings and rivers, and make use of a medium such as a compact disk, a digital video disc or a hard disk to store the data that relates to the cartographic features. After map matching the actual position of the user is indicated in the digital map. By acoustic and/or visualized information the user is guided to the predetermined destination.

**[0004]** The input of the destination, e.g., an address, by a user is still a relatively time-consuming and rather cumbersome process. For example, the user has to scroll through large lists of possible destinations. Even if the navigation system is provided with a speech input, selection of the desired destination is time-consuming due to the need for working through different levels of data organization and also error-prone due to the possibility of faulty speech recognition.

**[0005]** On the other hand, nowadays a great variety of possible destinations are electronically stored in mobile devices as, e.g., smartphones and Personal Digital Assistants (PDA), in form of entries in address books or vCards that are input and stored in the mobile devices. Recently, PDAs have been developed that are provided with navigation function. It possible to connect a PDA operating as a navigation aid with a vehicle information/navigation system and to have the route guidance carried out by the navigation module of the PDA. The multimodal dialog system called SmartKom, for example, addresses the problem of connecting a mobile device to a vehicle navigation system and also to continue route guidance that previously has been carried out by the vehicle navigation system by means of the mobile device.

**[0006]** Such solutions, however, demand for the implementation of navigation software in the mobile devices (e.g., PDAs or smartphones). In particular, the input of the desired destination is not sufficiently facilitated or improved by such recent developments.

**[0007]** Documents US 2002/0030698A1, DE10134-108A1, WO 02/42718A1, EP 1178286A2, and EP 0684592 disclose methods for inputting destinations from a mobile organiser to a navigation device.

**[0008]** Therefore, there is a need for a more convenient intelligent input of destinations in vehicle navigation systems.

### Description of the Invention

**[0009]** The above-mentioned drawbacks of the art are solved by the method for entering (inputting) a destination for route guidance in a vehicle navigation system according to claim 1.

**[0010]** If a location stored in the mobile electronic device is selected as the destination, the location is fed into the vehicle navigation system and selected as the destination. Storing a location and feeding it into the vehicle navigation system means storing and feeding/inputting of data related to / identifying a physical location, e.g., the name of an address or geographical coordinates or arbitrary coordinates corresponding to a physical location etc.

**[0011]** The vehicle in which the vehicle navigation system is installed by any motor vehicle, e.g., an automobile, a motorcycle, a boat, an airplane, etc.

**[0012]** The mobile electronic device can, e.g., be a Personal Digital Assistant (PDA) or a smartphone (PDA phone) both comprising a Personal Information Manager including a scheduler module (appointment calendar) and an address book. The mobile electronic device can be an electronic organizer and, in particular, it may be a Palm Top or a BlackBerry. The address book and the scheduler module, which comprises data representing scheduled appointments, may advantageously be synchronized with the vehicle navigation system, i.e. with the corresponding data stored in a database of the navigation system. Synchronization can be achieved by standard synchronization software as, e.g., HotSync or ActiveSync.

**[0013]** The connection between the mobile electronic device and the vehicle navigation system can be performed wirelessly, e.g., via a Bluetooth, an infrared link (as IrDA), Wireless Local Area Network (WLAN) or by wire, e.g., using a USB connection.

**[0014]** The inventive method allows for a simple, reliable and fast input of a destination for route guidance in the vehicle navigation system. No manual input, e.g., by a touch screen or keyboard, and no spelling of a destination name in the case of a navigation system equipped with a speech control are necessary any longer. Moreover, the functionality of some electronic Personal Information Manager can be integrated in the navigation system providing synergetic effects with respect to the scheduling of tasks and guidance to the locations associated with appointments.

**[0015]** If, e.g., an appointment is associated with a location (meeting someone somewhere), the associated location can be fed into the vehicle navigation system. The navigation system can localize an address given by

a city name and a street name/number by means of stored geographical data that includes, e.g., geographical coordinates. According to another example, an appointment may be a demand for refueling the vehicle. In this case, the destination selected on the basis of the scheduled appointment can be a gas station the geographic position of which is stored in the navigation system (i.e. a location database of the navigation system). In particular, the gas station of a number of stored gas stations that is closest to the actual position of the vehicle can be selected as a destination for route guidance.

**[0016]** In particular, the scheduled appointment can be associated with a person whose address is stored in the mobile electronic device (e.g., in an electronic address book of a PDA or a smartphone) or the vehicle navigation system and it is this address that can represent the location that is associated with the scheduled appointment. For example, the scheduler module may include an entry indicating an appointment with a particular person. Then, the address may be looked-up by means of a relational database including data relating the name of the person to a vCard (or other kind of data including the address of the respective person) also stored in the mobile electronic device. The data that is necessary for locating the address in a digital map and for calculating a route to the destination are provided by the vehicle navigation system that usually comprises a GPS receiver and a database for storing digital map data.

**[0017]** According to the inventive method it is automatically determined whether a scheduled appointment stored in the scheduler module of the mobile electronic device and associated with a location stored in the mobile electronic device or in the vehicle navigation system is coming up within a predetermined time interval and if it is determined that such a scheduled appointment is coming up within the predetermined time interval, i.e. the appointment is scheduled for some future point of time within some predetermined time range, the associated location is selected as the destination for route guidance.

**[0018]** The predetermined time interval may comprise any point of time in the future. The method may also comprise checking whether there was an appointment scheduled at some time before the connection of the mobile electronic device to the vehicle navigation system has been established and informing the user about such an appointment if it is detected.

**[0019]** Either automatically or on demand by a user in response to a prompt given by the vehicle navigation system the associated location is selected as the destination and/or a route to the destination is calculated.

**[0020]** Thus, it is possible that a destination is automatically chosen without a need for any operation by the user (e.g., the driver of the vehicle). The destination is automatically chosen in response to information about appointments stored in the mobile electronic device which not only assists the driver in entering the next destination for a travel but also in remembering important appointments.

**[0021]** However, it might be preferred to have the navigation system output a prompt, e.g., a synthetic speech output or a text display on a display device asking for acknowledgement of the selected destination as well as calculation of a route to the selected destination. In this case calculation of a route the user might not be interested in can be avoided and he can faster initiate route calculation to an alternative destination. If more than one scheduled appointment is found within the predetermined time interval, the user may particularly skip the temporarily next appointment to have, e.g., a location associated with the following appointment selected as the destination for route guidance.

**[0022]** In one embodiment a location stored in the mobile electronic device or a location stored in the vehicle navigation system is selected as the destination for route guidance based on the at least one scheduled appointment in response to a speech input by a user. In this case, the address book and the scheduler module of the mobile electronic device may preferably be synchronized with the vehicle navigation system, i.e. with the corresponding data stored in a database of the navigation system, and the user may initiate selection of a destination for route guidance by a verbal command. Automatic entering of an appropriate destination and/or calculation of a route to the destination can, thus, be carried out when a user is ready for driving to a location of a next scheduled appointment stored in his PDA or smartphone, etc.

**[0023]** In particular, the user may simply utter a name of a person associated with an upcoming appointment and, subsequently, the associated location that might be looked-up in an address book or a vCard is automatically selected as the destination for route guidance.

**[0024]** The speech input may alternatively represent some predetermined keyword. After recognition of the keyword uttered by a user the selection of a location stored in the mobile electronic device or a location stored in the vehicle navigation system as the destination for route guidance can be performed.

**[0025]** According to the method all scheduled appointments stored in the scheduler module of the mobile electronic device and associated with locations stored in the mobile electronic device or the vehicle navigation system that are coming up within the predetermined time interval are determined automatically and subsequently all or some of the locations that are associated with the scheduled appointments stored in the scheduler module of the mobile electronic device or the vehicle navigation system that are determined to come up within the predetermined time interval are selected as destinations for route guidance.

**[0026]** Those locations stored in the mobile electronic device and associated with upcoming appointments are fed into the vehicle navigation system and selected as destinations. A list of all destinations might be displayed to the user, whereby he is informed about the entire set of appointments within the predetermined time interval that may, e.g., represent the whole present day.

**[0027]** Again, automatically or on demand by a user in response to a prompt given by the vehicle navigation system (e.g., an acoustic or optical message) the associated locations are selected as the destinations and a route to some or all of the destinations may be calculated. In particular, irrespective of the actual temporal order of the scheduled appointments an optimal route connecting all or some of the destinations is calculated. The optimal route may be, e.g., the shortest or the fastest route. The fastest route might be determined with respect to the category of streets (highways, major streets, etc.) and/or may be determined taking into account the actual traffic situation. After calculation of the optimum route the user is asked whether he wants to be guided the optimum route or a route connecting destinations corresponding to locations associated with appointments in temporal order.

**[0028]** In one embodiment of the inventive method it is estimated whether a selected destination cannot be reached within a predetermined time interval (that may be identical to the above-mentioned predetermined time interval) or until the point of time of the appointment associated with the location that is selected as the destination, and if it is estimated that the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination, an event is generated, e.g., a warning is prompted or a message is displayed or announced. The message may offer establishment of a telephone connection to a person associated with the scheduled appointment. The telephone number may, e.g., be looked-up from a vCard of a person associated with the appointment that is stored in the mobile electronic device.

**[0029]** The user is informed about an appointment he cannot keep in due time and he, thus, can take appropriate measures. A typical measure would be to make a telephone call to the person he cannot meet in time. This embodiment of the inventive method efficiently assists the user in dealing with such a situation.

**[0030]** The information, that a meeting cannot be kept in time can be made available immediately after entering the destination or even during the travel on the grounds of real-time traffic information e.g. from traffic announcements or Traffic Message Channel (TMC) messages. The TMC is typically digitally coded using the FM Radio Data System (FM-RDS) on conventional FM radio broadcasts. It can also be transmitted on Digital Audio Broadcasting or satellite radio. Each traffic incident can be sent as a TMC message. One message consists of an event code and a location code in addition to time details.

**[0031]** In order to solve the above-mentioned drawbacks it is also provided a vehicle navigation system configured for route guidance to a destination, according to claim 9.

**[0032]** The inventive vehicle navigation system is particularly useful as a navigation system installed in an automobile.

**[0033]** Herein, it is to be understood that the expression "the control unit is configured to do .." covers the meaning that the control unit causes a separate logical or physical means to do something, e.g., to read data (locations, appointments) from the mobile electronic device.

**[0034]** It is also provided a vehicle navigation system as mentioned above that further comprises a database storing at least one location and wherein the control means is configured to read a location stored in the mobile electronic device or in the database based on the at least one read scheduled appointment and to select the read location as the destination for route guidance.

**[0035]** The control means of the vehicle navigation system is configured to automatically determine whether a scheduled appointment stored in the scheduler module of the mobile electronic device and associated with a location stored in the mobile electronic device or in the database is coming up within a predetermined time interval and to read the associated location, if it is determined that such a scheduled appointment is coming up within the predetermined time interval. The scheduled appointment can, in particular, be associated with a person whose address is stored in the mobile electronic device or in the vehicle navigation system and represents the location that is associated with the scheduled appointment.

**[0036]** The vehicle navigation system further comprises a route calculation means and the control means is configured to automatically read the locations associated with the scheduled appointments and to cause the route calculation means to calculate a route to the destination.

**[0037]** The vehicle navigation system according to the present invention further comprises

an input means, e.g., a speech input or a keyboard or a touch screen,

an output means, e.g., a speech output or a display device, as well as

a route calculation means, and

the control means is configured to instruct the output means to output a prompt to a user and to read the associated location and/or to cause the route calculation means to calculate a route to the destination in response to an input by the user that is input by the input means.

**[0038]** The control means is configured to

automatically determine all scheduled appointments stored in the scheduler module of the mobile electronic device and associated with stored locations that are coming up within the predetermined time interval;

read all or some of the locations associated with the scheduled appointments stored in the scheduler module of the mobile electronic device that are determined to come up within the predetermined time interval; and

select all or some of the read locations as destinations.

**[0039]** In this case the vehicle navigation system further comprises a route calculation means and the control means is configured to automatically read the associated locations and to cause the route calculation means to

calculate a route to the destinations.

**[0040]** In particular, the route calculation means is configured to calculate an optimal route, in particular, the shortest or the fastest route, to all or some of the destinations irrespective of the temporal order of the appointments.

**[0041]** According to a further embodiment the control means in one of the above-described examples of the inventive vehicle navigation system is configured to

estimate whether a selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination; and to

generate an event, in particular a warning or a message offering establishment of a telephone connection to a person associated with the appointment associated with the location that is selected as the destination, if it is estimated that the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination.

**[0042]** In this case the control means may also be configured to estimate whether the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination on the basis of traffic information, in particular, Traffic Message Channel messages, received by the navigation system.

**[0043]** Additional features and advantages of the present invention will be described with reference to the drawings. In the description, reference is made to the accompanying figures that are meant to illustrate preferred embodiments of the invention. It is understood that such embodiments do not represent the full scope of the invention and are not taken to limit the scope of protection that is exclusively defined by the appended claims.

**[0044]** Figure 1 illustrates an embodiment of the herein disclosed method for entering a destination in a vehicle navigation system comprising the steps of synchronization of an address book and a scheduler module of a PDA with a vehicle navigation system and determining an upcoming appointment from the entries of the scheduler module.

**[0045]** Figure 2 illustrates another embodiment of the herein disclosed method for entering a destination in a vehicle navigation system wherein an address found in the address book of a smartphone is used to select a destination for route guidance.

**[0046]** Figure 3 illustrates an embodiment similar to the one of Figure 3 but considering a case in which an upcoming appointment cannot be kept.

**[0047]** Figure 4 illustrates an embodiment of the herein disclosed method for entering a destination in a vehicle navigation system wherein a number of appointments stored in a PDA are detected by a vehicle navigation system and an optimum route to all of the detected appointments is automatically calculated.

**[0048]** Figure 1 shows basic steps of an embodiment of the method for entering a destination for route guidance in a vehicle navigation system according to the present invention. According to this embodiment a Personal Digital Assistant (PDA) is connected to a vehicle navigation system 1 by a person entering a vehicle and carrying the PDA. The connection can be established wirelessly, e.g., by means of a Bluetooth link, a WLAN link or by an infrared connection.

**[0049]** After connection of the PDA and the vehicle navigation system an address book and a scheduler module comprising scheduled appointments are automatically synchronized with the corresponding database of the navigation system 2. Therefore, the navigation system learns about one or more scheduled appointments that have been entered in the PDA by the user, e.g., the driver of the vehicle in which the vehicle navigation system is installed.

**[0050]** Next, the navigation system checks whether there is some upcoming appointment within a predetermined time interval that is associated with some location 3. The predetermined interval may, e.g., represent the actual day of connection of the PDA to the vehicle navigation system. The user might also be enabled to choose a suitable time interval by manual or verbal input facilitated by a manual or speech input means of the navigation system. According to the present example an appointment is determined that is associated with a location that is stored in the PDA. The location is given by an address including a city name and a street name and street number. The address can be part of the stored appointment entry or may be related to the appointment entry. The appointment entry can, e.g., include a name of a person to be met and the name can be related to an entry in an address book stored in the PDA.

**[0051]** The location associated with the determined upcoming appointment is selected as a destination for route guidance by the vehicle navigation system 4. Geographical data stored in a database of the navigation system is used for localization of the destination. The destination can, thus, be indicated on a digital map shown to the user /driver. The selection of the destination may be performed automatically without interaction with the user. It may be preferred that the user is asked by the navigation system whether the associated location shall be used as a destination for route guidance. The human-machine interaction can, in principle, be performed by means of a display device, a touch screen, push buttons, a speech input/output etc.

**[0052]** Once the location associated with the upcoming appointment is selected as the destination, a route from the present location to the destination, preferably the shortest or fastest route, is calculated 5 by the vehicle navigation system. The route can be indicated on a digital map. Again, the user may be prompted to initiate calculation of the route to the destination or alternatively route calculation is performed without further human-machine interaction. Optical and/or acoustical route guidance can subsequently be performed by the navigation system

based on the calculated route to the selected destination.

**[0053]** Figure 2 illustrates steps of another embodiment of the inventive method disclosed herein. A user enters 1 the "text meeting with Mr. X" in an appropriate place of an appointment calendar representing date and time, say, August 1, 11 am, of a meeting. The appointment calendar is part of a Personal Information Manager of a smartphone. Assume that the user enters his vehicle equipped with the navigation system of the present invention on August 1 at 9 am. He connects the smartphone to the vehicle navigation system 11. The navigation system automatically reads the appointment calendar and determines the upcoming appointment with Mr. X 12. The navigation system also automatically looks-up the address of Mr. X in an address book 13. The address book may be also stored in the smartphone. It is also considered that the address may be stored in a database of the navigation system.

**[0054]** After having determined the address of Mr. X, the navigation system is, in principle, ready for calculating a route to the address and to perform route guidance. In the present example, the navigation system prompts a message asking the user whether he wants to be guided to the address of Mr. X 14. In some detail, the navigation system may announce a message with the content that an appointment with Mr. X is scheduled for 11 am and may subsequently ask whether or not to perform route guidance to this address. Steps 13 and 14 can be carried out in reversed order.

**[0055]** The navigation system may prompt the message immediately after the appointment is detected or when an estimated time for travel to the location that is associated with the appointment is comparable to the time interval from the present time to the time of the appointment.

**[0056]** The user may approve that he wants to be guided to the address of Mr. X by means of a speech input, a keyboard a touch panel or any other input means known in the art of vehicle navigation systems 15. For example, he may utter a keyword to approve the selected destination for route guidance, i.e., the address of Mr. X.

**[0057]** In an alternative embodiment, the user is prompted to input manually or by speech input the destination after an upcoming appointment is detected in step 12. In any case, after the destination was selected the route to the destination, i.e. the address of Nr. X, is calculated 16 and route guidance to the destination can be started.

**[0058]** With reference to Figure 3 a case is described in which a detected upcoming appointment cannot be kept, since the traveling time from the present position would be too long to arrive at the location associated with the appointment in time. As in Figure 2 a meeting with Mr. X is entered in the smartphone 20, the smartphone is connected to the vehicle navigation system 21 and an upcoming appointment is automatically determined 22 by the vehicle navigation system after the connection has been established.

**[0059]** The location associated with the appointment, i.e. in the present example the address of Mr. X, is looked-up from an address book or a vCard stored in the smartphone. By means of geographical data stored in a database of the vehicle navigation system the distance from the present location of the vehicle and the address of Mr. X is estimated 23. Based on the estimated distance the traveling time to the address of Mr. X is estimated 24. This estimation may take into account any available traffic information provided, e.g., by some radio station.

**[0060]** Assume that the navigation system determines that the meeting with Mr. X cannot be kept, since the estimated traveling time is too long. In this case, a warning is prompted to the user / driver 25. For example, a synthesized speech output can be provided: "Meeting with Mr. X cannot be kept". Then, establishment of a telephone connection with Mr. X is offered by the vehicle navigation system 26. The corresponding telephone number can be looked up from the address book or vCard stored in the smartphone or in a database of the vehicle navigation system.

**[0061]** If the user agrees, a telephone connection is established. After the telephone conversation with Mr. X the navigation system may offer to delete the mentioned appointment or to postpone it to a later time/date.

**[0062]** The step of estimating the traveling time to the destination 24 can be performed continuously during the travel taken into account the actual traffic by real time traffic information, e.g. from radio traffic announcements or TMC messages. If during the travel the navigation system is informed about a traffic jam on the route to the destination, the system may prompt the warning that the appointment cannot be kept 25.

**[0063]** Figure 4 illustrates another aspect of the present invention. A PDA is wirelessly connected to a vehicle navigation system 30. Of course any other mobile electronic device including some kind of a Personal Information Manager can be used in this example (as in the examples above). The connection may be established via a Bluetooth link or a WLAN link, for example. The address book and the scheduler module of the PDA are automatically synchronized 31 with the corresponding database of the navigation system.

**[0064]** By synchronization of the scheduler module the navigation system detects 32 a number of appointments stored in the PDA. The appointments are usually stored and managed in temporal order in scheduler module. Assume that four appointments are stored, in the order 1, 2, 3, and 4, in the PDA for the present day. As in the previous examples the navigation system may automatically or on demand by the user select a location associated with an appointment, preferably, with that appointment that comes up next in time, as the destination for route guidance and may calculate the route to the destination automatically or on demand.

**[0065]** In the present example, the navigation system prompts the user, e.g., a commercial traveler, to acknowledge calculation of an optimum route to all locations as-

sociated with the four appointments 33. In response to a positive input by the user the navigation system, i.e, a route calculation means incorporated in the navigation system, calculates 34 an optimum route connecting the locations associated with the four appointments. In particular, each of the appointments may be linked to an address and the address can be related to geographical data stored in a database of the navigation system. The optimum route may be the shortest or fastest route from the present position to all of the locations. Assume that it turns out, however, that for an optimum route the appointments should be kept in some order different from the temporal one stored in the PDA, say, 1, 3, 2, 4. Consequently, calculation of the optimum route includes reordering of the appointments 34 in accordance with the optimum route.

**[0066]** Next, the navigation system informs the user about the optimal route, in particular, about the fact that the optimal route differs from a route connecting the locations associated with the appointments in temporal order and prompts the user to decide whether he wants to follow the optimal route or not 35.

**[0067]** If the user wants to be guided along the optimal route the navigation system offers the user to establish a telephone connection to one or more persons involved in appointments that cannot be kept in time when the optimal route is followed 36. This is possible, if the stored appointments are associated with persons whose telephone numbers are found in an address book or a vCard, etc. stored in the PDA or in a database of the navigation system. If, on the other hand, the user prefers to keep the four appointments in temporal order, the navigation system calculates 37 a route including the locations associated with the appointments that are, thus, selected as destinations for route guidance corresponding to the temporal order of the appointments (i.e., 1, 2, 3 and 4).

## Claims

1. Method for entering a destination for route guidance in a vehicle navigation system, comprising
providing a mobile electronic device storing locations and comprising a scheduler module storing scheduled appointments;
connecting the mobile electronic device to the vehicle navigation system; and automatically determining all scheduled appointments stored in the scheduler module of the mobile electronic device and associated with locations stored in the mobile electronic device or the vehicle navigation system that are coming up within the predetermined time interval;
selecting all or some of the locations associated with the scheduled appointments stored in the scheduler module of the mobile electronic device or the vehicle navigation system that are determined to come up within the predetermined time interval as destinations based on the scheduled appointments;
**characterised by**
automatically or on demand by a user in response to a prompt given by the vehicle navigation system calculating the optimal route to at least some of the destinations irrespective of the temporal order of the appointments;
after calculation of the optimal route prompting the user to decide on whether he wants to be guided either

a) the optimal route; or
b) a route connecting destinations corresponding to locations associated with scheduled appointments in temporal order.

2. The method according to claim 1, wherein at least one of the scheduled appointments is associated with a person whose address is stored in the mobile electronic device or in the vehicle navigation system and represents the location that is associated with the scheduled appointment.

3. The method according to one of the preceding claims, further comprising
estimating whether a selected destination cannot be reached within a predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination; and
generating an event, if it is estimated that the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination.

4. The method according to claim 3, wherein the estimating whether the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination is based on traffic information, in particular, Traffic Message Channel messages, received by the navigation system.

5. The method according to claim 3 or 4, wherein the generated event is a warning prompted to a user or a message offering establishment of a telephone connection to a person associated with the appointment associated with the location that is selected as the destination that cannot be reached within the predetermined time interval or until the point of time of the appointment.

6. The method according to one of the preceding claims, wherein the mobile electronic device comprises an address book and comprising the step of synchronizing the scheduler module and the address book with the vehicle navigation system.

7. The method according to one of the preceding claims, wherein the mobile electronic device is connected to the vehicle navigation system by wire or wirelessly, in particular, by a Bluetooth link or a WLAN link.

8. The method according to one of the preceding claims, wherein the mobile electronic device is a Personal Digital Assistant or a smartphone or an electronic organizer.

9. Vehicle navigation system configured for route guidance to a destination, comprising
a connection unit configured for connection to a mobile electronic device storing at least one location and comprising a scheduler module storing at least one scheduled appointment;
a database storing at least one location;
a control means configured to
automatically determine all scheduled appointments stored in the scheduler module of the mobile electronic device and associated with stored locations that are coming up within the predetermined time interval;
read all or some of the locations associated with the scheduled appointments stored in the scheduler module of the mobile electronic device that are determined to come up within the predetermined time interval; and
select all or some of the read locations as destinations;
**characterised by**
a route calculation means configured to calculate the optimal route to all or some of the destinations irrespective of the temporal order of the appointments and to calculate a route connecting destinations corresponding to locations associated with scheduled appointments in temporal order;
an input means;
an output means configured to output a prompt;
and wherein
the control means is configured to instruct the output means to
output a prompt to a user and to read the associated location and to cause the route calculation means to calculate the optimal route to the destination in response to an input by the user that is input by the input means; and
output a prompt to the user to decide on whether he wants to be guided either

a) the optimal route; or
b) the route connecting destinations corresponding to locations associated with scheduled appointments in temporal order.

10. The vehicle navigation system according to claim 9, wherein the control means is configured to estimate whether a selected destination cannot be reached within a predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination; and to generate an event, in particular a warning or a message offering establishment of a telephone connection to a person associated with the appointment associated with the location that is selected as the destination, if it is estimated that the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination.

11. The vehicle navigation system according to claim 10, wherein the control means is configured to estimate whether the selected destination cannot be reached within the predetermined time interval or until the point of time of the appointment associated with the location that is selected as the destination on the basis of traffic information, in particular, Traffic Message Channel messages, received by the navigation system.

**Patentansprüche**

1. Verfahren zum Eingeben eines Ziels zur Routenführung in ein Fahrzeugnavigationssystem, umfassend
Bereitstellen einer mobilen elektronischen Einrichtung, die Orte speichert und ein Planermodul umfasst, das geplante Verabredungen speichert;
Verbinden der mobilen elektronischen Einrichtung mit dem Fahrzeugnavigationssystem; und
automatisches Bestimmen sämtlicher geplanter Verabredungen, die in dem Planermodul der mobilen elektronischen Einrichtung gespeichert und mit Orten assoziiert sind, die in der mobilen elektronischen Einrichtung oder in dem Fahrzeugnavigationssystem gespeichert sind und die innerhalb eines vorbestimmten Zeitintervalls fällig werden;
auf der Grundlage der geplanten Verabredungen Auswählen sämtlicher oder einiger der Orte, die mit den geplanten Verabredungen, die in dem Planermodul der mobilen elektronischen Einrichtung oder in dem Fahrzeugnavigationssystem gespeichert sind, assoziiert sind, und von denen bestimmt wird, dass sie innerhalb des vorbestimmten Zeitintervalls fällig werden, als Ziele;
**gekennzeichnet durch**
automatisches oder auf einen Befehl eines Nutzers in Reaktion auf eine Eingabeanforderung, die von dem Fahrzeugnavigationssystem ausgegeben wird, erfolgendes Berechnen der optimalen Route zu zumindest einigen der Ziele ohne Berücksichtigung der zeitlichen Reihenfolge der Verabredungen;
Auffordern des Nutzers nach der Berechnung der optimalen Route, darüber zu entscheiden, ob er ent-

weder

a) die optimale Route; oder
b) eine Route, die Ziele entsprechend Orten verbindet, die mit geplanten Verabredungen in zeitlicher Reihenfolge assoziiert sind,

geführt werden will.

2. Das Verfahren gemäß Anspruch 1, in dem zumindest eine der geplanten Verabredungen mit einer Person assoziiert ist, deren Adresse in der mobilen elektronischen Einrichtung oder in dem Fahrzeugnavigationssystem gespeichert ist und den Ort darstellt, der mit der geplanten Verabredung assoziiert ist.

3. Das Verfahren gemäß einem der vorhergehenden Ansprüche, das weiterhin umfasst
Abschätzen, ob ein ausgewähltes Ziel innerhalb eines vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als das Ziel ausgewählt worden ist, nicht erreicht werden kann; und
Erzeugen eines Ereignisses, wenn abgeschätzt wird, dass das ausgewählte Ziel nicht innerhalb des vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als das Ziel ausgewählt worden ist, erreicht werden kann.

4. Das Verfahren gemäß Anspruch 3, in dem das Abschätzen, ob das ausgewählte Ziel innerhalb des vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als Ziel ausgewählt worden ist, nicht erreicht werden kann, auf der Grundlage von Verkehrsinformationen, insbesondere Nachrichten von einem Verkehrsnachrichtenkanal, die von dem Fahrzeugnavigationssystem empfangen werden.

5. Das Verfahren gemäß Anspruch 3 oder 4, in dem das erzeugte Ereignis eine Warnung, die an eine Nutzer ausgegeben wird, oder eine Nachricht ist, die den Aufbau einer Telefonverbindung mit einer Person anbietet, die mit der Verabredung, die mit dem Ort assoziiert ist, der als Ziel ausgewählt worden ist, der nicht innerhalb des vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung erreicht werden kann, assoziiert ist.

6. Das Verfahren gemäß einem der vorhergehenden Ansprüche, in dem die mobile elektronische Einrichtung ein Adressbuch umfasst und den Schritt des Synchronisierens des Planermoduls und des Adressbuchs mit dem Fahrzeugnavigationssystem umfassend.

7. Das Verfahren gemäß einem der vorhergehenden Ansprüche, in dem die mobile elektronische Einrichtung über Draht oder Funk, insbesondere eine Bluetooth-Verbindung oder eine WLAN-Verbindung, mit dem Fahrzeugnavigationssystem verbunden ist.

8. Das Verfahren gemäß einem der vorhergehenden Ansprüche, in dem die mobile elektronische Einrichtung ein Personal Digital Assistant oder ein Smartphone oder ein elektronischer Organizer ist.

9. Fahrzeugnavigationssystem, das zur Routenführung zu einem Ziel ausgebildet ist, umfassend
eine Verbindungseinheit, die für eine Verbindung mit einer mobilen elektronischen Einrichtung, die zumindest einen Ort speichert und ein Planermodul umfasst, das zumindest eine geplante Verabredung speichert, ausgebildet ist;
eine Datenbank, die zumindest einen Ort speichert;
eine Steuereinrichtung, die dazu ausgebildet ist,
automatisch sämtliche geplante Verabredungen zu bestimmen, die in dem Planermodul der mobilen elektronischen Einrichtung gespeichert und mit den gespeicherten Orten assoziiert sind, die innerhalb eines vorbestimmten Zeitintervalls fällig werden;
Auslesen sämtlicher oder einiger der Orte, die mit den geplanten Verabredungen assoziiert sind, die in dem Planermodul der mobilen elektronischen Einrichtung gespeichert sind und von denen bestimmt wird, dass sie innerhalb des vorbestimmten Zeitintervalls fällig werden;
Auswählen sämtlicher oder einiger der ausgelesenen Orte als Ziele;
**gekennzeichnet durch**
eine Routenberechnungseinrichtung, die dazu ausgebildet ist, die optimale Route zu sämtlichen oder einigen der Ziele ohne Berücksichtigung der zeitlichen Reihenfolge der Verabredungen zu berechnen und eine Route zu berechnen, die Ziele entsprechend Orten verbindet, die mit den geplanten Verabredungen in zeitlicher Reihenfolge assoziiert sind;
eine Eingabeeinrichtung;
eine Ausgabeeinrichtung, die dazu ausgebildet ist, eine Anforderung auszugeben;
und in der
die Steuereinrichtung dazu ausgebildet ist, die Ausgabeeinrichtung dazu anzuweisen
eine Anforderung an einen Nutzer auszugeben und den assoziierten Ort auszulesen und die Routenberechnungseinrichtung dazu zu veranlassen, die optimale Route zu dem Ziel in Reaktion auf eine Eingabe **durch** den Nutzer, die über die Eingabeeinrichtung eingegeben wird, zu berechnen; und
eine Aufforderung an den Nutzer, zu entscheiden, ob er entweder

a) die optimale Route; oder
b) eine Route, die Ziele entsprechend Orten ver-

bindet, die mit geplanten Verabredungen in zeitlicher Reihenfolge assoziiert sind,

geführt werden will, auszugeben.

10. Das Fahrzeugnavigationssystem gemäß Anspruch 9, in dem die Steuereinrichtung dazu ausgebildet ist, abzuschätzen, ob ein ausgewähltes Ziel innerhalb eines vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als das Ziel ausgewählt worden ist, nicht erreicht werden kann; und
ein Ereignis, insbesondere eine Warnung oder eine Nachricht, die den Aufbau einer Telefonverbindung mit einer Person anbietet, die mit der Verabredung, die mit dem Ort assoziiert ist, der als Ziel ausgewählt worden ist, assoziiert ist, zu erzeugen, wenn abgeschätzt wird, dass das ausgewählte Ziel nicht innerhalb des vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als das Ziel ausgewählt worden ist, erreicht werden kann.

11. Das Fahrzeugnavigationssystem gemäß Anspruch 10, in dem die Steuereinrichtung dazu ausgebildet ist, auf der Grundlage von Verkehrsinformationen, insbesondere Nachrichten von einem Verkehrsnachrichtenkanal, die von dem Fahrzeugnavigationssystem empfangen werden, abzuschätzen, ob das ausgewählte Ziel innerhalb des vorbestimmten Zeitintervalls oder bis zu dem Zeitpunkt der Verabredung, die mit dem Ort assoziiert ist, der als Ziel ausgewählt worden ist, nicht erreicht werden kann.

**Revendications**

1. Procédé d'introduction d'une destination de guidage routier dans un système de navigation pour véhicule, comprenant
la mise à disposition d'un dispositif électronique mobile stockant des emplacements et comprenant un module d'ordonnancement qui enregistre des rendez-vous planifiés ;
la connexion du dispositif électronique mobile au système de navigation pour véhicule ; et
la détermination automatique de tous les rendez-vous planifiés stockés dans le module d'ordonnancement du dispositif électronique mobile et associés à des emplacements stockés dans le dispositif électronique mobile ou dans le système de navigation pour véhicule qui apparaissent dans l'intervalle de temps prédéterminé ;
la sélection, en tout ou en partie, des emplacements associés aux rendez-vous planifiés stockés dans le module d'ordonnancement du dispositif électronique mobile ou dans le système de navigation pour véhicule et qui sont déterminés pour apparaître dans l'intervalle de temps prédéterminé comme destinations, sur la base des rendez-vous planifiés ;
**caractérisé par**
de manière automatique ou sur demande d'un utilisateur, en réponse à une invite fournie par le système de navigation pour véhicule, le calcul de l'itinéraire optimal à au moins une partie des destinations, indépendamment de l'ordre chronologique des rendez-vous ;
une fois l'itinéraire optimal calculé, l'envoi d'une invite à l'utilisateur pour décider s'il veut être guidé selon soit

a) l'itinéraire optimal ; soit
b) un itinéraire reliant des destinations correspondant à des emplacements associés à des rendez-vous planifiés en ordre chronologique.

2. Procédé selon la revendication 1, dans lequel au moins un des rendez-vous planifiés est associé à une personne dont l'adresse est stockée dans le dispositif électronique mobile ou dans le système de navigation pour véhicule et représente l'emplacement associé au rendez-vous planifié.

3. Procédé selon l'une des revendications précédentes, comprenant en outre
l'estimation du fait qu'une destination sélectionnée peut être atteinte ou non dans un intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination ; et
la génération d'un événement, s'il est estimé que la destination sélectionnée ne peut pas être atteinte dans l'intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination.

4. Procédé selon la revendication 3, dans lequel l'estimation du fait que la destination sélectionnée peut être atteinte ou non dans l'intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination est basée sur des informations de trafic, et en particulier sur des messages TMC, soit Traffic Message Channel, reçus par le système de navigation.

5. Procédé selon la revendication 3 ou 4, dans lequel l'événement généré est un avertissement envoyé comme invite à l'utilisateur ou un message offrant l'établissement d'une connexion téléphonique avec une personne associée au rendez-vous associé à l'emplacement sélectionné comme la destination qui ne peut pas être atteinte dans l'intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous.

6. Procédé selon l'une des revendications précéden-

tes, dans lequel le dispositif électronique mobile comporte un carnet d'adresses et comprenant l'étape consistant à synchroniser le module d'ordonnancement et le carnet d'adresses avec le système de navigation pour véhicule.

7. Procédé selon l'une des revendications précédentes, dans lequel le dispositif électronique mobile est connecté au système de navigation pour véhicule par fil ou sans fil, en particulier par une liaison Bluetooth ou WLAN.

8. Procédé selon l'une des revendications précédentes, dans lequel le dispositif électronique mobile est soit un assistant numérique personnel ou PDA - Personal Digital Assistant, soit un téléphone intelligent ou smartphone, soit un agenda électronique.

9. Système de navigation pour véhicule configuré pour le guidage routier vers une destination, comprenant une unité de connexion configurée pour la connexion à un dispositif électronique mobile stockant au moins un emplacement et comprenant un module d'ordonnancement stockant au moins un rendez-vous planifié ;
une base de données stockant au moins un emplacement ;
un moyen de contrôle configuré pour
déterminer automatiquement tous les rendez-vous planifiés stockés dans le module d'ordonnancement du dispositif électronique mobile et associés à des emplacements stockés qui apparaissent dans l'intervalle de temps prédéterminé ;
lire, en tout ou en partie, les emplacements associés aux rendez-vous planifiés stockés dans le module d'ordonnancement du dispositif électronique mobile, qui sont déterminés pour apparaître dans l'intervalle de temps prédéterminé ; et
sélectionner, en tout ou en partie, les emplacements lus comme destinations ;
**caractérisé par**
un moyen de calcul d'itinéraire configuré pour calculer l'itinéraire optimal aux destinations en tout ou en partie, indépendamment de l'ordre chronologique des rendez-vous, et pour calculer un itinéraire reliant des destinations correspondant aux emplacements associés aux rendez-vous planifiés en ordre chronologique ;
un moyen d'introduction ;
un moyen de sortie configuré pour sortir une invite ;
et dans lequel
le moyen de contrôle est configuré pour commander le moyen de sortie de façon à
sortir une invite pour un utilisateur, à lire l'emplacement associé et à faire exécuter, par le moyen de calcul d'itinéraire, le calcul de l'itinéraire optimal vers la destination en réponse à une entrée de l'utilisateur introduite par le moyen d'introduction ; et
sortir une invite pour l'utilisateur de manière à ce qu'il décide s'il veut ou non être guidé selon soit

a) l'itinéraire optimal ; soit
b) l'itinéraire connectant des destinations correspondant aux emplacements associés aux rendez-vous planifiés en ordre chronologique.

10. Système de navigation pour véhicule selon la revendication 9, dans lequel le moyen de contrôle est configuré pour
estimer si une destination sélectionnée peut ou non être atteinte dans un intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination ; et pour
générer un événement, en particulier un avertissement ou un message proposant l'établissement d'une liaison téléphonique avec une personne associée au rendez-vous associé à l'emplacement sélectionné comme destination, s'il est estimé que la destination sélectionnée ne peut pas être atteinte dans l'intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination.

11. Système de navigation pour véhicule selon la revendication 10, dans lequel le moyen de contrôle est configuré pour estimer si la destination sélectionnée peut ou non être atteinte dans l'intervalle de temps prédéterminé ou avant le moment fixé du rendez-vous associé à l'emplacement sélectionné comme destination sur la base d'informations de trafic, et en particulier sur des messages TMC reçus par le système de navigation.

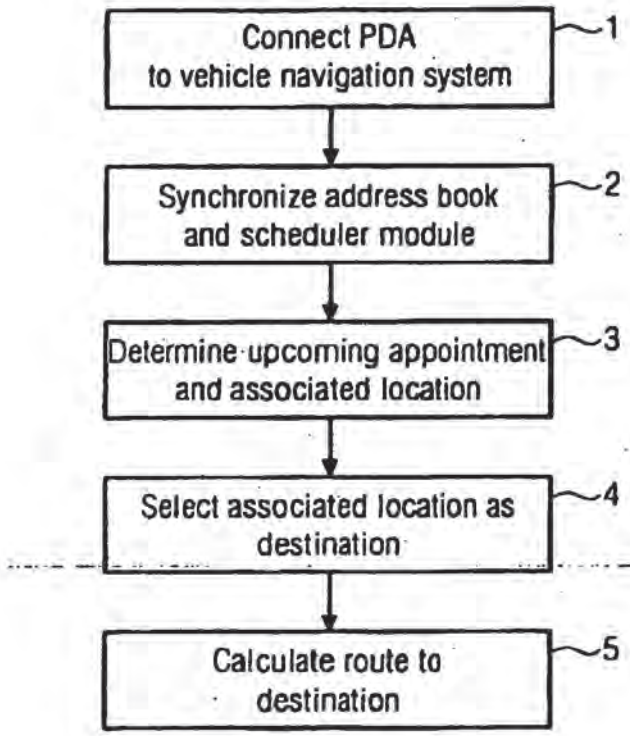
Connect PDA to vehicle navigation system
1
Synchronize address book and scheduler module
2
Determine upcoming appointment and associated location
3
Select associated location as destination
4
Calculate route to destination
5

FIG. 1

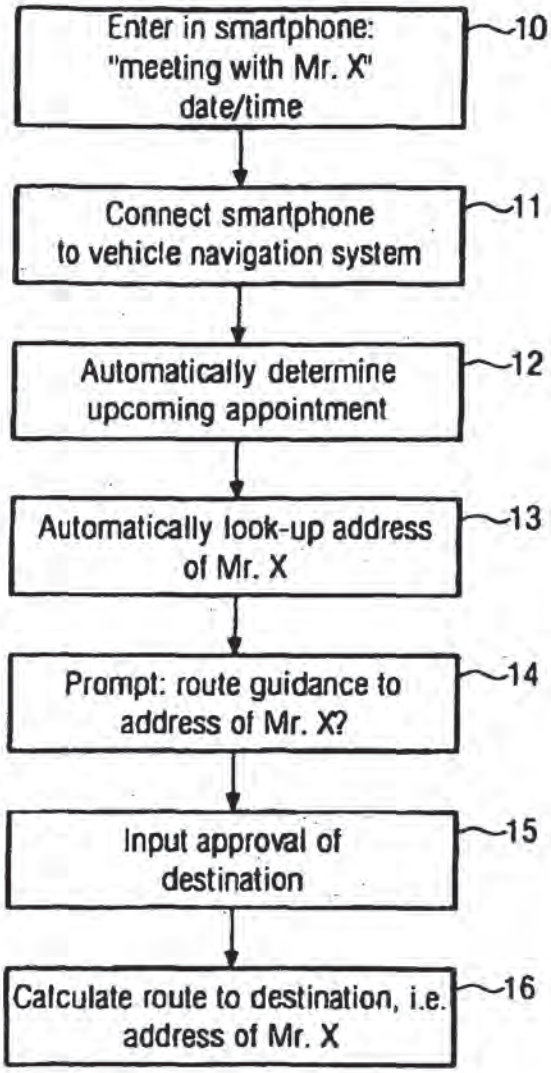
Enter in smartphone: "meeting with Mr. X" date/time
10
Connect smartphone to vehicle navigation system
11
Automatically determine upcoming appointment
12
Automatically look-up address of Mr. X
13
Prompt: route guidance to address of Mr. X?
14
Input approval of destination
15
Calculate route to destination, i.e. address of Mr. X
16

FIG. 2

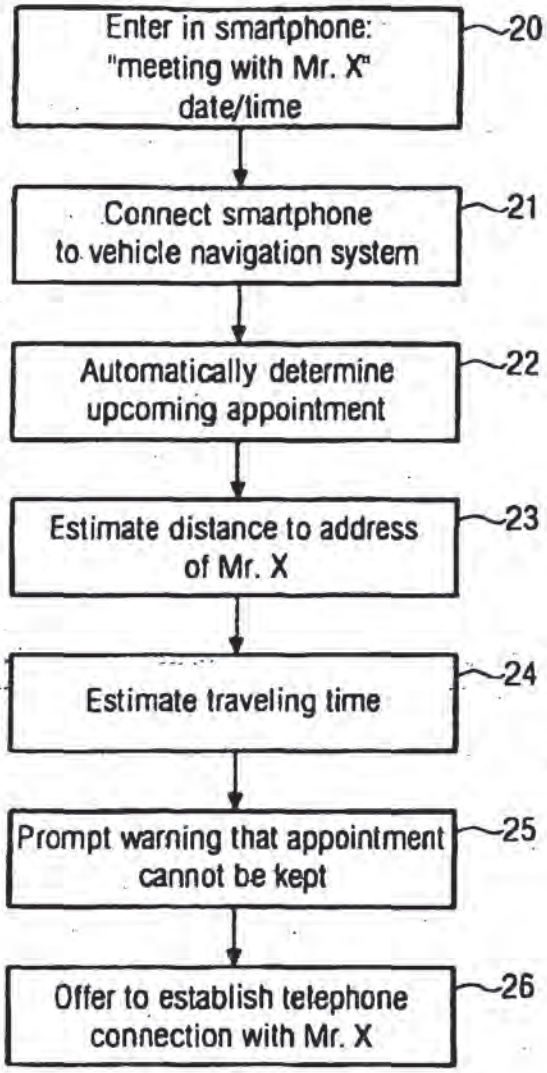
Enter in smartphone: "meeting with Mr. X" date/time
20
Connect smartphone to vehicle navigation system
21
Automatically determine upcoming appointment
22
Estimate distance to address of Mr. X
23
Estimate traveling time
24
Prompt warning that appointment cannot be kept
25
Offer to establish telephone connection with Mr. X
26

FIG. 3

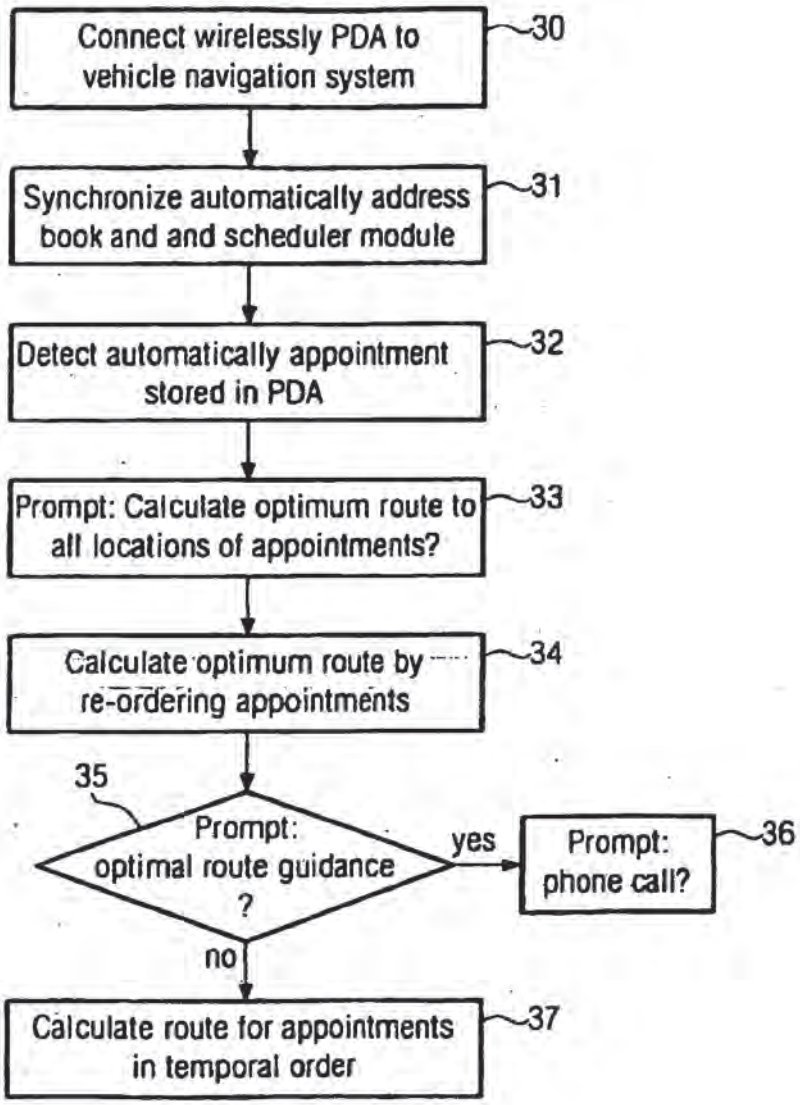
Connect wirelessly PDA to vehicle navigation system
30
Synchronize automatically address book and and scheduler module
31
Detect automatically appointment stored in PDA
32
Prompt: Calculate optimum route to all locations of appointments?
33
Calculate optimum route by re-ordering appointments
34
35
Prompt: optimal route guidance ?
yes
Prompt: phone call?
36
no
Calculate route for appointments in temporal order
37

FIG. 4

## REFERENCES CITED IN THE DESCRIPTION

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 August 2012 (02.08.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/102879 A1

(51) International Patent Classification:
*G06Q 50/00* (2012.01)

(21) International Application Number:
PCT/US2012/021314

(22) International Filing Date:
13 January 2012 (13.01.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/015,204 27 January 2011 (27.01.2011) US

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, 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, JP, 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, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published**:

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

(54) **Title**: CALENDAR SHARING FOR THE VEHICLE ENVIRONMENT USING A CONNECTED CELL PHONE

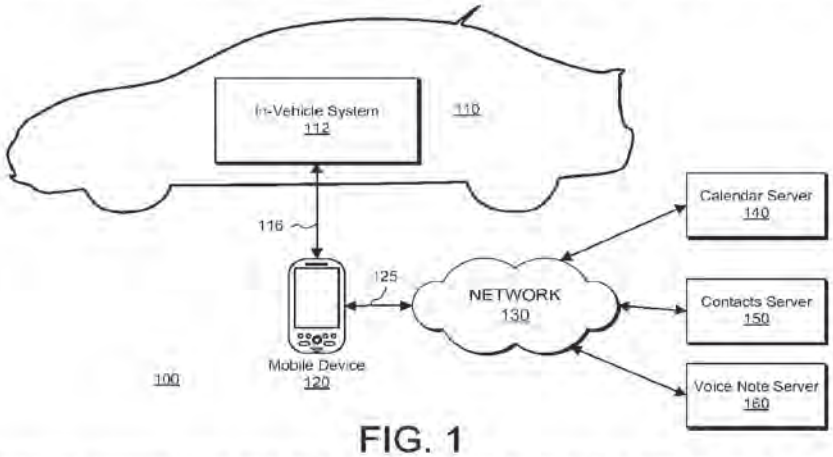


FIG. 1

(57) **Abstract**: A mobile device communicates with an in- vehicle system to provide a network-based calendar and related features for viewing and/or editing within a vehicle. The mobile device executes a specialized application that retrieves calendar data from one or more calendar sources in a native calendar format, and converts the calendar data to a customized vehicle format designed specifically for convenient transfer and viewing within the vehicle. The user may record spoken voice notes that can be processed to automatically create new calendar entries. An alert feature schedules visual and/or audio alerts to notify the user in advance of scheduled calendar events. When a scheduled calendar event time is reached, the in- vehicle system may automatically place a call to an event invitee or generating a route to an event destination.

WO 2012/102879 A1

# CALENDAR SHARING FOR THE VEHICLE ENVIRONMENT USING A CONNECTED CELL PHONE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

**[0001]** The present invention relates to in-vehicle electronics and, more specifically, to displaying calendar information within a vehicle.

2. Description of the Related Arts

**[0002]** The personal electronic calendar has been represented in many forms on many devices, and its use has become increasingly widespread. The prevalence of internet connected devices such as mobile phones and connected computers has allowed for "cloud-based" calendars to become practical. In this architecture, various devices can access a cloud-based calendar and synchronize calendar data. Thus, the user can easily view, add, and edit calendar information from any connected node of the network. If a calendar item is changed at one node, the rest of the connected nodes will automatically update so that the calendar always provides current information.

**[0003]** Despite the widespread use of electronic calendars, current calendar systems do not provide any convenient mechanism for accessing the electronic calendar from within an automotive vehicle environment. While drivers may bring their portable devices into the car, usability problems and new safety laws make this usage undesirable. Particularly, in the automotive environment, the driver's primary focus should be on piloting the vehicle. The small screen of mobile devices and the attention required to operate them prevents a driver from being able to drive safely while accessing calendar data.

**[0004]** Some modern vehicles come equipped with dashboard computer systems that can provide direct access to electronic calendars. However, such systems require that the vehicle have internet connectivity, which is usually available only at considerable extra cost to the vehicle owner. Furthermore, even when an in-vehicle system is equipped with internet connectivity, current systems only provide access to calendar information that is intended for viewing on a computer screen or mobile



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device, rather than on an in-vehicle display. Such conventional calendar interfaces typically include complicated displays and interfaces that require substantial attention from the user to view and control. Such systems are therefore impractical for use by the driver whose attention must instead be occupied with safely navigating the vehicle.

## SUMMARY OF THE INVENTION

A mobile device provides an electronic calendar for display within a vehicle. The mobile device receives calendar data from a calendar source (e.g., a network-based calendar server or a synchronized calendar stored internally by the mobile device) that stores the calendar data in a native calendar format specific to the calendar source. The mobile device converts the calendar data from the native calendar format to a vehicle calendar format suitable for transfer to an in-vehicle system. The mobile device then transfers the converted calendar data to an in-vehicle system using a short-range communication protocol.

In one embodiment, the mobile device receives the calendar data from two different calendar sources (e.g., two different network-based calendar servers or an internal calendar and a network-based calendar server), each storing the calendar data in different native formats. The mobile device aggregates the calendar data from the two different calendar sources into the vehicle format, and processes the calendar data to remove duplicate entries. Furthermore, the mobile device may time scale the received calendar data and/or apply filters to the calendar data to remove data types not suitable for use within the vehicle.

**[0005]** In one embodiment, the mobile device receives voice notes from the in-vehicle system comprising an audio recording of spoken words. The mobile device obtains dictated speech corresponding to the spoken words and processes the dictated speech to add or update calendar entries. Additionally, the mobile device may store the audio recordings for later retrieval.

**[0006]** An in-vehicle system displays and manages the electronic calendar within a vehicle environment. The in-vehicle system receives calendar data from the mobile device via the short-range communication protocol. The calendar data comprises a plurality of calendar entries. The in-vehicle system generates a user interface for displaying the calendar data. In one embodiment, the user interface comprises an events window for displaying a representation of scheduled calendar



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events and a notifications window for displaying a representation of calendar notifications. The in-vehicle system then outputs the user interface to an in-vehicle display.

**[0007]** In one embodiment, the in-vehicle system correlates the calendar entries with contacts entries and/or a points-of-interest database to find potential matches. When a scheduled event time for a calendar entry is reached, the in-vehicle system may automatically take an action based on the potential matches. For example, the in-vehicle system may automatically place a call to a contact whose name at least partially matches the name of an event invitee for the calendar event. Alternatively, the in-vehicle system may generate a route to an address of a contact or a point-of-interest that at least partially matches the event location for the scheduled calendar event.

**[0008]** In one embodiment, the in-vehicle system processes the calendar data and stores alerts related to scheduled calendar events. When a scheduled alert time is reached, the in-vehicle system may trigger a visual and/or audio alert. A snooze function allows the user to reschedule the alert for a later time.

**[0009]** The features and advantages described in the specification are not all inclusive and, in particular, many additional features and advantages will be apparent to one of ordinary skill in the art in view of the drawings, specification, and claims. Moreover, it should be noted that the language used in the specification has been principally selected for readability and instructional purposes, and may not have been selected to delineate or circumscribe the inventive subject matter.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** The teachings of the embodiments of the present invention can be readily understood by considering the following detailed description in conjunction with the accompanying drawings.

**[0011]** Figure (FIG.) 1 illustrates a vehicle environment in accordance with an embodiment of the invention.

**[0012]** Figure 2 is a block diagram illustrating a mobile device in accordance with an embodiment of the invention.

**[0013]** Figure 3 is a block diagram illustrating an in-vehicle system in accordance with an embodiment of the invention.



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**[0014]** Figure 4 is a flowchart illustrating a process for providing calendar data to a vehicle in accordance with an embodiment of the invention.

**[0015]** Figure 5 is a flowchart illustrating a process for converting calendar information in accordance with an embodiment of the invention.

**[0016]** Figure 6 illustrates a user interface screen for displaying calendar entries in a vehicle in accordance with an embodiment of the invention.

**[0017]** Figure 7A illustrates a first set of user interface screens for displaying calendar entries in a vehicle in accordance with an embodiment of the invention.

**[0018]** Figure 7B illustrates a second set of user interface screens for displaying calendar entries in a vehicle in accordance with an embodiment of the invention.

**[0019]** Figure 8 is a flowchart illustrating a process for utilizing voice notes in accordance with an embodiment of the invention.

**[0020]** Figure 9 is a flowchart illustrating a process for taking actions based on calendar entries in accordance with an embodiment of the invention.

**[0021]** Figure 10 illustrates user interface screens for taking actions based on calendar entries in accordance with an embodiment of the invention.

**[0022]** Figure 11 is a flowchart illustrating a process for managing calendar alerts in accordance with an embodiment of the invention.

**[0023]** Figure 12A illustrates a first user interface screen for managing a calendar alert in a vehicle in accordance with an embodiment of the invention.

**[0024]** Figure 12B illustrates a second user interface screen for managing a calendar alert in a vehicle in accordance with an embodiment of the invention.

## DETAILED DESCRIPTION OF EMBODIMENTS

**[0025]** Embodiments are now described with reference to the figures where like reference numbers indicate identical or functionally similar elements. Also in the figures, the left most digit of each reference number corresponds to the figure in which the reference number is first used.

**[0026]** Reference in the specification to "one embodiment" or to "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least one embodiment. The appearances of the phrase "in one embodiment" or "an embodiment" in various places in the specification are not necessarily all referring to the same embodiment.



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[0027] Some portions of the detailed description that follows are presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps (instructions) leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical, magnetic or optical signals capable of being stored, transferred, combined, compared and otherwise manipulated. It is convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. Furthermore, it is also convenient at times, to refer to certain arrangements of steps requiring physical manipulations or transformation of physical quantities or representations of physical quantities as modules or code devices, without loss of generality.

[0028] However, all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as "processing" or "computing" or "calculating" or "determining" or "displaying" or "determining" or the like, refer to the action and processes of a computer system, or similar electronic computing device (such as a specific computing machine), that manipulates and transforms data represented as physical (electronic) quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0029] Certain aspects of the embodiments include process steps and instructions described herein in the form of an algorithm. It should be noted that the process steps and instructions of the embodiments could be embodied in software, firmware or hardware, and when embodied in software, could be downloaded to reside on and be operated from different platforms used by a variety of operating systems. The embodiments can also be in a computer program product which can be executed on a computing system.



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**[0030]** The embodiments also relates to an apparatus for performing the operations herein. This apparatus may be specially constructed for the purposes, e.g., a specific computer, or it may comprise a general-purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but is not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, application specific integrated circuits (ASICs), or any type of media suitable for storing electronic instructions, and each coupled to a computer system bus. The memory/storage can be transitory or non-transitory. Memory can include any of the above and/or other devices that can store information/data/programs. Furthermore, the computers referred to in the specification may include a single processor or may be architectures employing multiple processor designs for increased computing capability.

**[0031]** The algorithms and displays presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose systems may also be used with programs in accordance with the teachings herein, or it may prove convenient to construct more specialized apparatus to perform the method steps. The structure for a variety of these systems will appear from the description below. In addition, the embodiments are not described with reference to any particular programming language. It will be appreciated that a variety of programming languages may be used to implement the teachings of the embodiments as described herein, and any references below to specific languages are provided for disclosure of enablement and best mode.

**[0032]** In addition, the language used in the specification has been principally selected for readability and instructional purposes, and may not have been selected to delineate or circumscribe the inventive subject matter. Accordingly, the disclosure of the embodiments are intended to be illustrative, but not limiting, of the scope of the embodiments, which are set forth in the claims.

OVERVIEW

**[0033]** A system, method, and computer-readable storage medium is described for obtaining, managing, and displaying an electronic calendar within a vehicle and for carrying out various features related to the electronic calendar. An application



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executing on a mobile device obtains calendar data pertaining to a user from one or more network-based calendar systems such as iCal, Google Calendar, Microsoft Outlook Calendar, and Yahoo Calendar. The application aggregates the calendar data and converts the calendar data to a vehicle format that is suitable for transfer and display within a vehicle. The mobile device then transfers the calendar information in the vehicle format to an in-vehicle display system. Unlike conventional calendar formats which are designed for viewing on computer screens or mobile device screens, the vehicle calendar format is designed specifically for viewing within a vehicle. Thus, the vehicle calendar format arranges the calendar information such that the user can view and/or edit calendar entries with minimal distraction. As a result, a driver can maintain focus on navigating the vehicle. Methods and example interfaces for processing and displaying calendar data within a vehicle are described in further detail below with respect to FIGS. 4-7.

**[0034]** Additional features related to the electronic calendar are also provided to improve the user's experience in the vehicle. First, the calendar system includes a "voice note" feature that allows the user to record a spoken message. The spoken message is then processed to extract particular words or phrases, and where appropriate, create a new calendar entry or address book entry based on the recorded voice note. This feature allows the user to easily add or modify calendar or address book entries with minimal distraction while navigating the vehicle. The voice note feature is described in further detail below with respect to FIG. 8.

**[0035]** Second, the system may be configured to process calendar data and take a particular action based on the content. For example, the system may process calendar entries and automatically configure a hands free telephone unit to place a call to an invitee of a scheduled calendar event, or configure a navigation unit to generate a route to an address of the scheduled calendar event. This relieves the user of having to manually perform such tasks, and thus further minimizes distractions to the driver. The calendar action feature is described in further detail below with respect to FIGS. 9-10.

**[0036]** Third, the system may be configured to process alerts associated with scheduled calendar events in order to notify users of a calendar event prior to, or concurrently with, its scheduled time. Alerts are displayed in a manner that is suitable for viewing and managing within a vehicle with minimal distraction to the driver.



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The calendar alert feature is described in further detail below with respect to FIGS. 11-12.

SYSTEM ARCHITECTURE

**[0037]** FIG. 1 illustrates an exemplary operating environment 100 for various embodiments. The operating environment 100 includes a vehicle 110 having an in-vehicle system 112, a mobile device 120, a short-range communication link 116 for communication between the in-vehicle system 112 and the mobile device 120, a network 130, a wireless networking communication link 125 between the mobile device 120 and the network 130, and various servers (e.g., a calendar server 140, a contacts server 150, and a voice note server 160) connected to the network 120. The communication links 116, 125 described herein can directly or indirectly connect these devices.

**[0038]** The in-vehicle system 112 comprises a computing device that may be part of the vehicle's telematics system. An embodiment of the in-vehicle system 112 is described in further detail below with reference to FIG. 3. In general, the in-vehicle system 112 is configured to display information to the user via a display screen and accept inputs from the user to control various functions. The in-vehicle system 112 includes short-range communication technology to allow the in-vehicle system 112 to exchange information with other devices, such as the mobile device 120. This allows, for example, the in-vehicle system 112 to obtain calendar information from the mobile device, display the calendar information on the in-vehicle system 112, and provide controls that enable the user to manage various calendar features.

**[0039]** The short-range communication link 116 between the in-vehicle system 112 and the mobile device 120 may use a wireless short-range communication technology, such as, for example, Bluetooth® technology or WiFi technology, or a wired short-range communication technology such as, for example, Universal Serial Bus (USB). The in-vehicle system 112 and mobile device 120 may connect, or pair, with each other via the short-range communication link 116.

**[0040]** Examples of a mobile device 120 include a cellular phone, personal device assistant (PDA), smart phone, pocket personal computer (PC), laptop computer, smart watch, or other transportable devices having a processor and communications ability. An embodiment of the mobile device 120 is described in further detail below with reference to FIG. 2. In general, the mobile device 120 is



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configured to execute one or more software applications that enable the mobile device 120 to communicate with the in-vehicle system 112 and carry out a number of different features and interactions that will be described in further detail below. For example, the mobile device 120 can manage and transfer calendar entries, calendar alerts, contacts data, and voice notes.

**[0041]** The mobile device 120 can also communicate over a network 130 with various servers such as a calendar server 140, a contacts server 150, and a voice note server 160. The network 130 may include a wireless communication network, for example, a cellular telephony network, as well as one or more other networks, such as the Internet, a public-switched telephone network (PSTN), a packet-switching network, a frame-relay network, a fiber-optic network, a Wifi network, a WiMAX network, a CDMA network, a GSM network, a 3G network, a 4G network, or other wireless networks.

**[0042]** The servers 140, 150, 160 comprise computing devices that communicate over the network 130 to carry out various functions and/or to store data accessible to other devices on the network 130. The calendar server 140 can comprise one or more network-based calendar servers such as, for example, an iCal Server, a Google Calendar Server, a Microsoft Exchange Server, or a Yahoo Calendar Server. The calendar server 140 stores, for a particular user, a set of calendar entries and provides calendar data pertaining to these entries to requesting devices on the network 130. Each calendar entry corresponds to a scheduled event (e.g., a meeting, an appointment, a reminder, etc.) schedule for a particular event time. Various other metadata may also be included with each calendar entry such as, for example, event title, event invitees, event description, event location, event end time, etc. Furthermore, one or more alerts may be associated with a calendar entry in order to remind the user of the event prior to, or concurrently with, the scheduled event time. Calendar entries may be added, modified, or removed by a user from any device on the network 130 that has direct or indirect access to the calendar server 140.

**[0043]** The contacts server 150 stores, for a particular user, a set of contacts entries and provides contacts data pertaining to these entries to requesting devices on the network 130. Each contact entry includes various metadata associated with persons or business such as, for example, name, address, phone number, email address, website, etc. The contacts server 150 may be part of the calendar server 140.



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For example, many network-based calendar servers such as iCal Server, Google Calendar Server, Microsoft Exchange Server, and Yahoo Calendar Server include an address book feature that may act as the contacts server 150. Alternatively, the contacts server 150 may be entirely separate from the calendar server 140.

**[0044]** The voice note server 160 stores and processes voice notes, i.e., a spoken memo recorded by a user. For example, the voice note server 160 may perform speech-to-text conversion on voice notes received from the mobile device 120 and return dictated text to the mobile device 120. Furthermore, the voice note server 160 may store the recorded audio files and/or deliver the audio files to the user via an email or text messaging service. Furthermore, the voice note server 160 may communicate with the calendar server 140 and the contacts server 150 to associate audio files with calendar or contacts entries.

**[0045]** Although only one of each type of server 140, 150, 160 is illustrated for clarity, in practice, multiple servers of each type may be present on the network 130. Furthermore, two or more of the servers 140, 150, 160 may be combined in a single computing device.

**[0046]** In operation, the in-vehicle system 112 and mobile device 120 communicate with each other via the short-range communication link 116. The mobile device 120 stores information received from the in-vehicle system 112, and/or may provide the information to a remote processing device, such as, for example, the calendar server 140, the contacts server 150, or the voice note server 160 via the network 130. Similarly, the mobile device 120 may store information from the remote servers 140, 150, 160, and/or may provide the information to the in-vehicle system 112. The in-vehicle system 112 thus leverages the mobile device 120 to indirectly communicate via the network 130, even if the in-vehicle system 112 is not equipped to access the network 130 directly.

Mobile Device

**[0047]** FIG. 2 is a block diagram illustrating an embodiment of the mobile device 120. In one embodiment, the mobile device 120 comprises a memory 210 and a processor 220. Other conventional components of the mobile device 120 such as a display, input keys, microphone, and speakers are omitted for clarity of description.

**[0048]** The processor 220 processes data and may comprise various computing architectures. Although only a single processor 220 is shown in FIG. 2, multiple



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processors may be included. The memory 210 may be a dynamic random access memory (DRAM) device, a static random access memory (SRAM) device, Flash RAM (non-volatile storage), combinations of the above, or some other memory device known in the art. The memory 210 may be used for data storage and for storing various applications that can execute on the mobile device 120. For example, the memory 210 may store iPhone™ or Android™-based applications that are available for download to the mobile device 120 via a wired or wireless system. In general, the applications include computer-executable program instructions for carrying out various functions. In operation, the instructions are loaded from the memory 210 and executed by the processor 220. In alternative embodiments, the applications can part of any of a variety of software paradigms, e.g., software as a service (SaaS), cloud computing.

**[0049]** In one embodiment, the memory 210 stores a vehicle connect (VC) application 212. The VC application 212 facilitates communication between the mobile device 120 and the in-vehicle system 112 and formats data for transfer to the in-vehicle system 112. The VC application 212 can communicate with the in-vehicle system 112 according to either a push or pull mechanism. Data may communicated between the mobile device 120 and the in-vehicle system 112 using, for example, a PBAP Bluetooth method or using OBEX Bluetooth protocols. The VC application 212 furthermore communicates with the various internet servers (e.g., servers 140, 150, 160) to aggregate and synchronize calendar entries and alerts, contact information, and/or voice note information.

**[0050]** In addition to the handling transfer of data, the VC application 212 may also manage the connection timings for access to both the network 130 and the in-vehicle system 112. For example, the VC application 212 may control the refresh timing for updating calendar and/or contacts information. In one embodiment, the VC application 212 may obtain data updates from the servers 140, 150, 160 and store them to the mobile device 120 even when the application 212 is not connected to the vehicle 110. Then, the VC application 212 can transfer these pre-acquired updates to the in-vehicle system 112 at a later time. This would allow, for example, the VC application 212 to acquire the updates whenever it is within coverage range of the network 130 (even if the mobile device 120 is not connected to the vehicle 110), and transfer the updates to the in-vehicle system 112 at a later time. When receiving data



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from the servers 140, 150, 160, the VC application 212 can apply filters to the data and cache the data prior to sending the information to the in-vehicle system 112. In this manner, collection and processing tasks performed by the VC application 212 may alleviate the processing requirements of the in-vehicle system 112. Furthermore, the in-vehicle system 112 need not have any direct access to the network 130.

**[0051]** The VC application 212 may also process data received from in-vehicle system 112. For example, the VC application 212 may receive changes to calendar or contacts data made by a user using the in-vehicle system 112, or may receive voice notes from the in-vehicle system 112 for processing. The VC application 212 compares and processes calendar and contacts modifications in order to provide calendar updates back to the calendar server 140 and provide contacts updates to the contacts server 150.

**[0052]** In one embodiment, the VC application 212 comprises a calendar module 214, a contacts module 216, and a voice note module 218. The calendar module 214 communicates with the calendar server 140 to obtain calendar data and transmit calendar updates back to the server 140. The calendar module 214 communicates using an Application Programming Interface (API) specific to the calendar server 140 (e.g., a CalDAV protocol or an MS Exchange protocol). The calendar module 214 may also include a calendar application that executes on the mobile device, which may include its own native calendar format. The calendar module 214 processes the calendar data to aggregate the data and convert the data from its native format specific to the calendar server 140 to a vehicle format suitable for transfer and display in the vehicle. Furthermore, the calendar module 214 communicates with the in-vehicle system 112 to transmit the formatted calendar data and receive updates.

**[0053]** The contacts module 216 communicates with the contacts server 150 via an API to obtain contacts data from the contacts server 150. The contacts module 216 processes and/or aggregates contacts data to convert it from its native format to a vehicle format and transmit the contacts data to the vehicle. The contacts module 216 may also receive updates from the in-vehicle system 112 and relay these updates to the contacts server 150.

**[0054]** The voice note module 218 receives recorded voice notes from the in-vehicle system 112 and transmits them to the voice note server 160. The voice note



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module 218 also receives dictated text from the voice note server 160 corresponding to the processed audio. The voice note module 218 may further process the dictated text to extract keywords or phrases and use these to create or modify calendar or contacts entries. The voice note feature is discussed in further detail below with respect to FIG. 8.

In-Vehicle System

**[0055]** FIG. 3 is a block diagram illustrating an embodiment of the in-vehicle system 112. In one embodiment, the in-vehicle system 112 comprises a memory 310, a processor 340, a navigation unit 350, and a telephone unit 360. Other conventional components of the in-vehicle system 112 such as a display, clock, input keys, microphone, speakers, and short-range communication unit are omitted for clarity of description.

**[0056]** The memory 310 stores a mobile connect (MC) application 320. The MC application 320 interfaces with the VC application 212 on the mobile device 120 using the short range communication link 116. The MC application 320 can push or pull data exchanged with the mobile device 120. Generally, data received by the MC application 212 has already been processed on the mobile device 120, thus reducing the amount of processing performed by the in-vehicle system 112. Upon receiving data, the MC application 212 stores the data (e.g., in an ASCII XML file) and accesses it as needed. The MC application 320 may receive refresh requests from a user and transmit these requests to the mobile device 120. Furthermore, the MC application 320 may receive data inputs from the user (e.g., to add, delete, or modify a calendar entry, a contacts entry, or a voice note), and transfer these updates back to the mobile device 120.

**[0057]** The MC application 320 generates a user interface that enables interaction between the user and the in-vehicle system 112. For example, the user interface may provide various displays, menus, controls, and other conventional user interface features. In one embodiment, the user interface displays data in a predefined format. In this embodiment, the display format is not entirely determined by the data received, but rather by a "skin" associated with the user interface. If the skin changes, the appearance changes. For example, a skin may specify display attributes such as font, font color, font size, background color, etc. Furthermore, various skins may



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cause different types of data to be included or excluded from display, or displayed in a different format.

**[0058]** The MC application 320 interacts with various databases including a calendar database 332, a contacts database 334, and an alert database 336. The calendar database 332 and contacts database 334 store calendar entries and contacts entries respectively received by the in-vehicle system 112 from the mobile device 120, or inputted or modified by the user using the in-vehicle system 112. In one embodiment, calendar and contacts entries are stored according to a data schema (e.g., an ASCII XML format) that includes various fields related to different aspects of the event. For example, a calendar data schema for each calendar entry may include the following fields: event date, event start time, event stop time, event title, event location, event description, event people, and event notification time. A contacts data schema for each contacts entry may include fields corresponding to contact name, contact address, contact phone number, contact fax number, and contact email address. One or more of the metadata fields may be blank if the data is unknown or inapplicable for the particular entry. For example, some calendar entries may omit an "event location" if the entry merely corresponds to a reminder rather than an appointment or meeting (e.g., Mom's birthday).

**[0059]** The MC application 320 may process calendar entries to create and manage alerts based on the event notification time and store the alerts to the alert database 336. Using the alert database 336, the MC application 320 may monitor the current time and trigger an alert when the current time matches an alert time for a scheduled alert. The notification time may be prior to the event time (e.g., to provide a reminder), or may correlate directly to the event time of a calendar entry.

**[0060]** In one embodiment, the MC application 320 processes entries in the calendar database 332 and contacts database 334 to compare and cross correlate entries. For example, the MC application 320 may locate matching metadata between calendar and contacts entries. This would allow, for example, the MC application 320 to automatically determine a phone number or address of an event invitee (e.g., by finding a match between the event person field of a calendar entry and the contact name field of a contacts entry). The MC application 320 could then take an action based on this match, such as placing a call to the invitee using a hands-free telephone unit 360 or generating a route to the address using the navigation unit 350. The MC



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application 320 may additional correlate calendar or contacts entries with points of interest (POIs) in a POI database 352 that may be included as part of the in-vehicle navigation unit 350. A processing for generating actions based on calendar events is described in more detail below with respect to FIGs. 9-10.

## OPERATION AND USE

### In-Vehicle Electronic Calendar

**[0061]** FIG. 4 illustrates an embodiment of a process for providing an electronic calendar for use within a vehicle environment 100. Various steps of the process are illustrated as being performed by the calendar server 140, the mobile device 120, and the in-vehicle system 112. In alternative embodiments, steps may be performed by different entities, or more than one entity may collectively carry out the described step.

**[0062]** Transfer of the calendar data to the in-vehicle system 112 is generally initiated when the mobile device 120 detects 402 a refresh trigger event. The refresh trigger event may be a manual refresh request initiated by a user, or the refresh trigger event may occur automatically when specified refresh conditions are met. For example, in one embodiment, the mobile device 120 is configured to provide a calendar refresh to the in-vehicle system 112 after a fixed amount of time has elapsed since the last refresh (e.g., every 10 minutes). In another embodiment, the refresh trigger event comprises receipt of a signal from the in-vehicle system 112 initiated by, for example, ignition of the vehicle 110 or another detectable event.

**[0063]** Upon detecting the refresh trigger event, the mobile device 120 requests 404 calendar information from the calendar server 140 according to a specified date range using the appropriate calendar API. Alternatively, the mobile device 120 may request the calendar information from a different calendar source, or load the information from an internally stored calendar. The request may include requests to multiple calendar servers 140 utilizing different calendar systems (e.g., iCal, MS Outlook Calendar, Google Calendar, Yahoo Calendar, etc.). The specified date range is typically substantially smaller the full range of dates stored by the calendar server 140. For example, the calendar server 140 may store calendar entries for many years before and after the current date, but the mobile device 120 may request calendar data for only the next 30 days. The requested date range may comprise a greater timeframe than the timeframe that the in-vehicle system 112 is configured to display.



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This would allow, for example, the mobile device 120 and/or the in-vehicle system 112 to cache the extra data until it is needed. Furthermore, this allows the in-vehicle system 112 to display "upcoming events" to the user that occur outside the standard date range of the in-vehicle calendar display, or to schedule an alert in advance of the actual event.

**[0064]** The calendar server 140 receives 406 the request and provides 408 the requested calendar information to the mobile device 120. The mobile device 120 receives 410 the requested calendar information from the server 140, and converts 412 the received calendar information from the calendar server format to the vehicle calendar format. A process for converting 412 the calendar information to the vehicle format is described in further detail below with reference to FIG. 5. The converted calendar information is then transferred 414 to the in-vehicle system 112. The in-vehicle system 112 receives 416 the calendar information and updates 418 the in-vehicle display accordingly.

**[0065]** FIG. 5 illustrates an embodiment of a process performed by the mobile device 120 (e.g., using the calendar module 214 of the VC application 212) for converting 412 the calendar information from the calendar server format to the vehicle format (or from an internally stored calendar format to the vehicle format). The mobile device 120 identifies 502 the native calendar format(s) of the received calendar information. For example, the mobile device 120 may receive calendar information in one or more of a CalDAV format, an MS Exchange format, a Google calendar format, or another standard calendar format, or may use a format native to a calendar application that executes on the mobile device 120. The mobile device 120 then applies 504 conversion rules to the calendar information received in each of the native formats to convert all the calendar data to a common format (e.g., an ASCII XML format) such that calendar data from different calendar systems can be compared and aggregated. The mobile device 120 then aggregates 506 the calendar data to identify and remove duplicate entries. Duplicate entries may be detected by comparing metadata fields and finding matches. For example, duplicate entries may be detected if two entries have the same event start time and the same event title, event people, or event location. The mobile device 120 modifies 508 the calendar data according to predefined time frame rules. For example, the mobile device 120 may receive calendar data covering a first time frame (e.g., 30 days), but scale the



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data to cover only a second shorter time frame (e.g., 7 days). The mobile device 120 then processes and filters 510 the data for transfer to the in-vehicle system 112. Processing and filtering may include removing certain data types that are not suitable for display in the vehicle such as, for example, hyperlinks, unusually characters, and attachment artifacts. This step may also include processing the data into a uniform data type and container size. For example, in one embodiment, calendar entries are converted to an ASCII format for transfer to the in-vehicle system 112. In one embodiment, processing and filtering may also include characterizing calendar entries as either "events" or "notifications." Events may include, for example, meetings, appointments, or activities. Typically, calendar entries are characterized as an event if the entry specifies a set time period (e.g., between a time *x* and a time *y*, where time *x* is before time *y*). In contrast, an entry may be characterized as a notification if the entry does not specify a non-zero time period. For example, the calendar entry may indicate a start time and end time that are the same, or may not indicate any start time or end time. These types of entries may be created, for example, for all day events or as reminders about birthdays, holidays, items on a to-do list, etc. that do not specify a specific non-zero time window. In alternative embodiments, the characterization of entries as "events" or "notifications" may be performed by either the mobile device 120 or the in-vehicle system 112. In other alternative embodiments, different or additional criteria may be used for characterizing calendar entries as notifications or events.

**[0066]** FIG. 6 is an example of a calendar interface screen 600 for displaying calendar information within a vehicle. In the illustrated embodiment, the calendar interface screen 600 includes a notifications window 605 and an events window 610. The events window 610 comprises an ordered lists of upcoming calendar events (e.g., event N, event N+1, event N+2, etc), typically listed chronologically. The notifications window 605 provides a list of notifications. Notifications and events typically remain on display until cleared by the user, or may be configured to clear automatically after a specified time period. In one embodiment, both the notifications window 605 and the events window 610 include a "more" function that, when selected, cause the display to show additional events and /or notifications beyond those presently displayed.



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**[0067]** FIG. 7A-B illustrate specific examples of a calendar user interface and operation of the "more" function described above. FIG. 7A illustrates a user interface screen 702 showing a set of notifications and a set of events. The "..." below the list of events indicates that there are more events for the day following the events presently appearing in the events window. If the user selects the "more" function (designated by "..."), the display is updated to show the user interface screen 704. Interface screen 704 shows the additional events for the day (e.g., 4:30 PM Follow up Call, 7:30 PM Dinner with wife). Furthermore, the "..." above the list of events in interface screen 704 indicates that there are more events for the day prior to the events appearing in the events window. If the user selects the more function in user interface screen 704, the display returns to user interface screen 702.

**[0068]** FIG. 7B illustrates a user interface screen 706 showing another set of notifications and a set of events. The "..." below the list of notifications indicates that there are more notifications for the day following than those presently appearing in the events window. If the user selects the "more" function (designated by "..."), the display is updated to show user interface screen 708. Interface screen 708 shows the additional notifications for the day (e.g., Donna's Birthday). Furthermore, the "..." above the list of notifications in interface screen 708 indicates that there are additional notifications for the day prior to those appearing in the notifications window. If the user selects the more function in user interface screen 708, the display returns to user interface screen 706.

Voice Note Function

**[0069]** In one embodiment, a voice note feature allows a user to record a voice memo from within the vehicle 110. For example, the user may want to set a reminder for a newly scheduled appointment, document a new phone number or address, or record other important information for later retrieval. Beneficially, the driver can use the voice note function with minimal distraction and can therefore maintain his focus on navigating the vehicle.

**[0070]** FIG. 8 illustrates an exemplary process for processing a voice note in the vehicle environment. Various steps of the process are illustrated as being performed by the voice note server 160, the mobile device 120, and the in-vehicle system 112. In alternative embodiments, steps may be performed by different entities, or more than one entity may collectively carry out the described step.



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[0071] The in-vehicle system 112 detects and records 802 audio corresponding to a spoken voice note. In one embodiment, the user selects a voice note feature on the in-vehicle system 112 by, for example, manually selecting a menu option or providing a predefined voice command. The in-vehicle system 112 then prompts the user to speak and records the audio. In some embodiments, the in-vehicle system 112 divides the prompts into multiple parts to provide additional clarity. For example, for a calendar voice note, the in-vehicle 112 system may separately prompt the user to provide the event time, the event people, the event title, etc. according to the various metadata fields used for calendar entries. For a contacts voice note, the in-vehicle system 112 may separately prompt the user for the contact name, the contact address, the contact phone number, the contact email address, etc. according to the various metadata fields used for contacts entries. In other embodiments, the in-vehicle system 112 does not provide any prompt, but instead automatically begins recording when it detects the user speaking. In one embodiment, rather than the in-vehicle system 112 providing specific prompts for different metadata fields, the user may speak predefined tag words in order to separate different fields of the entry. For example, the user may speak the prompt "time" prior to speaking the time of the event, so that the system recognizes that the subsequent speech is a time entry and correlate the speech to the appropriate metadata fields. In another mode of operation, a user can edit a current calendar or contacts entry. For example, the user may select the entry to edit using menus on the in-vehicle system 112, or may use predefined voice commands to identify an entry. The user may then edit various fields using further voice commands.

[0072] Once the voice note is recorded to the in-vehicle system 112, the in-vehicle system 112 transfers 804 the recorded audio to the mobile device 120. The mobile device 120 receives 806 the voice note recording and uploads 808 the voice note recording to the voice note server 160 for processing. The voice note server 160 receives 801 the voice note and performs 812 speech-to-text conversion to convert the audio recording to text. The speech-to-text conversion may be achieved using conventional dictation software. The voice note server 160 then delivers 814 the dictated text back to the mobile device 120. Optionally, the voice note server 160 may also deliver 816 the audio file to the user via various services such as, for example, Short Message Service (SMS) or email, or the voice note server 160 may



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store the audio recording in association with a calendar entry or contacts entry of the user. Alternatively, the voice note server 160 may instead deliver a hyperlink to the user from which the audio file can be downloaded or streamed. This provides the user with the original sound file should the dictation not be available later on, or in case the dictation is not accurate.

**[0073]** The mobile device 120 receives the dictated text from the voice note server 160 and extracts 818 useful data from the dictated text. In this step, the mobile device 120 processes the dictated text to locate text relevant to a calendar entry and/or a contacts entry. For example, for a calendar voice note, the text may be searched for an event time, the participating parties, subject of the event, or other relevant fields. For a contacts voice note, the text may be searched for a contact name, a phone number, an address, or an email address, or other relevant fields. The data extraction can be simplified if the dictated text includes appropriate field tags separating the text into the various data fields.

**[0074]** The mobile device 120 then updates 820 the entries (e.g., calendar or contacts) according to the extracted text. These updates are then provided 822 to the vehicle in the manner described above. The in-vehicle system 112 receives 824 the updated calendar or contacts entries and updates 826 the display as appropriate.

**[0075]** The voice note feature thus allows a user to add or edit calendar or contacts entries within the vehicle 110 with little distraction. Furthermore, the feature maintains the original recorded speech and can provide to the user in case the dictation is not satisfactory.

Calendar Actions

**[0076]** Calendar entries generally identify an event's invitees and/or a location of the event. Commonly, the user will want to contact the invitees shortly before the scheduled event time, find an address of an invitee where the event may be held, or find a different address of the event referenced in the calendar entry. Thus, in one embodiment, the in-vehicle system 112 includes a feature for performing an action based on calendar metadata at the scheduled time of the event or at the scheduled notification time prior to the event. For example, the in-vehicle system 112 can dial a phone number of an invitee using the hands-free telephone unit 360. Additionally, the in-vehicle system 112 can input the address to the navigation unit 350 in order to generate a route to the meeting location.



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[0077] In order to determine the desired action, the in-vehicle system 112 performs a comparison and cross-linking of information between the calendar database 332 and the contacts database 334. Optionally, the in-vehicle system 112 may also correlate calendar and contacts data with POIs stored in the POI database 352 of the navigation unit 350. By automatically performing this cross-correlation of data, the user is relieved of manually performing this task and can therefore better focus on safely driving the vehicle.

[0078] FIG. 9 illustrates one embodiment of a process performed by the in-vehicle system 112 (e.g., using the MC application 320) for generating an action based on a calendar entry. The in-vehicle system 112 reads 902 the calendar data for a calendar entry. The in-vehicle system 112 then searches 904 the contacts database 334 and the POI database for possible matches to terms in the calendar entry. Matching weights are then assigned 906 to the matches based on the strength of the match. Various types of matching and ranking metrics may be used. For example, in one embodiment, a fuzzy search method is used that applies weights based on a similarity between text fields. Then, the matching metric is compared to a threshold, and entries above the threshold are accepted as matches.

[0079] The in-vehicle system 112 prompts 908 the user to select to call a contact or route to a destination. If the user selects 910 to call a contact, the in-vehicle system 112 displays 912 a list of potential contact matches ordered according to the matching weights (e.g., beginning with the strongest match). The user may then select a contact to call, and the telephone system 360 places the call 914 to the selected contact. In one embodiment, the list of matches may be limited those exceeding a minimum matching weight. Furthermore, if only one contact exceeds the minimum matching weight, the in-vehicle system 112 may automatically call the contact without first displaying the list.

[0080] Alternatively, if the user selects 916 to generate a route, the in-vehicle system display 918 a list of potential location matches ordered according to the matching weights (e.g., beginning with the strongest match). The location matches may either be an address associated with a matching contact from the contacts database 334 or a POI (or address of a POI) from the POI database 352. The user may then select an address or POI, and the navigation unit 350 generates 920 a route to the selected destination. In one embodiment, the list of matches may be limited



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those exceeding a minimum matching weight. Furthermore, if only one destination exceeds the minimum matching weight, the in-vehicle system 112 may automatically configure the navigation unit 350 to generate a route to the destination without first displaying the list.

**[0081]** In one embodiment, steps 902-908 are pre-processing steps that occur in advance of the scheduled event time. For example, steps 902-908 may be performed whenever calendar updates are received from the mobile device 120. Then steps 910-920 occur when a scheduled event time is reached, or a scheduled notification time prior to the event time. Alternatively, the in-vehicle system 112 may perform all steps (including steps 902-908) for each calendar entry as the calendar events occur rather than pre-processing them in advance. In yet another embodiment, one or more of the steps 902-920 may instead be performed by the mobile device 120.

**[0082]** FIG. 10 illustrates examples of user interface screens that the in-vehicle system 112 may display while executing the process described above. Interface screen 1002 comprises a display screen associated with a calendar entry. This calendar entry may be displayed, for example, when the user selects to view the entry from a list of calendar entries, or the entry may be displayed automatically when the notification time or event time is reached. The interface screen 1002 includes a route option 1004 and a call option 1006. If the user selects the call option 1006, interface screen 1008 is displayed. Interface screen 1008 shows a list of contacts (e.g., name and phone number) matching at least a portion of the calendar data. Here, items (1) and (2) in interface screen 1008 are displayed in bold indicating that those contacts are exact matches with the calendar metadata. If the user instead selects the route option 1004, interface screen 1010 is displayed. Interface screen 1010 shows a list of destinations (e.g., name and addresses) matching at least a portion of the calendar data. Items (1) and (2) in interface screen 1010 are displayed in bold indicating that they are those destinations are exact matches with the calendar metadata.

Calendar Alerts

**[0083]** The in-vehicle system 112 may include a calendar alert feature that provides visual alerts and/or audible alarms to notify the user about calendar events. Alerts are useful, for example, to remind the user of an upcoming event or the need to perform some action (e.g., an item on a "to-do list"). In one embodiment, calendar alerts are generated by the in-vehicle system 112 from calendar data stored in the



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vehicle's calendar database 332. Alternatively, the alerts may be generated by the mobile device 120 and transmitted to the vehicle system 112 as they occur. Unlike conventional calendar alerts which are designed for display on computer screens or mobile devices, the in-vehicle system 112 instead generates calendar alerts specifically designed for the vehicle environment. As a result, the alerts can be viewed and managed by the driver with minimal distraction.

**[0084]** FIG. 11 illustrates an embodiment of a process for providing in-vehicle alerts based on calendar entries. The in-vehicle system 112 processes 1102 calendar entries in the calendar database 332 to add alerts to the alert database 336. Each entry in the alert database 336 may include various metadata fields that include information related to the alert such as, for example, alert time, alert message, alert audio, and alert action. The alert time field indicates the time (e.g., day, hour, minute) at which the alert will be triggered. Alert times can be extracted from the notification time included with calendar entry. For example, an alert may be set to trigger 15 minutes before an event time, 30 minutes before an event time, 24 hours before an event time, or another fixed time period. Alternatively, the alert may be set to trigger at the same time as the event time for the calendar entry. The alert message field indicates a message that will be displayed when the alert is triggered. This may correspond to information in the related calendar entry, or may be an entirely different message. The alert audio field identifies an audible alert, if any, that will be played when the alert triggers. The user may choose the alert audio when setting the alert from one of a stored set of possible audible alerts, or a default alert audio may be used. The alert action field identifies an action to be taken when the alert is triggered such as, for example, dialing a particular phone number, generating a route to a particular destination, or loading a particular website.

**[0085]** The in-vehicle system 112 continuously monitors 1106 the current time to determine when the current time matches an alert time in one of the stored alerts in the alert database 336. If the current time does not match any alert time, the in-vehicle system 112 continues monitoring 1106. If an alert is triggered 1108 (i.e., when the current time matches an alert time), the in-vehicle system 112 displays 1110 a visual alert (which may include the alert message) and activates 1112 an audible alert (which may include the selected alert audio). When an alert is activated, the user may have the option of selecting a snooze function. The snooze function allows the



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user to delay the alert for a predefined time period (i.e., a "snooze time"). The snooze time may be a default value (e.g., 10 minutes) or the in-vehicle system 112 may present the user the option of selecting a desired snooze time. If the snooze function is not activated at step 1114, the alert is completed and the alert is removed 1116 from the alert database 336. If the snooze function is active at step 1114, the display is updated 1118 to indicate that the alert has been "snoozed." The in-vehicle system 112 then updates 1120 the alert time for the snoozed alert according to the snooze time (e.g., by adding the snooze time to the previously configured alert time). The in-vehicle system 112 then continues to monitor 1106 alerts. This includes monitoring for when the current time matches the updated alert time of a snoozed alert.

**[0086]** FIGS. 12A and 12B illustrate examples of user interface screens displayed by the in-vehicle system 112 when carrying out the alert process described above. FIG. 12A illustrates an example of an interface screen 1204 that is displayed when an alert is triggered. A notification window 1202 includes information from the calendar entry including the time and subject of the scheduled event (in this example, "9:30AM: Meet with John to discuss new interface"). The notification window 1202 also indicates an estimated time until the scheduled event (in this example, less than 50 minutes). The notification window 1202 includes a snooze button 1206, that when selected, activates the snooze function described above. Furthermore, the notification window 1202 includes route button 1208 and call button 1210 that when selected, causes the in-vehicle system 112 to take the selected action as described above. Additionally, the notification window 1202 includes an icon 1212 and a Multiple Information Display (MID) bar 1204. In one embodiment, the notification window 1202 automatically pops up on the display screen when the alert is triggered. The icon 1212 can comprise any icon designated by the in-vehicle system 1212 or by the notification parameters. For example, in the case of an alert for a meeting, the icon 1212 could symbolize a meeting. In the case of an alert for a person's birthday, the icon 1212 could be a picture of the person. The MID bar 1204 typically displays information for various gauges such as odometer information and other related item. In one embodiment, the MID bar 1204 may be displayed on any of the display screens so that the information is continuously available to the user.

**[0087]** FIG. 12B illustrates an example of an interface screen that is displayed when the user selects the snooze function. A notification bar 1222 is displayed



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indicating that a previous alert has been snoozed. In one embodiment, the notification bar 1222 could instead display the next scheduled event as a convenient reminder to the user. While the alert is snoozed, the user can view other screens in the "any screen" window 1224 (e.g., audio control screen, navigations screen, etc.) In one embodiment, when the snooze function is activated, the any screen window 1224 automatically returns to the screen previously displayed prior to activation of the alert. The MID bar 1226 is also displayed as described above.

**[0088]** The features described herein thus allow a user to view and manage an electronic calendar and related functions within a vehicle 110. Beneficially, by utilizing a mobile device 120 connected to the vehicle 110, the in-vehicle system 112 itself need not be equipped with direct internet connectivity, and much of the data processing can be performed by the VC application 212 on the mobile device 120 rather than by the in-vehicle system 112. This therefore reduces the cost of the vehicle 110 to buyers, and allows current vehicle owners to simply download an application to their mobile device 120 without having to install a new in-vehicle system 112. Furthermore, because the calendar data and related features are specifically formatted for use in a vehicle, a driver can safely view and manage the electronic calendar with minimal distraction.

**[0089]** Upon reading this disclosure, those of skill in the art will appreciate still additional alternative designs for calendar sharing in the vehicle environment using a connected phone, having the features described herein. Thus, while particular embodiments and applications of the present invention have been illustrated and described, it is to be understood that the invention is not limited to the precise construction and components disclosed herein and that various modifications, changes and variations which will be apparent to those skilled in the art may be made in the arrangement, operation and details of the method and apparatus of the present invention disclosed herein without departing from the spirit and scope of the invention as defined in the appended claims.



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WHAT IS CLAIMED IS:

1. A method for providing an electronic calendar for display within a vehicle, the method comprising:

receiving, by a mobile device, first calendar data from a first calendar source the first calendar source storing the first calendar data in a first native calendar format specific to the first calendar source;

converting the first calendar data formatted in the first native calendar format to a vehicle calendar format suitable for transfer to an in-vehicle system; and

transferring, using a short-range communication protocol, the converted calendar data from the mobile device to the in-vehicle system.

2. The method of claim 1, further comprising:

receiving, by the mobile device, calendar data from a second calendar source the second calendar source storing the calendar data in a second native calendar format specific to the second calendar source, the second native calendar format different than the first native calendar format;

converting the second calendar data formatted in the second native calendar format to the vehicle calendar format suitable for transfer to the in-vehicle system; and

aggregating the first and second calendar data to remove duplicate calendar entries.

3. The method of claim 2, wherein the first calendar source comprises a first network-based calendar server and the second calendar source comprises a second network-based calendar server.

4. The method of claim 2, wherein the first calendar source comprises a first network-based calendar server and the second calendar source comprises a calendar application executable by the mobile device.

5. The method of claim 1, further comprising:

scaling the first calendar data to extract calendar entries falling within a predefined time range, the predefined time range smaller than a time range of the first calendar data received in the first native calendar format.

6. The method of claim 1, further comprising;



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filtering the first calendar data to remove at least one of hyperlinks, special characters, and attachments from calendar entries.

7. The method of claim 1, further comprising:

receiving, from the in-vehicle system, updated calendar data reflecting a change to a calendar entry made using the in-vehicle system, the updated calendar data in the vehicle calendar format;

converting the updated calendar data in the vehicle calendar format to the first native calendar format; and

providing the updated calendar data to the first calendar source in the first native calendar format.

8. The method of claim 1, further comprising:

detecting a refresh trigger event; and

responsive to the detecting the refresh trigger event, requesting a refresh of the first calendar data from the first calendar source.

9. The method of claim 8, wherein detecting the refresh trigger event comprises receiving a signal from the in-vehicle system indicating vehicle ignition.

10. The method of claim 8, wherein detecting the refresh trigger event comprises detecting that a predefined time period has elapsed since a last refresh.

11. The method of claim 1, further comprising:

receiving a voice note from the in-vehicle system, the voice note comprising an audio recording of spoken words;

obtaining dictated text comprising a speech-to-text conversion of the spoken words;

creating a new calendar entry scheduling an event described in the dictated text; and

transferring the new calendar entry to the in-vehicle system.

12. The method of claim 10, wherein obtaining the dictated text comprises:

uploading the voice note to a voice note server for processing; and

receiving the dictated text from the voice note server.

13. A computer-readable storage medium storing instructions executable by a processor, the instructions when executed cause the processor to perform steps including:



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receiving first calendar data from a first calendar source the first calendar source storing the first calendar data in a first native calendar format specific to the first calendar source;

converting the first calendar data formatted in the first native calendar format to a vehicle calendar format suitable for transfer to an in-vehicle system; and

transferring, using a short-range communication protocol, the converted calendar data from the mobile device to the in-vehicle system.

14. The computer-readable storage medium of claim 13, wherein the instruction when executed further cause the processor to perform steps including:

receiving calendar data from a second calendar source the second calendar source storing the calendar data in a second native calendar format specific to the second calendar source, the second native calendar format different than the first native calendar format;

converting the second calendar data formatted in the second native calendar format to the vehicle calendar format suitable for transfer to the in-vehicle system; and

aggregating the first and second calendar data to remove duplicate calendar entries.

15. A method for managing an electronic calendar within a vehicle environment, the method comprising:

receiving, by an in-vehicle computing system, calendar data comprising a plurality of calendar entries, the calendar data received from a mobile device via a short-range communication protocol;

generating a user interface for displaying the calendar data, the user interface comprising an events window for displaying a representation of scheduled calendar events, and a notifications window for displaying a representation of calendar notifications; and

outputting the user interface to a in-vehicle display.

16. The method of claim 15, wherein the calendar events comprise calendar entries having a non-zero time period and wherein the calendar notifications comprise calendar entries without a non-zero time period.

17. The method of claim 15, wherein the user interface further comprises:



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a more events function that when selected by a user updates the user interface to display additional events scheduled before or after the scheduled calendar events in the events window;

18. The method of claim 15, wherein the user interface further comprises:

a more notifications function that when selected by a user updates the user interface to display additional notifications scheduled before or after the scheduled calendar notifications in the notifications window.

19. The method of claim 15, further comprising:

correlating the calendar entries with contacts entries to locate potential matches between metadata of the calendar entries and metadata of the contacts entries; and

responsive to reaching a scheduled time for a calendar entry, initiating an action using the potential matches.

20. The method of claim 19, wherein initiating the action comprises:

displaying a list of contact entries that include a contact name matching at least a portion of an event invitee in the calendar entry or a contact address matching at least a portion of the event location in the calendar entry.

21. The method of claim 20, further comprising:

responsive to a receiving a selection of one of the list of contact entries, placing a telephone call using a telephone number associated with the selected contact entry.

22. The method of claim 20, further comprising:

responsive to a receiving a selection of one of the list of contact entries, generating a navigation route to an address associated with the selected contact entry.

23. The method of claim 19, wherein initiating the action comprises:

displaying a list of point of interest that match at least a portion of an event location in the calendar entry; and

responsive to a receiving a selection of one of the list of points of interest, generating a navigation route to an address associated with the selected point of interest.

24. The method of claim 15, further comprising:



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storing to an alert database one more scheduled calendar alerts, each calendar alert associated with a calendar entry and comprising a scheduled alert time;

determining when a current time matches the scheduled alert time;

responsive to the current time matching the scheduled alert time, triggering an alert.

25. The method of claim 24, wherein triggering the alert comprises at least one of:

displaying a visual message on the vehicle display; and

activating and audible alert.

26. The method of claim 24, further comprising:

receiving a snooze request for the triggered alert;

updating the alert time by adding a predefined snooze time to the alert time; and

storing the updated alert time to the alert database.

27. A system for managing an electronic calendar within a vehicle environment, the system comprising:

a short-range communication device for receiving calendar data comprising a plurality of calendar entries from a mobile device via a short-range communication protocol; and

an in-vehicle display for displaying a user interface showing the received calendar data, the user interface comprising an events window displaying a representation of scheduled calendar events, and a notifications window displaying a representation of calendar notifications.



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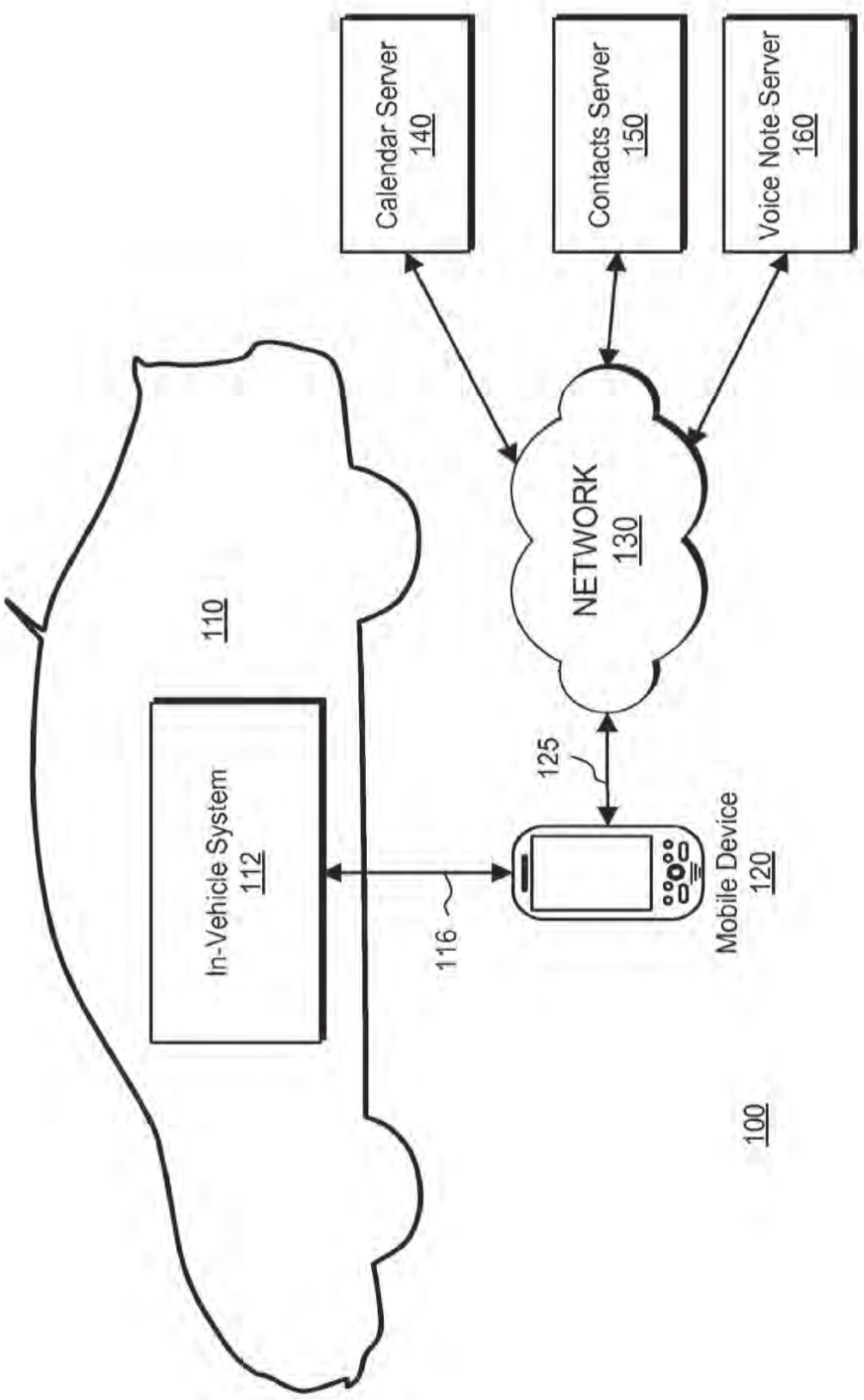
Calendar Server
140
Contacts Server
150
Voice Note Server
160
NETWORK
130
110
In-Vehicle System
112
125
116
Mobile Device
120
100

FIG. 1

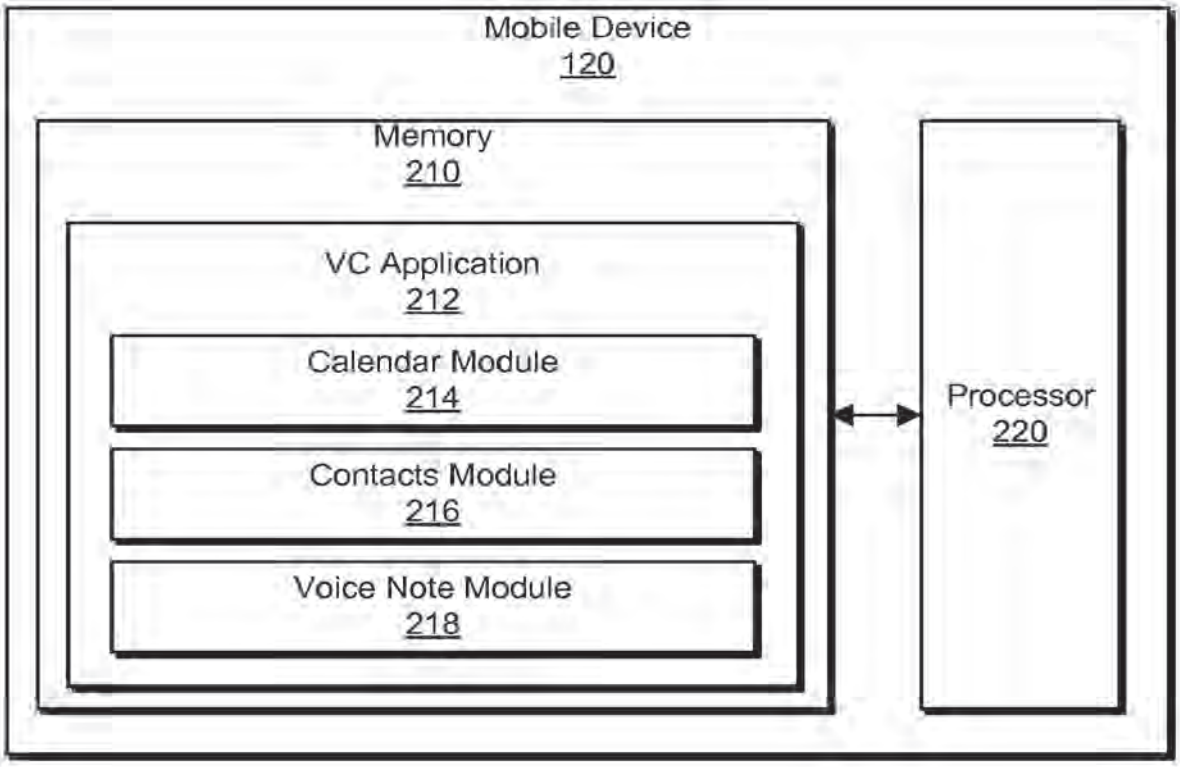
Mobile Device
120
Memory
210
VC Application
212
Calendar Module
214
Contacts Module
216
Voice Note Module
218
Processor
220

FIG. 2

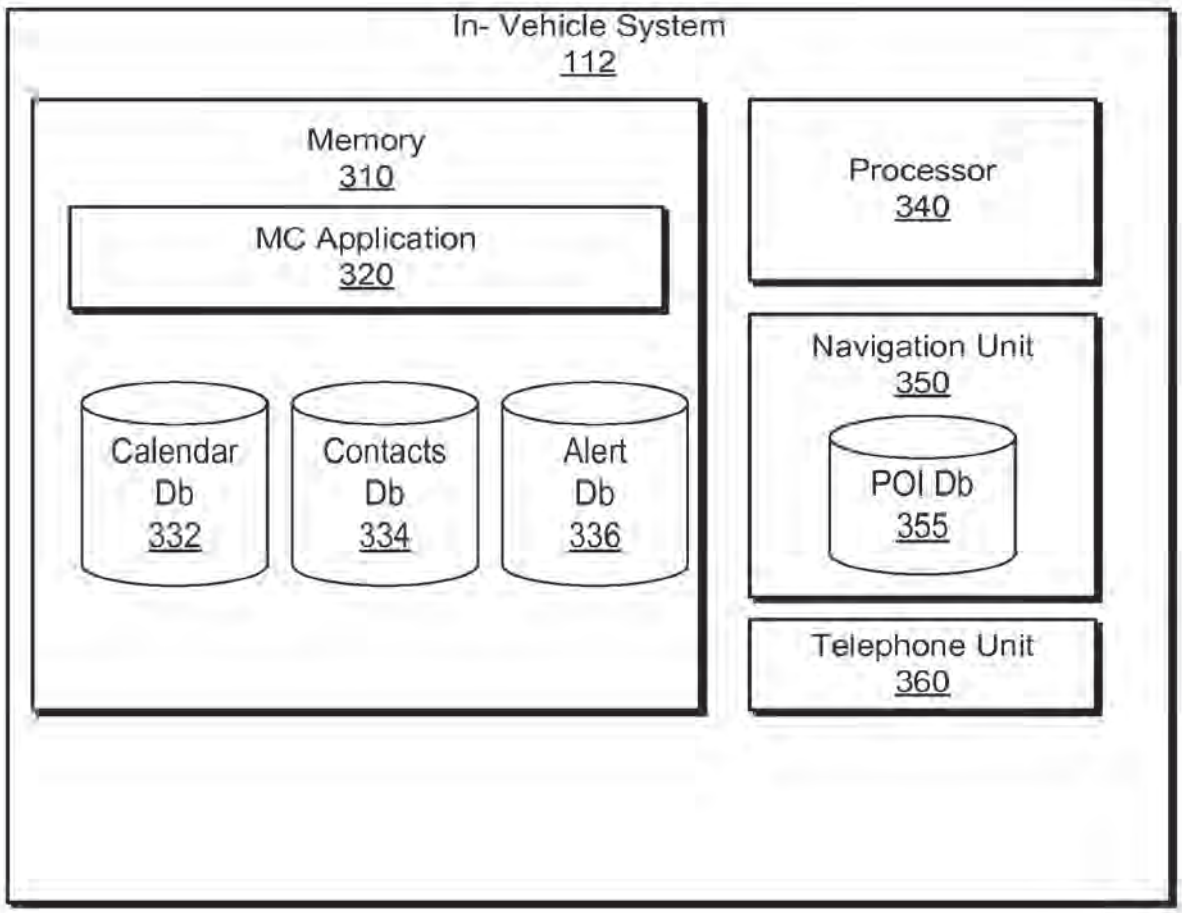
In- Vehicle System
112
Memory
310
MC Application
320
Calendar
Db
332
Contacts
Db
334
Alert
Db
336
Processor
340
Navigation Unit
350
POI Db
355
Telephone Unit
360

FIG. 3

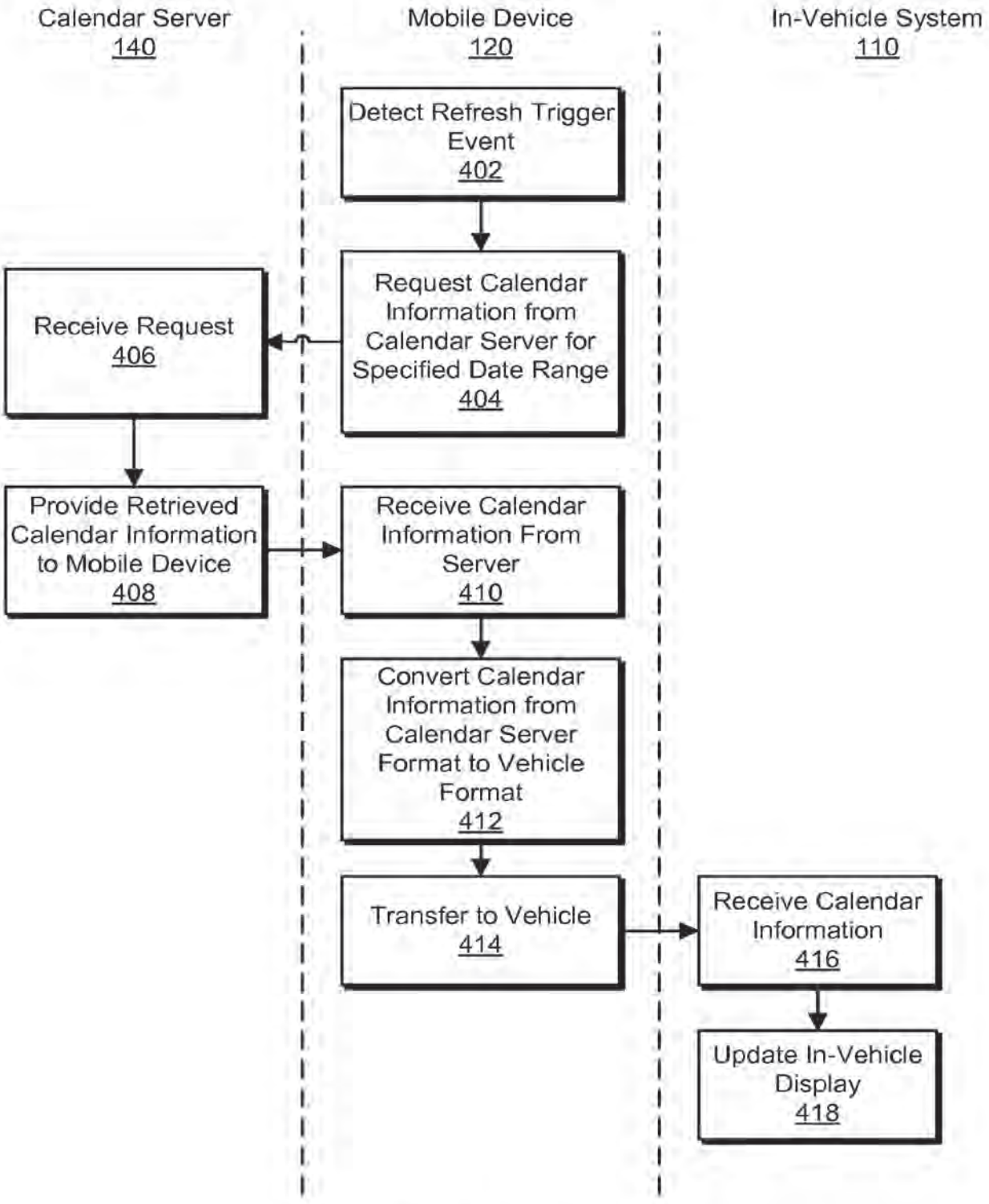
Calendar Server
140
Mobile Device
120
In-Vehicle System
110
Detect Refresh Trigger Event
402
Request Calendar Information from Calendar Server for Specified Date Range
404
Receive Request
406
Provide Retrieved Calendar Information to Mobile Device
408
Receive Calendar Information From Server
410
Convert Calendar Information from Calendar Server Format to Vehicle Format
412
Transfer to Vehicle
414
Receive Calendar Information
416
Update In-Vehicle Display
418

FIG. 4

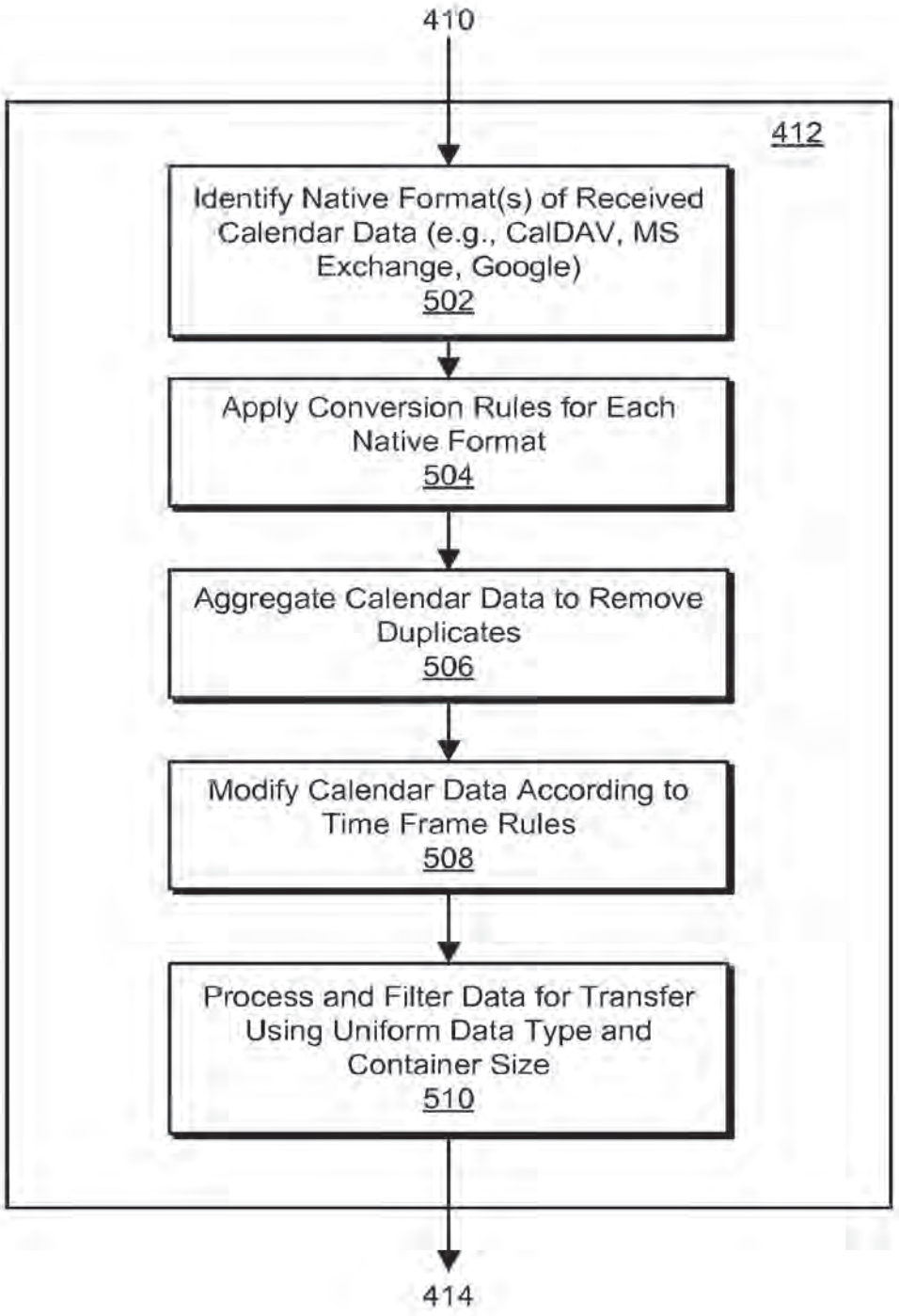
410
412
Identify Native Format(s) of Received Calendar Data (e.g., CalDAV, MS Exchange, Google)
502
Apply Conversion Rules for Each Native Format
504
Aggregate Calendar Data to Remove Duplicates
506
Modify Calendar Data According to Time Frame Rules
508
Process and Filter Data for Transfer Using Uniform Data Type and Container Size
510
414

FIG. 5

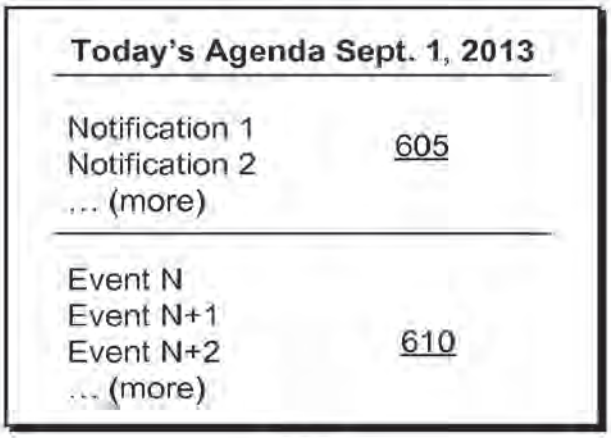
Today's Agenda Sept. 1, 2013
Notification 1
Notification 2
... (more)
605
Event N
Event N+1
Event N+2
... (more)
610
600

FIG. 6

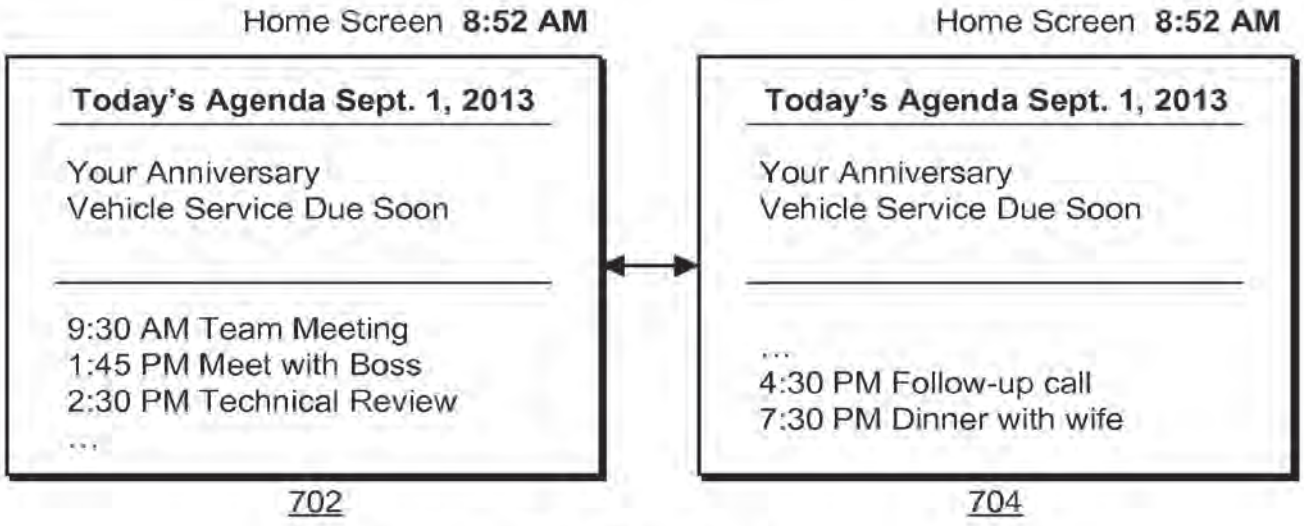
Home Screen 8:52 AM
Today's Agenda Sept. 1, 2013
Your Anniversary
Vehicle Service Due Soon
9:30 AM Team Meeting
1:45 PM Meet with Boss
2:30 PM Technical Review
...
Home Screen 8:52 AM
Today's Agenda Sept. 1, 2013
Your Anniversary
Vehicle Service Due Soon
...
4:30 PM Follow-up call
7:30 PM Dinner with wife
702
704

FIG. 7A

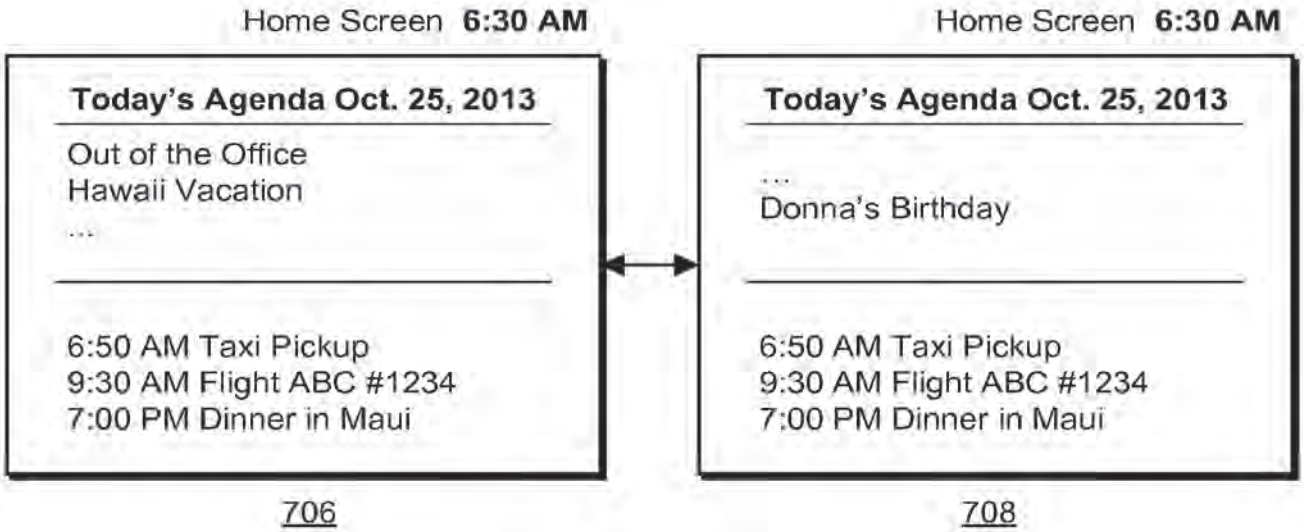
Home Screen 6:30 AM
Today's Agenda Oct. 25, 2013
Out of the Office
Hawaii Vacation
...
6:50 AM Taxi Pickup
9:30 AM Flight ABC #1234
7:00 PM Dinner in Maui
Home Screen 6:30 AM
Today's Agenda Oct. 25, 2013
...
Donna's Birthday
6:50 AM Taxi Pickup
9:30 AM Flight ABC #1234
7:00 PM Dinner in Maui
706
708

FIG. 7B

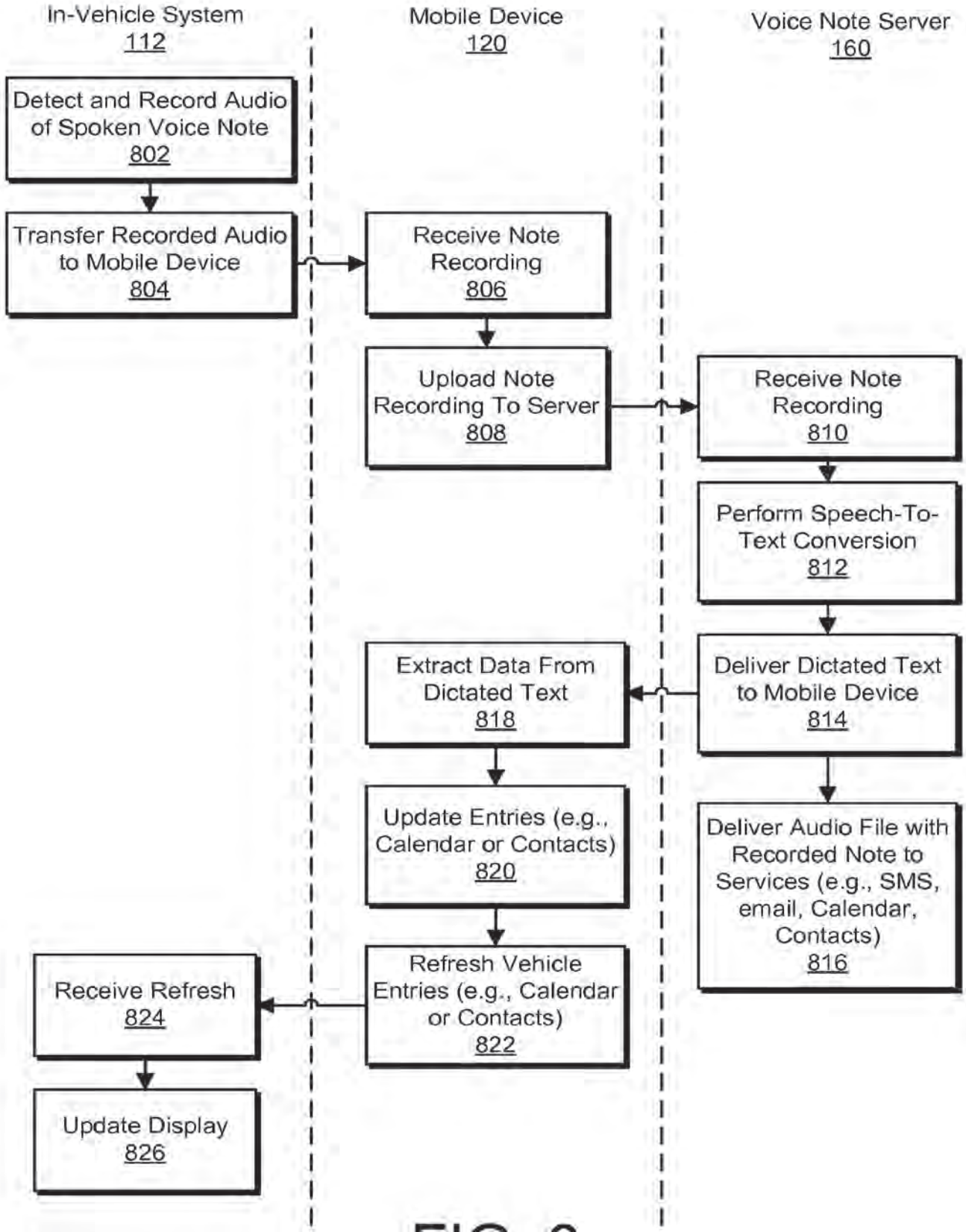
In-Vehicle System
112
Mobile Device
120
Voice Note Server
160
Detect and Record Audio of Spoken Voice Note
802
Transfer Recorded Audio to Mobile Device
804
Receive Note Recording
806
Upload Note Recording To Server
808
Receive Note Recording
810
Perform Speech-To-Text Conversion
812
Deliver Dictated Text to Mobile Device
814
Deliver Audio File with Recorded Note to Services (e.g., SMS, email, Calendar, Contacts)
816
Extract Data From Dictated Text
818
Update Entries (e.g., Calendar or Contacts)
820
Refresh Vehicle Entries (e.g., Calendar or Contacts)
822
Receive Refresh
824
Update Display
826

FIG. 8

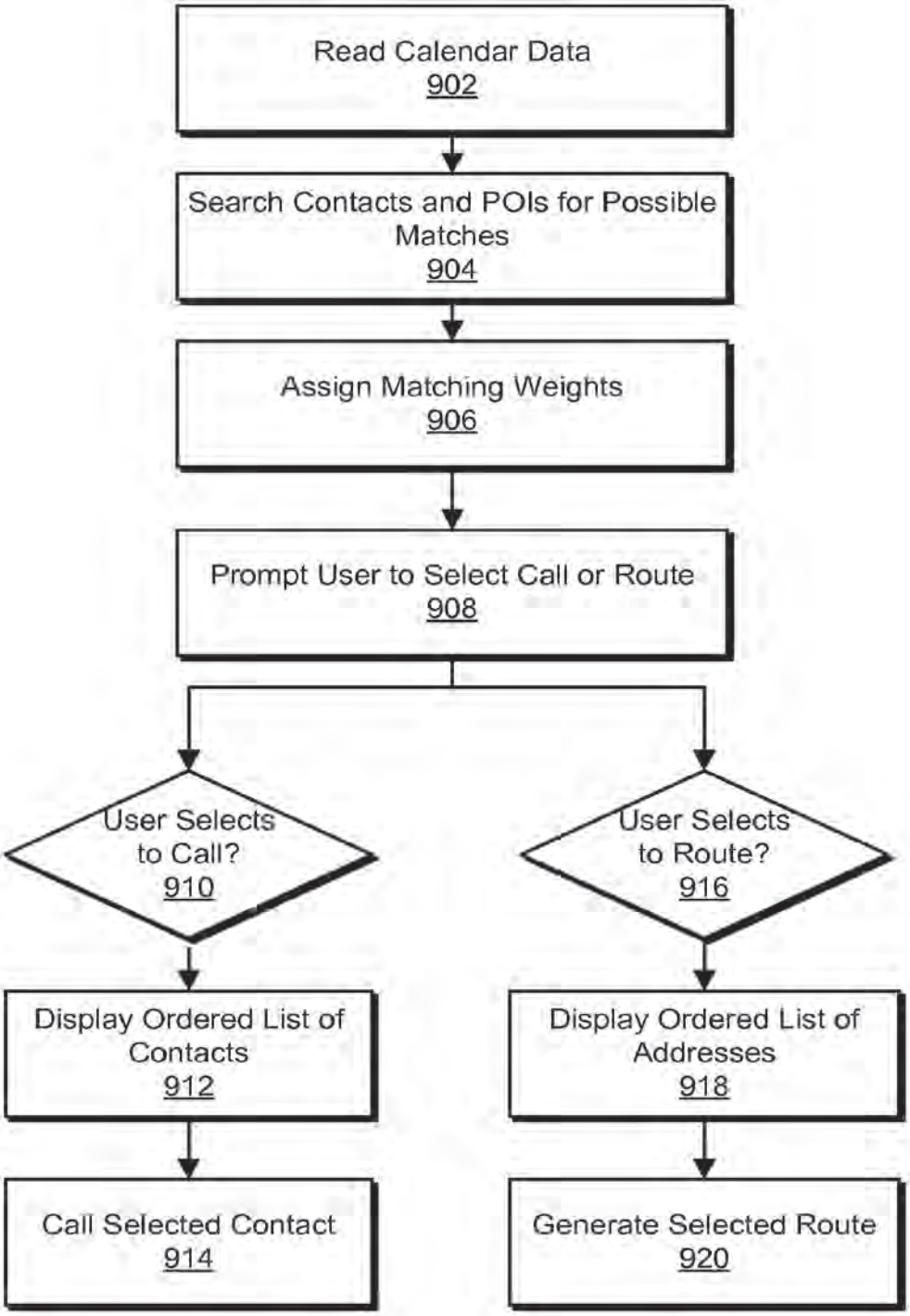
Read Calendar Data
902
Search Contacts and POIs for Possible Matches
904
Assign Matching Weights
906
Prompt User to Select Call or Route
908
User Selects to Call?
910
User Selects to Route?
916
Display Ordered List of Contacts
912
Display Ordered List of Addresses
918
Call Selected Contact
914
Generate Selected Route
920

FIG. 9

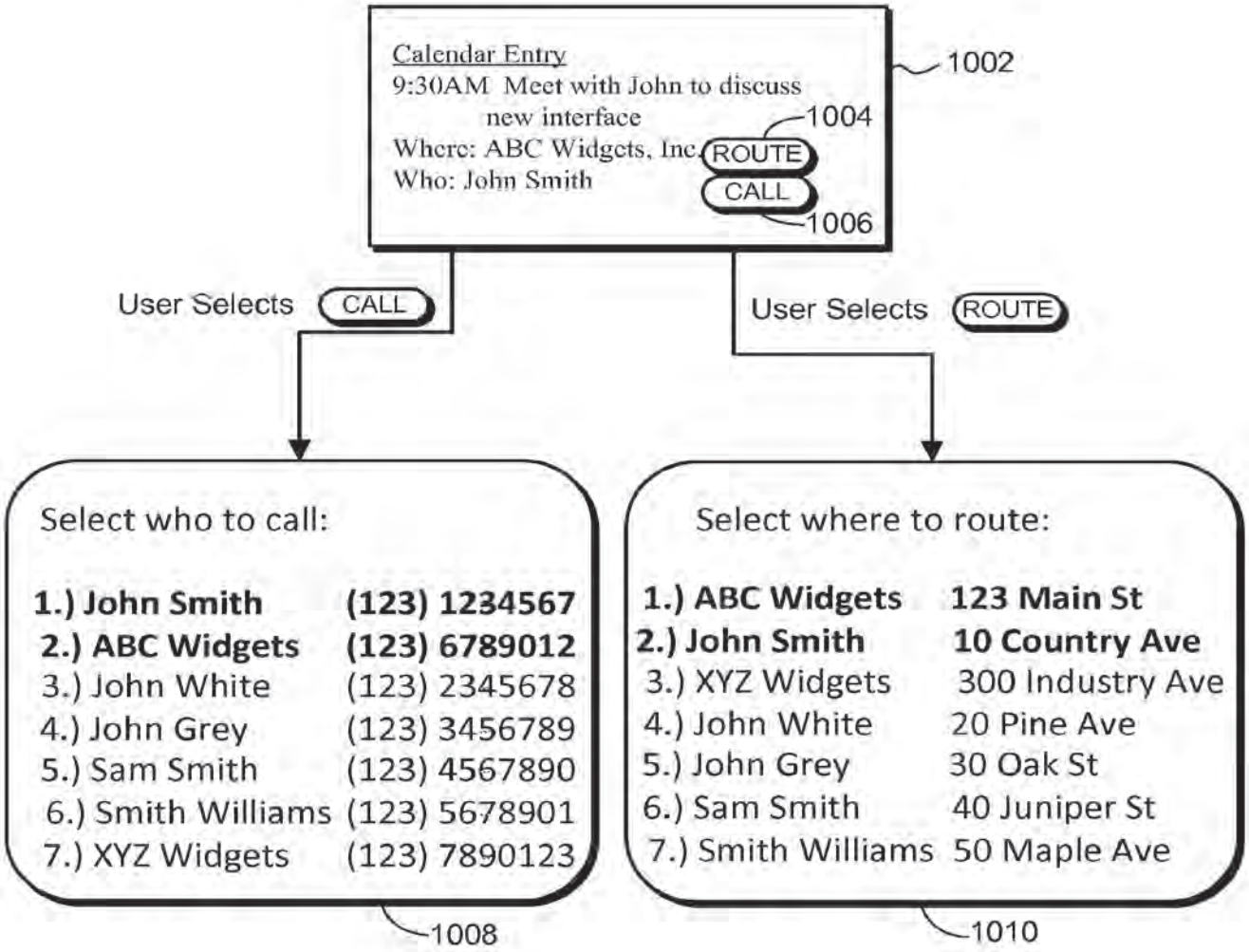
Calendar Entry
9:30AM Meet with John to discuss new interface
Where: ABC Widgets, Inc.
Who: John Smith
ROUTE
CALL
1002
1004
1006
User Selects CALL
User Selects ROUTE
Select who to call:
1.) John Smith (123) 1234567
2.) ABC Widgets (123) 6789012
3.) John White (123) 2345678
4.) John Grey (123) 3456789
5.) Sam Smith (123) 4567890
6.) Smith Williams (123) 5678901
7.) XYZ Widgets (123) 7890123
1008
Select where to route:
1.) ABC Widgets 123 Main St
2.) John Smith 10 Country Ave
3.) XYZ Widgets 300 Industry Ave
4.) John White 20 Pine Ave
5.) John Grey 30 Oak St
6.) Sam Smith 40 Juniper St
7.) Smith Williams 50 Maple Ave
1010

FIG. 10

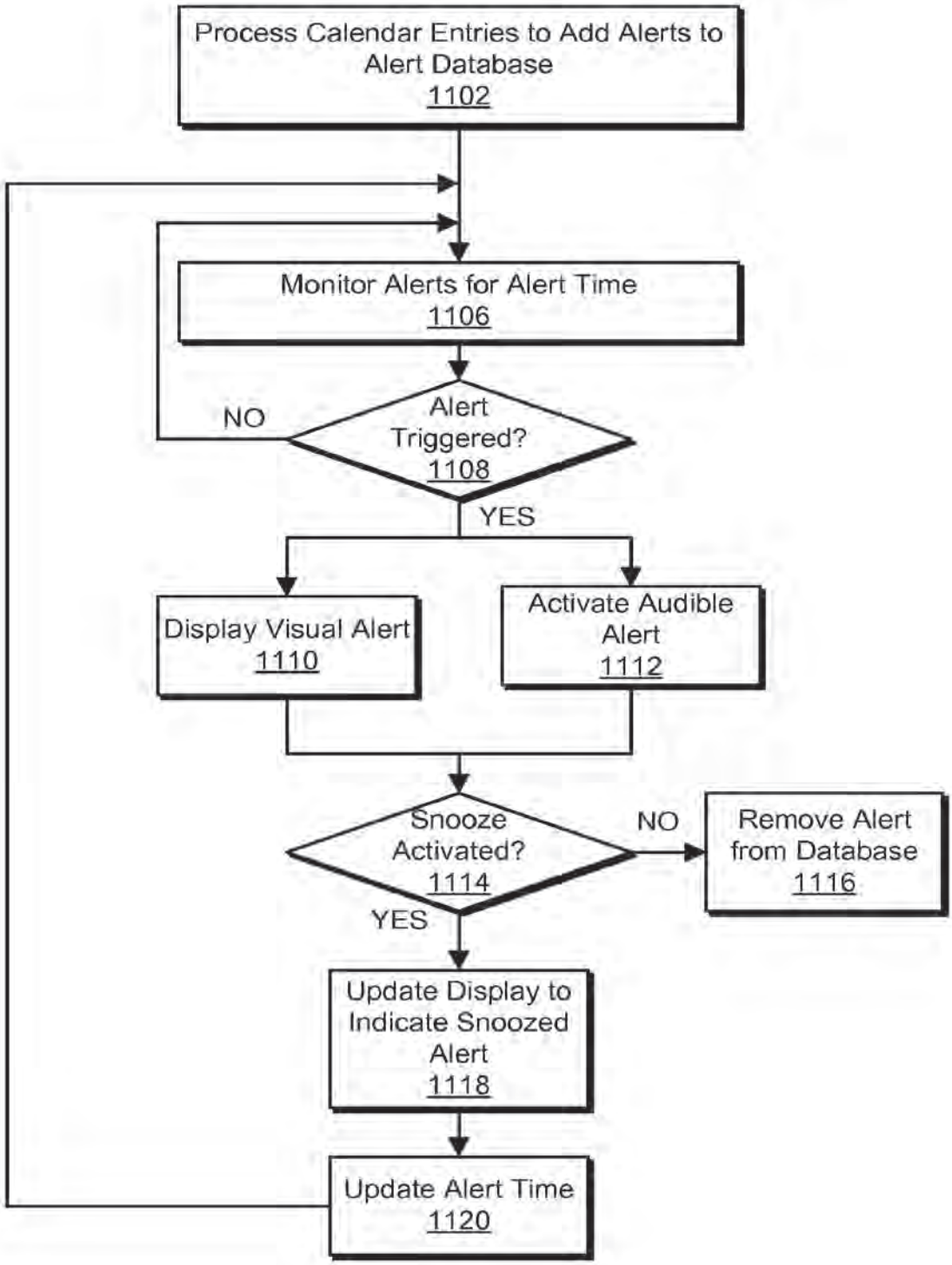
Process Calendar Entries to Add Alerts to Alert Database
1102
Monitor Alerts for Alert Time
1106
Alert Triggered?
1108
NO
YES
Display Visual Alert
1110
Activate Audible Alert
1112
Snooze Activated?
1114
NO
Remove Alert from Database
1116
YES
Update Display to Indicate Snoozed Alert
1118
Update Alert Time
1120

FIG. 11

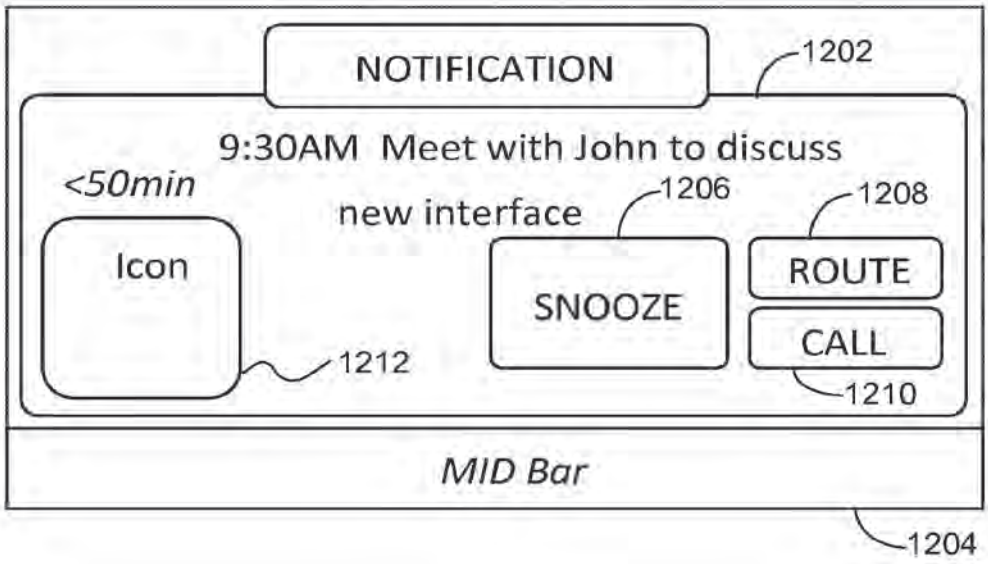


FIG. 12A

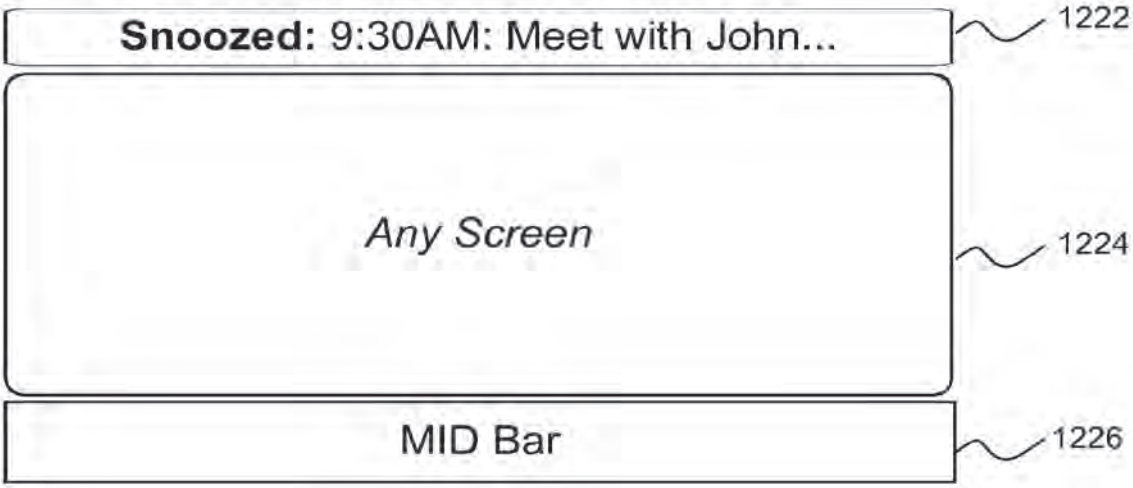


FIG. 12B

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 12/21314

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - G06Q 50/00 (2012.01)
USPC - 705/6
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(8): G06Q 50/00 (2012.01)
USPC: 705/6

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 701/1, 7.13, 7.15, 7.16, 7.18, 32.4, 36, 49, 55, 409, 412, 468; 368/10, 28; 709/203, 220; 719/318, 328 (view search terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST: (PGPB, USPT, EPAB, JPAB); Google Scholar
Search Terms: vehicle calendar, in-car calendar, mobile device, calendar, receive calendar, calendar source, format, reformat, convert, transform, short-range communication, Bluetooth, wi-fi, display, second calendar, aggregate, merge, join, remove duplicate

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X<br>—<br>Y | US 2010/0306309 A1 (SANTORI et al.) 02 December 2010 (02.12.2010) entire document, especially abstract; para [0010], [0012], [0014], [0030]-[0038], [0041]-[0044], [0047]-[0051], [0053]-[0055], [0057]-[0058], [0062], [0064]-[0065], [0070], [0073]-[0080], [0089], [0094]. | 1-8, 10-18, 24, 25, 27<br>---<br>9, 19-23, 26 |
| Y | US 2009/0106036 A1 (TAMURA et al.) 23 April 2009 (23.04.2009) entire document, especially abstract; para [0064], [0070]. | 9 |
| Y | US 2009/0177745 A1 (DAVIS et al.) 09 July 2009 (09.07.2009) entire document, especially abstract; para [0038]-[0040], [0082], [0099], [0136]-[0146]. | 19-23 |
| Y | US 2006/0010206 A1 (APACIBLE et al.) 12 January 2006 (12.01.2006) entire document, especially abstract; para [0143], [0172], [0203], [0208], [0234]. | 26 |
| A | US 2009/0157513 A1 (BONEV et al.) 18 June 2009 (18.06.2009) entire document. | 1-27 |

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"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 |
|---|---|
| 17 April 2012 (17.04.2012) | 08 MAY 2012 |
| Name and mailing address of the ISA/US<br>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents<br>P.O. Box 1450, Alexandria, Virginia 22313-1450<br>Facsimile No. 571-273-3201 | Authorized officer:<br>Lee W. Young<br>PCT Helpdesk: 571-272-4300<br>PCT OSP: 571-272-7774 |

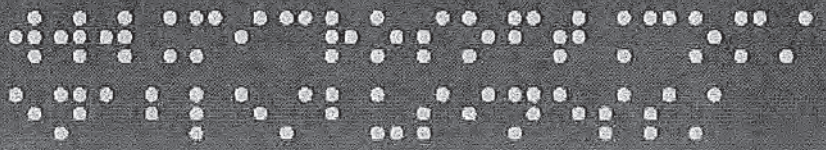
Form PCT/ISA/210 (second sheet) (July 2009)

Microsoft

# Accessibility

## A Guide for Businesses and Organizations

Empowering employees, customers and partners
with accessible technology



www.microsoft.com/enable/business/

# Accessibility:

## A Guide for Businesses and Organizations

Empowering employees, customers, and partners with accessible technology

www.microsoft.com/enable/business/

Published by Microsoft Corporation
Trustworthy Computing
One Microsoft Way
Redmond, Washington 98052-6399

Managing editor: Bonnie Kearney, Trustworthy Computing, Accessibility Outreach

First edition. Published in 2011.

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# About this guide

## Purpose of this guide

In an era when technology is redefining the workplace and creating a knowledge-based global economy that places a high value on communication, collaboration, and mobility, accessibility is increasingly essential in doing business. Accessible technology addresses the personal needs of all computer users, including those with physical disabilities, learning and language impairments, and age-related limitations, making it easier for organizations to empower employees, serve customers, and engage with partners.

This guide from Microsoft® provides information about accessibility and accessible technology to help organizations worldwide ensure that all the people they serve or engage have equal access to information and services. For organizations new to accessibility and working with people with disabilities, accessibility can sometimes seem overwhelming. To help your organization meet the needs of people with all types of abilities, this guide provides specific information about many types of impairments and some of the accessible technology solutions that help address them.

## How to use this guide

Chapter 1 provides an overview of accessibility, defines accessible technology, and discusses why it is important for organizations to make accessibility an integral part of their business.

Chapter 2 is organized by the types of disabilities and the accessibility solutions available to help individuals who have disabilities. The chapter defines each type of impairment and offers examples of accessibility features and assistive technology products that are helpful in addressing and accommodating these impairments.

Chapter 3 provides more in-depth information, including an overview of accessibility features in the most recent versions of the Windows® operating system, Windows Internet Explorer®, and Microsoft Office. This chapter also includes more details about assistive technology products and resources to help you find and select assistive technology products for your employees or other users.

Chapter 4 provides guidance on planning and training for accessibility and gives an overview to the online accessibility trainings provided in CD format at the back of this guide and available online at http://msdn.microsoft.com/accessibility. These trainings are designed to help organizations create more accessible software products using the Windows platform.

## Download

This guide is available for download on the Microsoft Accessibility website (www.microsoft.com/enable/business/).



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# Chapter 1: Accessibility in the workforce

Over the past three decades, innovations such as personal computers, the Internet, mobile devices, and cloud computing have revolutionized how people work, communicate, and get information. These advances, in turn, have dramatically changed the way we do business. And as technology continues to transform the workplace, demand is growing for accessible technology that can accommodate the needs and preferences of all users.

Businesses and organizations—from government agencies and universities to utilities and financial institutions—are looking for more effective ways to engage customers; to recruit, empower, and retain valuable employees; and to increase efficiency and productivity across their organizations. In today's connected world, technology is at the heart of all these initiatives. Yet to achieve those goals, organizations must make technology and its benefits accessible to the largest possible number of people—regardless of age or ability.

Accessible technology can make it easier for anyone to see, hear, and use a computer. It enables people with a wide range of abilities—including those with disabilities, age-related impairments, or temporary limitations, in addition to novice computer or web users—to adjust technology to accommodate their individual visual, dexterity, hearing, learning, and language needs and preferences or to modify their personal technology experience.

Microsoft is one of the technology industry leaders in accessibility innovation, in building products that are safer and easier to use, such as Windows 7 and Microsoft Office 2010, and in providing a platform that enables other companies to develop their own accessible technology solutions. Creating technology products that are accessible to everyone, regardless of age or ability, is an integral part of the Microsoft corporate mission: *to help people and businesses throughout the world to realize their full potential.*

This chapter introduces accessibility, defines more precisely what accessible technology is, and explains why it is important to modern businesses and organizations.



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## What is *accessibility*, what is *accessible technology*?

For the purpose of this guide, we define *accessible technology* as any computer technology that individuals can adjust to accommodate their vision, dexterity, hearing, cognitive, and speech needs or that businesses and organizations can use to make online information and services accessible to more people.

For many people with disabilities, *accessibility* is what makes computer use possible, but accessibility has much broader applications. Accessibility makes it easier for *anyone* to see, hear, and use a computer and to personalize their computers to meet their own needs and preferences. If technology is truly accessible, it can be adjusted to meet the needs and preferences of people with a wide range of abilities—not just those with severe disabilities.

Actually, most people who use computers also benefit from at least a few accessibility features and settings that enable them to personalize their computers and work environments, such as changing font sizes and styles, background images, colors, and computer sounds.

For businesses and organizations, accessible technology encompasses five elements:

- **Accessibility features or settings** that are built into software programs to allow users to adjust and customize product settings to meet their vision, dexterity, hearing, language, and learning needs. In Windows, for example, changing the font size and color and the mouse pointer options are accessibility settings. Windows, Office, and Internet Explorer include many accessibility features and settings that make it easier for users to see, hear, and use their computer.
- **Assistive technology products** (specialty hardware devices or software programs) that are specially designed and carefully chosen to accommodate either a specific disability or multiple disabilities. Examples include a screen magnification program for a computer user who has low vision or an ergonomic keyboard for a computer user with arthritis.
- **Web accessibility** design features that make it easier for people with certain disabilities to understand online content or to access online services. Examples include text enlargement for people with low vision and text equivalents of photos, graphics, and video files that work with assistive screen readers used by people who are blind.
- **Internal business applications**, such as intranets and internal purchasing applications, that are accessible to all employees.
- **Compatibility between assistive technology products**, the operating system, and software programs. This is critical for assistive technology products to function properly.

This guide presents accessibility features and assistive technology products that are compatible with the Windows operating system. Many of the accessibility features available in Windows 7 and Windows Vista can be found through the Ease of Access Center (located in the Control Panel). The Ease of Access Center (Figure 1-1) provides a convenient, centralized place where people can find accessibility settings and programs to help make their computers easier to use.



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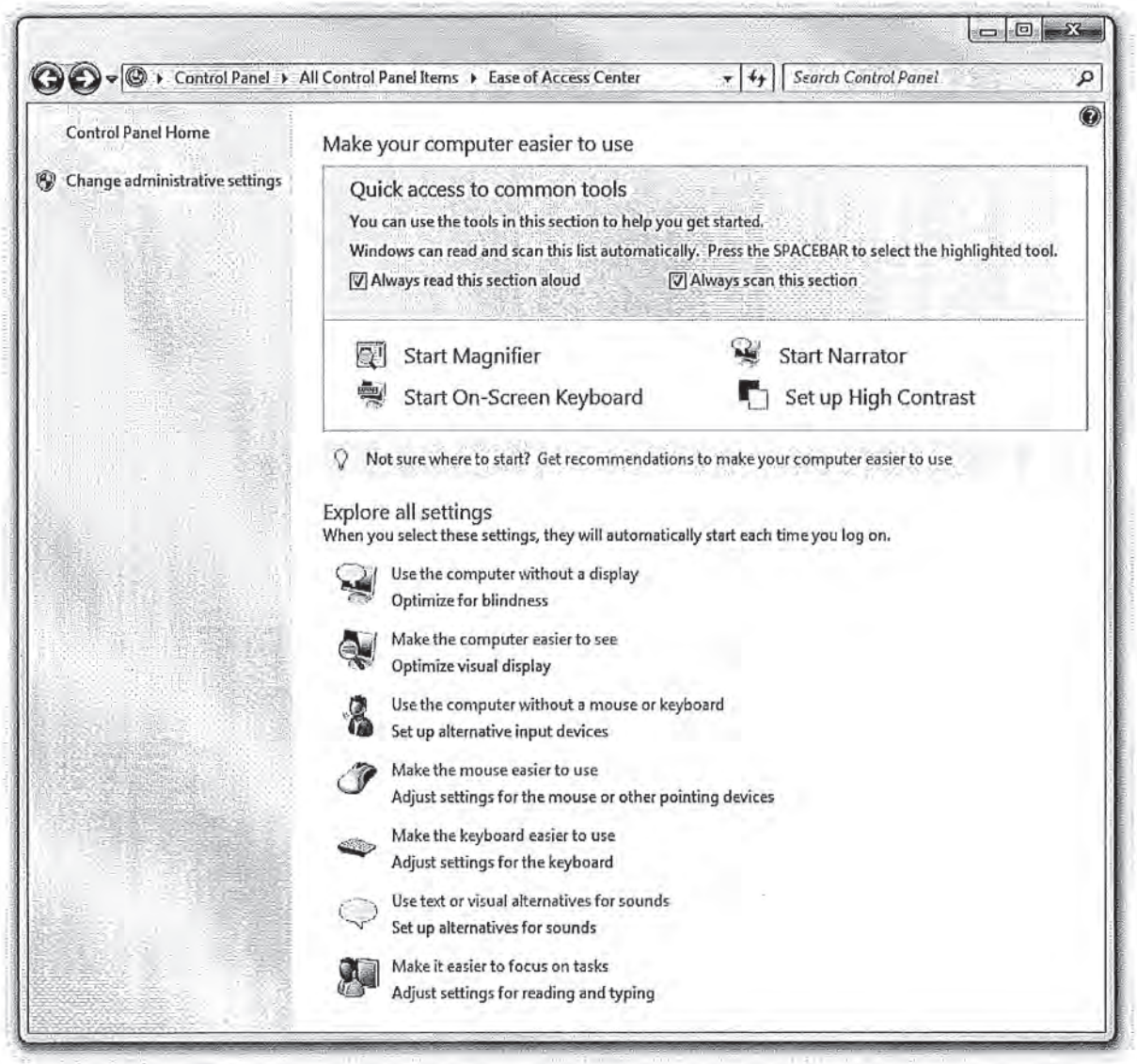


Figure 1-1 The Ease of Access Center is found in Windows 7 and Windows Vista.

## The need for accessible technology in business and organizations

Accessible technology is important in the workplace for several reasons. Accessible technology helps businesses support workforce diversity, recruit from a larger pool of candidates, and enhance team collaboration and communication among all employees—including those with disabilities. For example, accessible technology can facilitate communication and collaboration between sighted and non-sighted colleagues by providing just-in-time delivery of information without the need for special printing and by enabling people who are blind or have other vision impairments to enlarge or customize fonts, choose high-contrast settings for greater visibility, or use a screen reader to access team documents.



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Today, more than half of all U.S. jobs—from the front office to the factory floor—require some technology skills.[1] Simultaneously, the percentage of the workforce represented by individuals 55 years and older is increasing.[2] As a result of functional limitations that result from aging, these employees will require environmental modifications and/or technology accommodations.[3]

Accessibility can also help businesses attract new customers and interact more easily and effectively with a wider range of existing and potential customers, partners, and suppliers. Organizations that make accessibility a priority in their business can advertise job openings, requests for proposal, and other opportunities on websites that are accessible to people with vision impairments. And accessibility can help organizations increase online traffic and loyalty on their websites with design practices that are user-friendly and accessible to all users, including those with disabilities or age-related impairments.

Companies today are marketing many goods and services online. Governments and other organizations are offering more and more information and benefits over the Internet—sometimes exclusively. And just as the Internet has created a worldwide marketplace where even small businesses can compete on a global scale, web-enabled mobile devices have put a shopping cart in nearly every purse and pocket. Consumers today compare products, make purchases, book travel, and pay bills online while exchanging instant messages or emails with salespeople and customer service representatives—from any place and at any time.

## Accessibility helps everyone

Another powerful consideration for making accessibility a part of any large business or organization is the sheer number of people around the world who need accessible technology, could benefit from using it, or choose to use accessible technology for a more comfortable or convenient computing experience.

In the United States alone, about one in five residents (54.4 million people) reported having some level of disability in 2005, according to a U.S. Census Bureau report that was released in December 2008 (the most current information available when this guide was published), but that doesn't tell the whole story. A two-part study commissioned by Microsoft and conducted by Forrester Research in 2003 and 2004 found that more than half (57 percent) of computer users in the United States between the ages of 18 and 64 could likely benefit from accessible and assistive technology due to mild-to-moderate difficulties or impairments that interfere with their ability to use a computer or to perform routine tasks.

Most of these users did not identify themselves as having a disability or impairment, but the Forrester Research study found that among computer users:

- One in four experiences a visual difficulty.
- One in four experiences pain in their wrists or hands.
- One in five experiences hearing difficulty.

---

[1] Bay Ledger News Zone, February 24, 2009. AFP American Edition

[2] Occupational Outlook Handbook, 2010-11 Edition. Overview of the 2008-18 Projections; US Bureau of Labor Statistics; www.bls.gov/oco/oco2003.htm

[3] Chappell NL, Cooke HA. 2011. Age Related Disabilities - Aging and Quality of Life. In: JH Stone, M Blouin, editors. International Encyclopedia of Rehabilitation. Available online: http://cirrie.buffalo.edu/encyclopedia/en/article/189/



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## Accessibility and aging

As the global population continues to grow older and the number of age-related impairments (such as low vision or arthritis) increases, so does the need for accessible and assistive technology. People today are living and working longer, and lower birth rates in developed nations since the mid-1960s mean that there are fewer younger workers in such countries to replace those who do retire. For example:

- Japan's population is aging faster than that of any other country in the world. By 2020, about 30 percent of the population will be older than 65. That figure is expected to climb to 37 percent by 2040.[4]
- By 2018, more than one in five U.S. workers will be older than 55—an increase of more than 33 percent over 2008 when that age group accounted for only 18 percent of the U.S. labor force.[5]
- By 2050, an estimated 45 percent of the working-age population in the European Union will be over age 65.[6]

Many people with age-related disabilities develop those impairments during their working lives. That trend is bound to increase as the global workforce grows older and more workers begin to experience age-related limitations that may interfere with their job performance or even force them to retire. Accessible and assistive technology can help businesses and organizations recruit and retain experienced employees and can help older workers keep their jobs and remain at peak productivity for as long as they choose to work.

In addition to the aging populations in many countries increasing the need for accessible technology among employees and customers, many nations are extending civil rights for people with disabilities to encompass accessibility and digital inclusion. Some governments are requiring procurement officials to purchase the most accessible products available, creating economic incentives for businesses to build accessible technology products.

Perhaps most important, organizations that make accessibility a priority are sending a clear message to employees and customers that their needs matter. And that can breed satisfaction and loyalty.

---

[4] http://www.stat.go.jp/english/data/handbook/c02cont.htm Acquired February 10, 2011.

[5] http://www.bls.gov/oco/oco2003.htm Acquired February 10, 2011.

[6] http://www.un.org/esa/population/publications/ReplMigED/EU.pdf Acquired February 10, 2011.



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# Chapter 2: Impairment types and technology solutions

This chapter defines *disability* and outlines the different types of impairments that people experience, including vision, mobility and dexterity, hearing, language, learning, and age-related limitations. Specific examples of accessible technology solutions are matched to each type of impairment.

## Defining *disability* and *impairments*

What is *disability*? A quick Internet search on that question is likely to return thousands of matches. Each person who tries to answer the question does so from a particular perspective and bias shaped by their own experience.

Disabilities and impairments can be mild or severe, permanent or temporary. Some people are born with disabilities, but the majority of disabilities are the result of an injury, accident, illness, or some other condition. And disabilities can change during the course of a person's life, often growing worse as people age. No matter how we define disability or impairment, it is relevant in this discussion because we are talking about accessible technology solutions for different types of impairments.

Before determining how accessible technology can benefit your customers and employees, it helps to understand the different types of impairments and how they affect computer use and access to online information.

The next sections include descriptions of different impairment types and suggested accessibility features and assistive technology products for:

- Vision impairments.
- Mobility and dexterity impairments.
- Hearing impairments and deafness.
- Learning impairments.
- Language impairments.
- Age-related limitations.



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# Vision impairments

Among computer users in the United States alone, approximately one in four (27 percent) has a vision impairment that affects his or her computer use. There are many ways for people with vision difficulties to modify their computer display and its appearance to make it easier to see or to receive information through sound or touch.

**Did you know?**
Visual acuity is expressed as a fraction. The top number refers to the distance you stand from the vision chart, which is usually 20 feet. So 20/200 vision indicates that the line you read correctly at 20 feet could be read by a person with normal vision at 200 feet.

Vision impairments include:

- **Low vision.** People with low vision do not have clear vision even with the use of eyeglasses, contact lenses, or intraocular lens implants. There are many ways to adjust and personalize the appearance of Windows to make it easier for someone with a vision impairment to see what is on the computer screen. For people with vision impairments and low vision, the computer monitor, appearance, text and icon size, and resolution should all be modified to make text and images more legible and easier to see. For those who still have difficulty seeing things on the screen, sound and touch options are available through Windows and compatible assistive technology products to make computing possible. On the following pages, you'll find options in Windows that can increase clarity and legibility on the screen to make the computer easier to see.
- **Colorblindness.** People who are colorblind have difficulty seeing particular colors or distinguishing between certain color combinations. Computer programs that allow users to choose the display's color combinations and to adjust screen contrast are helpful for people who are colorblind. Individuals with a variety of vision impairments often find it easier to read white text on a black background instead of black on white. Windows lets you use a High Contrast setting or select your own color schemes so you can find the colors that are easiest for you to see when you read.
- **Blindness.** Blindness occurs in a variety of degrees, and many people who are considered blind still have some measure of sight. In the United States, for example, a person whose level of sight is equal to or less than 20/200—even with corrective glasses or lenses—is considered "legally blind." A person who is completely sightless is considered "blind." Many diseases and conditions may contribute to (or cause) blindness, including cataracts, cerebral palsy, diabetes, glaucoma, and multiple sclerosis. Accidents, diabetes, and macular degeneration account for most blindness in the United States. Worldwide, according to the World Health Organization, the number of people blinded by infectious diseases has been greatly reduced, but age-related impairment is increasing. Cataracts remain the leading cause of blindness globally.

People who are blind can interact with a computer through screen readers, keyboards, Braille devices, and audio/voice rather than with a traditional monitor and mouse. The use of sophisticated assistive technology provides for both computer input and output and is critical for people who are blind.

People who are both deaf and blind can also use computers with the help of assistive technology products. For someone who is both deaf and blind, captioning and other sound options are of no use, but Braille assistive technology products are critical. People who are both deaf and blind can use computers by using refreshable Braille displays and Braille embossers, which are discussed in more detail in the following sections.


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## Accessibility features in Windows

Windows makes it easy to find options that are helpful for people who have difficulty seeing the screen or for those who are blind and need to use the computer without a display. In the following pages, you will find information on accessibility features in Windows 7 and Windows Vista: Make the computer easier to see, Use the computer without a display (or monitor), and Keyboard shortcuts.

If you don't know whether you could benefit from accessibility or which accessibility features would be most helpful, fill out the questionnaire in the Ease of Access Center in Windows 7 and Windows Vista. The questionnaire poses a series of questions about your personal experience with everyday tasks, such as watching television or using a pen or pencil. Windows can use your answers to those questions to suggest settings you may find useful.

### Make the computer easier to see

For people who have vision impairments and low vision, start by using the **Make the computer easier to see** page in the Ease of Access Center found in Windows 7 and Windows Vista.

> **Tip**
> To go to the Ease of Access Center, press Windows logo key + U.

1. In Windows 7 or Windows Vista, open the Make the computer easier to see page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Make the computer easier to see.**

2. On the **Make the computer easier to see** page, you can select the options that you want to use:
   - **Choose a High Contrast theme.** This option allows you to set a high-contrast color scheme that heightens the color contrast of some text and images on your computer screen, making those items more distinct and easier to identify.
   - **Turn on or off High Contrast when LEFT ALT+LEFT SHIFT+PRINT SCREEN is pressed.** This option allows you to toggle a high-contrast theme on or off by pressing Left Alt+Left Shift+Print Screen keys.
   - **Turn on Narrator.** This option sets Narrator to run when you log on to your computer. Narrator reads on-screen text aloud and describes some on-screen events (such as the appearance of error messages) while you're using the computer. For more information about using Narrator, read Hear text read aloud with Narrator (http://windows.microsoft.com/en-us/windows7/Hear-text-read-aloud-with-Narrator)
   - **Turn on Audio Description.** This option sets Audio Descriptions to run when you log on to your computer. Audio Descriptions describe what's happening in videos. Audio Descriptions are not included with all videos.
   - **Change the size of text and icons.** This option allows you to make text and other items on your screen appear larger, so they're easier to see. For more information, see Make the text on your screen larger or smaller (http://windows.microsoft.com/en-us/windows7/Make-the-text-on-your-screen-larger-or-smaller)
   - **Turn on Magnifier.** One of the most common accessibility solutions for a computer user with low vision is a screen magnifier. Windows includes a screen magnifier program called Magnifier which enlarges portions of the screen and makes it easier to view text and images and to see the whole screen more easily. Magnifier in Windows 7 now includes full-screen mode, lens mode, and docked mode. The magnification quality is improved, and you can set the magnification level up to 16 times the original size and choose to track what you magnify by movement of your mouse, the keyboard, or text editing. For more information about using Magnifier, see Make items on the screen appear bigger with Magnifier (http://windows.microsoft.com/en-us/windows7/Make-items-on-the-screen-appear-bigger-Magnifier)


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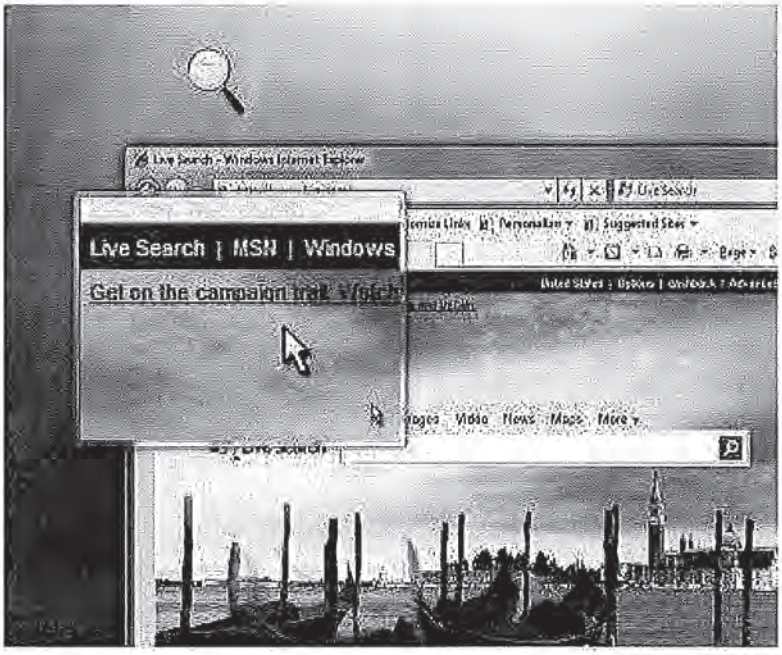


Figure 2-1 Use Magnifier in lens mode to improve screen visibility.

- **Adjust the color and transparency of the window borders.** This option allows you to change the appearance of window borders to make them easier to see.
- **Fine tune display effects.** This option allows you to customize how certain items appear on your desktop.
- **Make the focus rectangle thicker.** This option makes the rectangle around the currently selected item in dialog boxes thicker, which makes it easier to see.
- **Set the thickness of the blinking cursor.** This option allows you to make the blinking cursor in dialog boxes and programs thicker and easier to see.
- **Turn off all unnecessary animations.** This option turns off animation effects, such as fading effects, when you close windows and other elements.
- **Remove background images.** This option turns off all unimportant, overlapped content and background images to help make the screen easier to see.

For additional information about how to use accessibility features in Windows and other Microsoft products, see the Microsoft Accessibility Tutorials available online at www.microsoft.com/enable/training/.

## Use the computer without a display

For people who are blind or partially sighted, assistive technology products are critical for productive computer use. To get started, Windows has many features that enable you to use the computer without a display. For example, you can have screen text read aloud by using Narrator and you can have Windows describe screen activity to you.

People who are blind and cannot use a monitor can turn on or adjust settings to **Use the computer without a display** in the Ease of Access Center. In the following section, you'll find assistive technology products that are needed for people who are blind or partially blind.

**Tip**

To go to the Ease of Access Center, press Windows logo key + U.



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1. In Windows 7 or Windows Vista, open the Use the computer without a display page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Use the computer without a display**.
2. On the **Use the computer without a display** page, select the options that you want to use:
   - **Turn on Narrator.** Windows comes with a basic screen reader called Narrator, which reads text on the screen aloud and describes some events (such as the appearance of an error message) that happen while you're using the computer. For more information about Narrator, read Hear text read aloud with Narrator (http://windows.microsoft.com/en-us/windows7/Hear-text-read-aloud-with-Narrator).
   - **Turn on Audio Description.** This option sets Audio Description to run when you log on to Windows. Audio descriptions describe what's happening in videos.
   - **Turn off all unnecessary animations (when possible).** This option turns off animation effects, such as fading effects, when windows and other elements are closed.
   - **How long should Windows notification dialog boxes stay open?** This option sets how long notifications are displayed on the screen before they are closed.

### Keyboard shortcuts

Keyboard shortcuts are combinations of two or more keys that, when pressed, can be used to perform a task that would typically require a mouse or other pointing device. Keyboard shortcuts can make it easier for people with all kinds of impairments, particularly vision impairments, to interact with their computers. Memorizing a few keyboard shortcuts makes it easier for some people who have difficulty seeing the monitor or keyboard to quickly accomplish tasks.

A list of keyboard shortcuts for Windows is available at http://windows.microsoft.com/en-US/Windows7/Keyboard-shortcuts.

## Assistive technology products for people with vision impairments

For the operating system or an application to be accessible to someone who is blind, it must provide information about its interactions with the user so that assistive technology can then present those interactions in an alternative format. For example, if the computer provides a list box containing several selections to choose from, the assistive technology product must inform a computer user who is blind that he or she needs to choose from a list of selections. The list of selections might be spoken or presented in tactile fashion with a Braille display. A common assistive technology product used by people who are blind is a *screen reader*, a software program that presents graphics and text as speech. Computer users who are blind also may use Braille displays and Braille embossers. In fact, it is common for people who are blind to use a combination of assistive technology products.

> **Tip**
> The Assistive Technology Product Starter Guide—a table with details about specific assistive technology products, is included in Chapter 3.

Assistive technology products with different features are available to help people with vision impairments. Some assistive technology products provide a combination of features that help specific individuals. Assistive technology products that are helpful to many people with vision impairments are described in the following list.


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- **Screen magnifiers** work like a magnifying glass. They enlarge a portion of the screen as the user moves the focus—increasing legibility for some users. Some screen enlargers (software or hardware) allow a user to zoom in and out on a particular area of the screen. Learn about Magnifier in Windows 7 and Windows Vista and about the built-in zoom and magnify features in Microsoft mouse and keyboard products. Another example of a screen magnifier program is ZoomText by Ai Squared.
- **Screen readers** are software programs that present graphics and text as speech. A screen reader is used to verbalize, or "speak," everything on the screen, including names and descriptions of control buttons, menus, text, and punctuation. An example of a screen reader is Window-Eyes.
- **Braille printers** (or embossers) transfer computer-generated text into embossed Braille output. Braille translation programs convert text scanned in or generated via standard word processing programs into Braille, which can be printed into raised Braille. The Tiger Cub Jr. is an example of a Braille printer.
- **Braille displays**, as shown in Figure 2-2, provide tactile output of information represented on the computer screen. The user reads the Braille letters with his or her fingers, and then, after a line is read, refreshes the display to read the next line. The Seika Braille Display is an example.

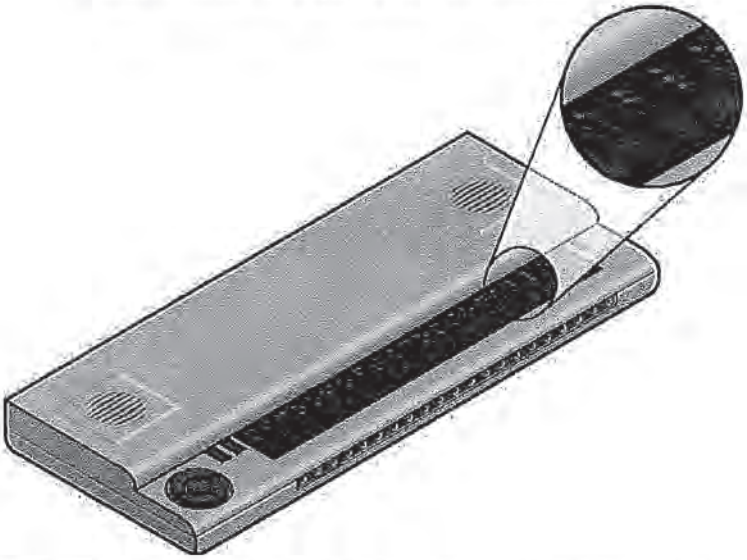

**Figure 2-2** Braille displays, such as this one, can help someone who is blind read what is displayed on a computer screen.

- **Braille notetakers** enable someone who is blind to capture notes and then transfer them to a PC. Braille notetakers take advantage of refreshable Braille technology. In some cases, Braille notetakers replace or supplement a standard keyboard. An example of such a notetaker is the Eurobraille Esys.
- **Book readers.** Some people with low vision need book-reading assistance. Magnification devices are available as a desktop magnification aid (such as Desktop SenseView DSV) or as a portable magnification aid (such as SmartView Nano Magnifier). People with low vision may also use a PC configuration for book reading assistance (for example, Cicero Text Reader). Some may also use a dedicated reading device (such as the Victor Reader Wave). An individual's ability to read materials and the accommodations they will use depends on the format in which the material is available. For example, printed materials and books can be read by people with low vision with the assistance of a desktop or portable magnification aid. Someone who is blind would need to have printed material scanned and read aloud through a text-to-speech software program on the PC. Books are available in digital formats through organizations such as Bookshare (www.benetech.org) and Recording for the Blind and Dyslexic (www.rfbd.org). The most common digital format is the Digital Accessible Information System, or DAISY.


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- Microsoft provides an **add-in for Microsoft Word** to convert documents to DAISY format. The Word-to-DAISY translator lets you take a document in Microsoft Office Word 2010, Word 2007, Word 2003, or Word XP and easily convert the Word document to the talking DAISY book format. This makes it easier for people to share Word documents with colleagues who need to use book readers to read documents. Learn more, and download the DAISY/Word add-in at http://office.microsoft.com/en-us/help/HA102786941033.aspx.

# Mobility and dexterity impairments

Mobility and dexterity impairments can be caused by a wide range of common illnesses and accidents. They can also result from cerebral palsy, multiple sclerosis, loss of limbs or digits, spinal cord injuries, and repetitive stress injury, among other causes. As a result of accidents or conditions, some people may be unable to use (or may be without) arms or fingers to interact with their computers using a standard keyboard or mouse.

Others who have dexterity impairments or pain in their hands, arms, and wrist might need to adjust settings to make it more comfortable to use a keyboard or mouse. For example, some people cannot press multiple keys simultaneously (like Ctrl+Alt+Delete). Still others may strike multiple keys or repeat keys unintentionally. Some people may have use of their hands and arms but have a limited range of motion. All of these conditions can make using a standard mouse or keyboard difficult, if not impossible.

Mobility and dexterity impairments need to be individually addressed to choose the right mix of accessibility features in Windows and assistive technology hardware and software solutions.

There are many types of products available to allow people with mobility and dexterity impairments to use a computer, even if they can move only their eyes. The following section outlines accessibility features in Windows to make the mouse and keyboard more comfortable. In addition, you can set up a computer for a person who needs to use an on-screen keyboard and other alternative input options rather than a standard keyboard or mouse. Following are examples of assistive technology hardware and software products.

## Accessibility features in Windows

Accessibility features built into Windows that are useful to people with mobility impairments include keyboard filters that compensate somewhat for erratic motion, tremors, slow response time, and similar conditions. For example, Sticky Keys (a feature in Windows) allows the user to enter key combinations without having to hold one key down while depressing a second. Other options allow users to adjust how quickly a letter appears on the screen when they hold down a key. In addition, Windows allows users to adjust mouse options, such as button configuration, double-click speed, pointer size, and how quickly the mouse pointer responds to movements of the mouse. Users can also increase the size of screen elements to provide a larger target, which can benefit people who have disabilities related to fine motor skills.

### Make the mouse easier to use

For people who have pain or discomfort when using the mouse or who have other dexterity impairments, consider a different style of mouse (options discussed later in this section) and try changing the size of the mouse cursor and the mouse button options to make the mouse easier to use. Start by exploring the mouse options available on the **Make the mouse easier to use** page in the Ease of Access Center.

Tip

To go to the Ease of Access Center, press Windows logo key + U.



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1. In Windows 7 or Windows Vista, open the Make the mouse easier to use page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Make the mouse easier to use**.

2. On the **Make the mouse easier to use** page, select the options that you want to use:
   - **Change the color and size of mouse pointers.** You can use these options to make the mouse pointer larger or to change the color to make it easier to see.
   - **Turn on Mouse Keys.** You can use this option to control the movement of the mouse pointer by using the numeric keypad.
   - **Activate a window by hovering over it with the mouse.** This option makes it easier to select and activate a window by pointing at it with the mouse rather than by clicking it.
   - Prevent **windows from being automatically arranged when moved to the edge of the screen.** This option prevents windows from automatically resizing and docking along the sides of your screen when you move them there.
   - You can also **change mouse settings,** including customizing the mouse in a variety of ways, such as reversing the functions of your mouse buttons, making the mouse pointer more visible, and altering the scroll wheel speed. In Windows 7 and Windows Vista, open the Mouse Control Panel by clicking **Mouse settings**.

## Make the keyboard easier to use

For a person who experiences pain, discomfort, or hand tremors when using the keyboard, consider a different style of keyboard (options discussed later in this section) and make sure to adjust the keyboard controls. You can adjust these settings on the **Make the keyboard easier to use** page in the Ease of Access Center.

1. In Windows 7 or Windows Vista, open the Make the keyboard easier to use page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Make the keyboard easier to use**.
2. On the **Make the keyboard easier to use** page, select the options that you want to use:
   - **Turn on Mouse Keys.** This option sets Mouse Keys to run when you log on to Windows. Instead of using the mouse, you can use the arrow keys on your keyboard or on the numeric keypad to move the pointer.
   - **Turn on Sticky Keys.** This option sets Sticky Keys to run when you log on to Windows. Instead of having to press three keys at once (such as when you must press the Ctrl, Alt, and Delete keys together to log on to Windows), you can use one key at a time by turning on Sticky Keys and adjusting the settings. Then, you can press a modifier key and have it remain active until another key is pressed.
   - **Turn on Toggle Keys.** This option sets Toggle Keys to run when you log on to Windows. Toggle Keys can play an alert each time you press the Caps Lock, Num Lock, or Scroll Lock keys. These alerts can help prevent the frustration of inadvertently pressing a key and not realizing it.
   - **Turn on Filter Keys.** This option sets Filter Keys to run when you log on to Windows. You can set Windows to ignore keystrokes that occur in rapid succession or keystrokes that are held down for several seconds unintentionally.
   - **Underline keyboard shortcuts and access keys.** This option makes keyboard access in dialog boxes easier by highlighting access keys for the controls in them. (For more information about keyboard shortcuts, see the section that follows).
   - **Prevent windows from being automatically arranged when moved to the edge of the screen.** This option prevents windows from automatically resizing and docking along the sides of your screen when you move them there.



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## Keyboard shortcuts

Keyboard shortcuts are combinations of two or more keys that, when pressed, can be used to perform a task that would typically require a mouse or other pointing device. Keyboard shortcuts can make it easier for people with all kinds of impairments to use a computer, particularly those with dexterity impairments who may find using the mouse tiring. Memorizing a few keyboard shortcuts makes it faster for people to get where they need to go.

A list of keyboard shortcuts for Windows is available at http://windows.microsoft.com/en-US/Windows7/Keyboard-shortcuts.

Here are a few keyboard shortcuts for the features mentioned in this section:

| Press this key | To do this |
|---|---|
| Right Shift for eight seconds | Turn Filter Keys on and off |
| Left Alt+Left Shift+Print Screen | Turn High Contrast on or off |
| Left Alt+Left Shift+Num Lock | Turn Mouse Keys on or off |
| Shift five times | Turn Sticky Keys on or off |
| Num Lock for five seconds | Turn Toggle Keys on or off |
| Windows logo key +U | Open the Ease of Access Center |

## Use the computer without the mouse or keyboard

Windows has two features that make it possible to use the computer without using a mouse or keyboard: Speech Recognition, which lets you use voice commands to navigate Windows 7 or Windows Vista, and On-Screen Keyboard, which lets you enter text by selecting keys on a visual keyboard on the screen.

You can turn on or adjust settings for these features on the **Use the computer without a mouse or keyboard** page in the Ease of Access Center.

**Tip**
To go to the Ease of Access Center, press Windows logo key + U.


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1. In Windows 7 or Windows Vista, open the Use the computer without a mouse or keyboard page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Use the computer without a mouse or keyboard.**
2. Select the options that you want to use:
   - **Use On-Screen Keyboard.** On-Screen Keyboard displays a visual keyboard with all the standard keys. Instead of relying on the physical keyboard to type and enter data, you can use On-Screen Keyboard to select keys using the mouse or another pointing device. On-Screen Keyboard in Windows 7 can be resized and customized to make it easier to see and use. On-Screen Keyboard now also includes text prediction in eight languages. When text prediction is enabled, as you type, On-Screen Keyboard displays a list of words that you might be typing. For more information, see Type without using the keyboard (On-Screen Keyboard) (http://windows.microsoft.com/en-us/windows7/Type-without-using-the-keyboard-On-Screen-Keyboard).

Figure 2-3 On-Screen Keyboard in Windows 7 includes text prediction.

   - **Use Speech Recognition.** Use this option to control the computer with your voice. Using a microphone, you can speak commands that the computer will understand and respond to, and you can dictate text. For more information about setting up Speech Recognition, see Set up Speech Recognition (http://windows.microsoft.com/en-us/windows7/Set-up-Speech-Recognition).

## Assistive technology products for people with mobility and dexterity impairments

The following list describes assistive technology products used with computers by people with mobility and dexterity impairments.

- **Ergonomic keyboards and mice.** Ergonomic keyboards and mice are designed to be more comfortable than a standard keyboard and mouse. To improve the quality of your PC experience, Microsoft designers and ergonomists created industry-leading keyboard and mouse products to encourage healthier hand and wrist positions. Microsoft Natural® keyboards and mice have set the industry standard for comfort and can significantly reduce carpal tunnel syndrome symptoms. Microsoft keyboards and mice (http://www.microsoft.com/hardware/) also have built-in zoom and magnifier options.
- **Joysticks** can be plugged into the computer's mouse port and used to control the cursor on the screen. Joysticks benefit users who need to operate a computer with or without the use of their hands. For example, some people might operate the joystick with their feet or with the use of a cup on top of the joystick that can be manipulated with their chin. An example of a joystick is the SAM-Joystick.


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- **Trackballs** look like an upside down mouse with a movable ball on top of a stationary base. An example of a trackball is shown in Figure 2-4. The ball can be rotated with a pointing device or a hand. People who have fine motor skills but lack gross motor skills can use these devices more easily and comfortably than they can use a traditional mouse. BIGtrack is an example of a trackball-style mouse that is more comfortable for many people with dexterity issues.

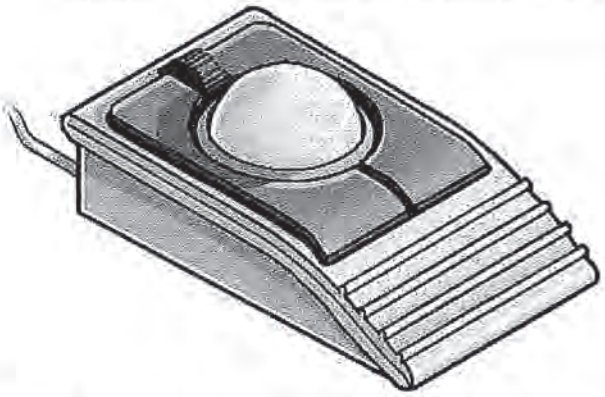

**Figure 2-4** A trackball can be rotated with a pointing device or a hand.

- **On-screen keyboard programs** provide an image of a standard or modified keyboard on the computer screen. The user selects the keys with a mouse, touchscreen, trackball, joystick, switch, or electronic pointing device. On-screen keyboards often have a scanning option. With the scanning capability turned on, the individual keys on the on-screen keyboard are highlighted. When a desired key is highlighted, the user is able to select it by using a switch positioned near a body part that he or she has under voluntary control. On-Screen Keyboard is found in Windows 7 and Windows Vista. ScreenDoors 2000 is another on-screen keyboard product that can be helpful for some people.
- **Keyboard filters** include typing aids, such as word prediction utilities and add-on spelling checkers. These products can often be used to reduce the number of keystrokes. As an example, imagine you have to type the letter "g." However, to type the letter, you first have to move your finger over the entire first row of your keyboard and halfway across the second row. Along the way, you might accidentally press the "R," "P," or "D" keys, but you only want the letter "g." Keyboard filters enable users to quickly access the letters they need and to avoid inadvertently selecting keys they don't want. SoothSayer Word Prediction is an example of a keyboard filter.
- **Touchscreens** are devices placed on the computer monitor (or built into it) that allow direct selection or activation of the computer by touching the screen. These devices can benefit some users with mobility impairments because they present a more accessible target. It is easier for some people to select an option directly rather than through a mouse movement or keyboard. Moving the mouse or using the keyboard for some might require greater fine motor skills than simply touching the screen to make a selection. Other users might make their selections with assistive technology, such as mouth sticks. With Windows 7 and a touchscreen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom.
- **Alternative PC hardware and all-access workstations.** In some cases, alternative PC hardware is needed. Some individuals with mobility impairments find it challenging to open the monitor of a laptop because the laptop latch isn't accessible for them. Or some might need a laptop to be mounted to a wheelchair. Such assistive technology solutions are referred to as *all-access workstations*. **Alternative input devices** allow users to control their computers through means other than a standard keyboard or pointing device.



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Alternative input devices include:

- **Alternative keyboards** are available in different sizes with various keypad arrangements and angles. Larger keyboards (such as the BigKeys LX) are available with enlarged keys (see Figure 2-5), which are easier to access by people with limited motor skills. Smaller keyboards are available with smaller keys (or keys placed closer together) to allow someone with a limited range of motion to reach all the keys. Many other keyboards are also available—one-hand keyboards, keyboards with keypads located at various angles, and split keyboards where the keypad is split into sections.

**Figure 2-5** An alternative keyboard can include large keys and an "ABC" layout.

- **Electronic pointing devices** allow the user to control the cursor on the screen using ultrasound, an infrared beam, eye movements, nerve signals, or brain waves. When used with an on-screen keyboard, electronic pointing devices also allow the user to enter text or data. The assistive technology product HeadMouse Extreme is an example of a pointing device.
- **Sip-and-puff device**, shown in Figure 2-6, refers to just one of many different types of switch access. In typical configurations, a dental saliva extractor is attached to a switch. An individual uses his or her breath to activate the switch. For example, a puff generates the equivalent of a keystroke, the pressing of a key, or a mouse click. Maintaining constant "pressure" on the switch (more like sucking than sipping) is the equivalent of holding a key down. With an on-screen keyboard, the user "puffs" out the letters. Moving the cursor over a document's title bar and "sipping" enables the user to drag items around on the screen just as you would with a mouse. This technology is often used with on-screen keyboards. The Jouse 2 is an example of a sip-and-puff device.



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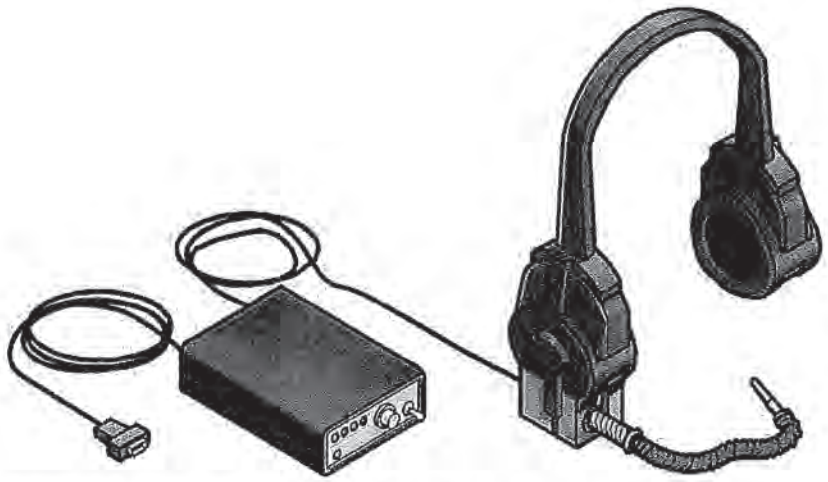

Figure 2-6. A sip-and-puff device is breath activated.

- **Wands and sticks** are typing aids used to strike keys on the keyboard. They are most commonly worn on the head, held in the mouth, strapped to the chin, or held in the hand. They are useful for people who need to operate their computers without the use of their hands or who have difficulty generating fine movements. The majority of these devices are customized for a user by adapting a pencil or a wooden dowel which can be purchased in any hardware store.

# Hearing impairments and deafness

Hearing impairments encompass a range of conditions—from slight hearing loss to deafness. According to Forrester Research, an estimated one in five computer users has some form of hearing loss.

Hearing impairments include:

- **Hearing loss and hard-of-hearing.** People who have hearing loss or are hard-of-hearing may be able to hear some sound but might not be able to distinguish words. People with this type of hearing impairment can use an amplifying device to provide functional hearing. On the computer, adjusting sounds, using alternatives for sounds (such as visual indicators and captions), and headphones to eliminate background noise can be helpful options.
- **Deafness.** People who are deaf may not be able to hear any sounds or words spoken. It is helpful to adjust the computer to use visual alternatives for sounds.

## Computer use among people who are both deaf and blind

Although it's not well known, people who are both deaf and blind can use computers with the aid of assistive technology. To someone who is both deaf and blind, captioning and other sound options are of no use, but Braille assistive technology products are critical. People who are both deaf and blind can use computers with assistive technology, such as refreshable Braille displays and Braille embossers.



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## Accessibility features in Windows

Accessibility features for those with hearing impairments include changing notifications from sound to visual notifications, volume control, and captioning. These features are available in Windows 7 and Windows Vista. Visual notifications (Sound Sentry) and captions (Show Sounds) allow users to choose to receive visual warnings and text captions, rather than sound messages, for system events, such as the arrival of a new email message.

Accessibility features helpful for people who have hearing impairments include:

- Adjust volume.
- Change computer sounds.
- Use text or visual alternatives for sounds.

### Adjust volume

Although most speakers have a volume control, you can also control speaker volume using Windows. The quickest way to change the speaker volume for your computer is to click the **Speakers** button in the notification area of the taskbar and then move the slider up or down to increase or decrease the speaker volume.

### Adjust overall sound volume in Windows 7 or Windows Vista

1. Open **Volume Control:** Click the **Start** button, click **Control Panel**, click **Hardware and Sound**, and then, under **Sound**, click **Adjust system volume.**
2. Under **Main Volume**, move the slider up or down to raise or lower the volume.



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## Change computer sounds

You can select the sounds that play when certain events occur on the screen. This is helpful for people who have trouble hearing some sounds—high or low-pitched sounds, for example, or sounds associated with other devices. To change sounds in Windows 7 or Windows Vista:

1. Open **Sound:** Click the **Start** button, and then click **Control Panel.** In the search box, type **sound,** and then click **Sound.**
2. Click the **Sounds** tab.
3. In the **Sound Scheme** list, click the sound scheme that you want to use, and then click **OK.**

To change an individual sound, select an event (under Program Events) to which you want to assign a new sound. You can click **Test** to hear each sound.

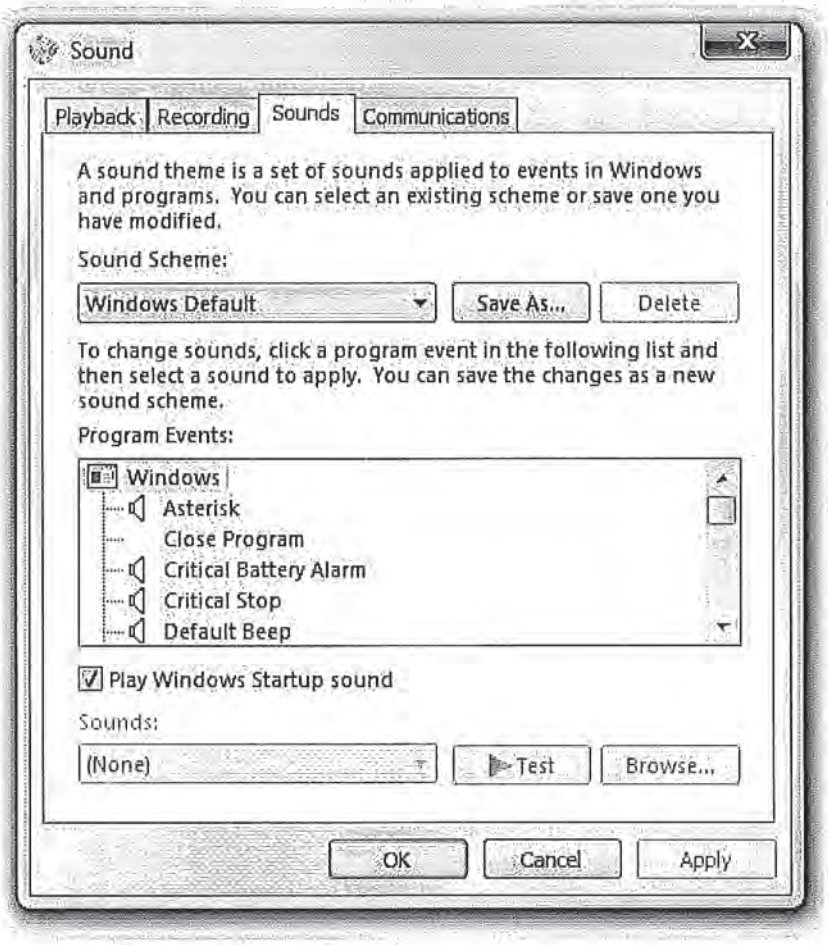


**Figure 2-7** The Windows operating system offers many sound options.



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## Use text or visual alternatives to sounds

Windows provides settings for using visual cues to replace sounds in many programs. You can adjust these settings on the **Use text or visual alternatives for sounds** page in the Ease of Access Center.

1. In Windows 7 or Windows Vista, open the Use text or visual alternatives for sounds page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Use text or visual alternatives for sounds**.
2. On the **Use text or visual alternatives for sounds** page, select the options that you want to use:
   - **Turn on visual notifications for sounds (sound sentry).** This option sets sound notifications to run when you log on to Windows. Sound notifications replace system sounds with visual cues, such as a flash on the screen, so that system alerts are noticeable even when they're not heard. You can also choose how you want sound notifications to warn you.
   - **Turn on text captions for spoken dialog (when available).** This option causes Windows to display text captions in place of sounds to indicate that activity is happening on your computer (for example, when a document starts or finishes printing).

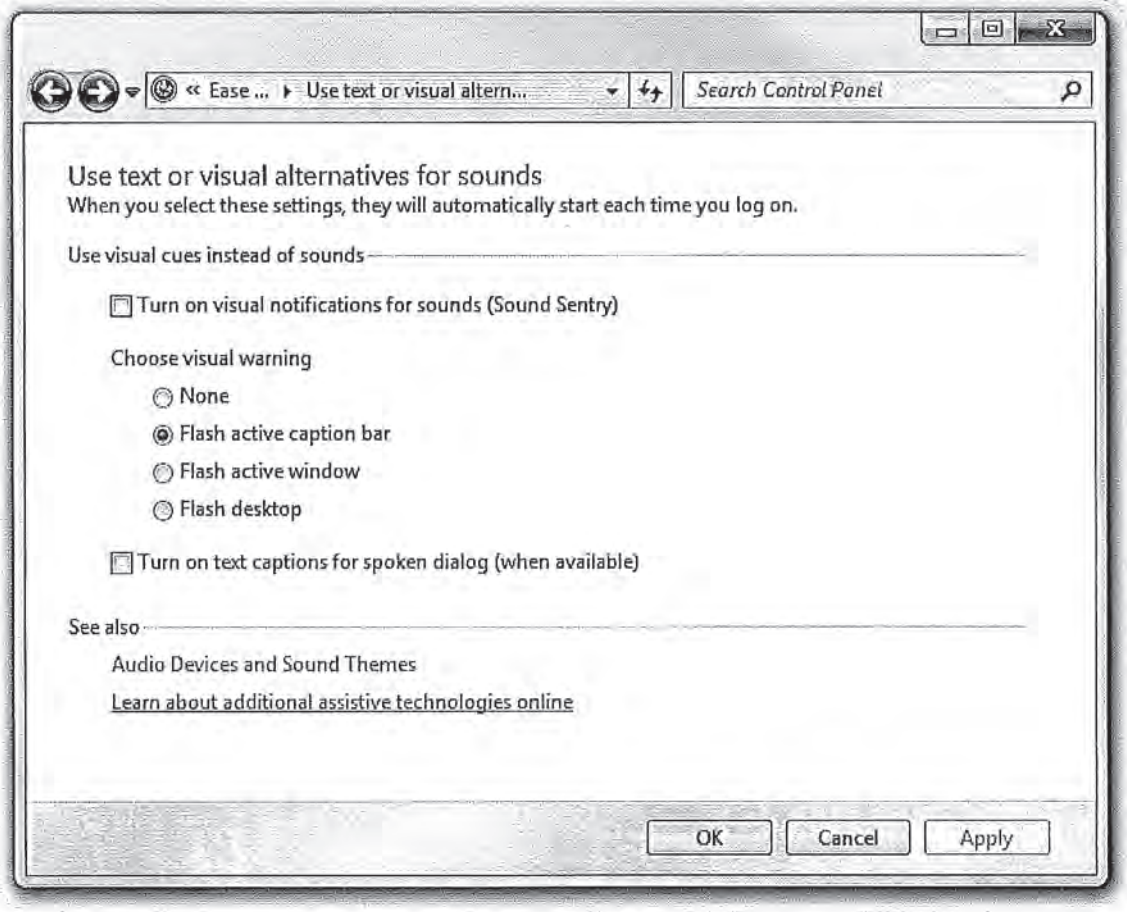


**Figure 2-8** For visual cues, go to the **Use text or visual alternatives for sounds** page in the Ease of Access Center.



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### Assistive technology products for people with hearing impairments

Individuals with hearing impairments may need a sign-language interpreter or other accessibility solutions to be able to communicate actively in the workplace.

Personal listening devices and personal amplifying products can also be helpful for people who still have some hearing.

One product that may be useful is iCommunicator—a graphical sign-language translator that converts speech to sign language in real time to enable people who are deaf to communicate more easily with hearing people. For more information, see www.icommunicator.com.

Depending on the environment, people with hearing impairments may be able to use Microsoft Office Outlook®, Microsoft Office Communicator and other instant messaging services, and Office Live Meeting solutions for receiving text rather than spoken dialogue to communicate with colleagues or customers. A combination of speech recognition (available in Windows 7 and Windows Vista) paired with Outlook and instant messaging could be effective in helping people with hearing impairments communicate in real-time.

## Language impairments

Language impairments include conditions such as aphasia (loss or impairment of the power to use or comprehend words, often as a result of brain damage), delayed speech (a symptom of cognitive impairment), and other conditions resulting in difficulties remembering, solving problems, or perceiving sensory information. For people who have these impairments, complex or inconsistent visual displays or word choices can make using computers more difficult. For most computer users, in fact, software that is designed to minimize clutter and competing objects on the screen is easier to use, more inviting, and more useful.

Some people with language impairments do not have the ability to communicate orally. These individuals can use augmentative and assistive communication devices to "speak" for them. To communicate, they either type out words and phrases that they wish to "say" or select from a series of images that, when arranged in a particular way, generate a phrase. For example, an individual could use the combination of a picture of an apple and a representation of the McDonald's golden arches to order a hot apple pie. Pairing the picture of the arches with a picture of a car could say, "Let's take a ride to McDonald's."

### Accessibility features in Windows

When Windows 7 and Windows Vista were developed, there was a focus on reducing screen clutter to help individuals focus on only the things important to them. Windows 7 and Windows Vista let you eliminate shortcuts and icons from the desktop if they are not helpful. Reducing unnecessary options on the screen benefits people with language and learning impairments, in particular, because it reduces visual clutter, which can be confusing.

Other options that allow for abbreviated menus and customized toolbars, for example, also help reduce the number of competing elements on the screen. Spelling and grammar checkers are also helpful for those who commonly reverse the order of letters because of dyslexia or other learning impairments.



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## Make it easier to focus on reading and typing tasks

You can use the settings on the **Make it easier to focus on tasks** page in the Ease of Access Center in Windows 7 and Windows Vista to reduce the amount of information on the screen and to help people with language impairments focus on tasks.

1. In Windows 7 or Windows Vista, open the Make it easier to focus on tasks page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Make it easier to focus on tasks**.
2. Then, select the options that are most helpful:

   - **Turn on Narrator.** This option sets Narrator to run when you log on to Windows. Narrator reads on-screen text aloud and describes some events (such as the appearance of an error message) while you're using the computer. For more information about using Narrator, read Hear text read aloud with Narrator (http://windows.microsoft.com/en-us/windows7/Hear-text-read-aloud- with-Narrator).
   - **Remove background images.** This option turns off all unimportant, overlapped content and background images to help make the screen easier to see.
   - **Turn on Sticky Keys.** This option sets Sticky Keys to run when you log on to Windows. Instead of having to press three keys at once (such as when you must press the Ctrl, Alt, and Delete keys together to log on to Windows), you can press one key at a time by turning on Sticky Keys and adjusting the settings. Then, you can press a modifier key and have it remain active until another key is pressed.
   - **Turn on Toggle Keys.** This option sets Toggle Keys to run when you log on to Windows. Toggle Keys can play an alert each time you press the Caps Lock, Num Lock, or Scroll Lock These alerts can help prevent the frustration of inadvertently pressing a key.
   - **Turn on Filter Keys.** This option sets Filter Keys to run when you log on to Windows. You can set Windows to ignore keystrokes that occur in rapid succession or keystrokes that are held down for several seconds unintentionally.
   - **Turn off all unnecessary animations (when possible).** This option turns off animation effects, such as fading, when windows and other elements are closed.
   - **How long should Windows notification dialog boxes stay open?** With this option, you can choose how long notifications are displayed on the screen before they close.
   - **Prevent windows from being automatically arranged when moved to the edge of the screen.** This option prevents windows from automatically resizing and docking along the sides of your screen when you move them there.

**Tip**
**Replacement for Serial Keys**
Windows 7 does not include Serial Keys. In previous versions of Windows, Serial Keys provided support so that alternative input devices, such as augmentative communication devices, could be plugged into the computer's serial port. For individuals who use these devices, it is important to install an alternative solution prior to upgrading to Windows 7. Recommended solutions: AAC Keys from AAC Institute (www.aacinstitute.org/) and SKEYS from Eyegaze (www.eyegaze.com/).


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## Assistive technology products for people with language impairments

Assistive technology products used with computers by people with language impairments are described in the following list.

- **Augmentative and assistive communication (AAC) devices** are used by individuals who cannot speak or who find speaking difficult. The user types in a word, phrase, or sentence to communicate—or selects a series of symbols or pictures on the device—and the device "speaks" aloud for the user. Often these devices are used to replace a PC keyboard. In these cases, the user is able to use one device for both communicating and for computer input. One example of an augmentative communication device is QualiSPEAK Pro.
- **Touchscreens** are devices placed on the computer monitor (or built into it) that allow direct selection or activation of the computer by touching the screen. Earlier we discussed how touchscreens benefit people with mobility impairments, but they also benefit users with language disabilities. The ability to touch the computer screen to make a selection is advantageous for people with language and learning disabilities because it is a more simple, direct, and intuitive process than making a selection using a mouse or keyboard. With Windows 7 and a touch-screen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom. Additional touchscreen technologies are available for Windows. The Gus Communicator PC10 Touch Screen Tablet PC is an example of an assistive technology product that can be used via touch to communicate.
- **Speech synthesizers** provide the user with information through a computer voice. Also known as *text-to-speech (TTS)*, the speech synthesizer receives information in the form of letters, numbers, and punctuation marks and then "speaks" it out loud to the user in a computer voice. Scan and Read Pro is an example of an assistive technology product that produces more natural-sounding speech synthesis.

# Learning impairments

Learning impairments can range from conditions such as dyslexia and attention deficit disorder to retardation. Processing problems are the most common and have the most impact on a person's ability to use a computer. These conditions interfere with the learning process.

Many people with these impairments are perfectly capable of learning if information is presented to them in a form and at a pace that is appropriate to them individually. Information that is presented in short, discrete units is often easier to understand. In addition, many individuals with learning disabilities learn more efficiently using their visual abilities rather than their auditory skills. Many are primarily visual or auditory learners, whereas other learners are "ambidextrous." Control over the individual learner's single- or multisensory experience is critical.

**Did you know?**
According to the International Dyslexia Association and the Learning Disabilities Association of America, about 15 percent of the population (close to one in seven people) has a learning disability.[7]

[7] http://www.interdys.org/FAQHowCommon.htm Acquired February 10, 2011.



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## Accessibility features in Windows

The simplified interface in Windows 7 and Windows Vista benefits people with learning impairments, in addition to those with language impairments, because it helps reduce the number of competing elements on the screen. Complicated user interfaces can interfere with learning. User interface engineers found that an emphasis on a consistent user experience had the greatest positive impact on individuals with processing problems. Consider the person who can't read his own handwriting but can edit for others by using a computer. Additional computer settings, such as adjustable text and screen element sizes, speech capabilities, choice of visual or sound warnings for system events, and Internet display options, can benefit those with learning impairments.

Features in Windows and Office that might be useful for people with learning impairments include:

- Make it easier to focus on reading and typing tasks.
- Check spelling and grammar in Office programs.
- Use AutoComplete in Office 2010.

### Make it easier to focus on reading and typing tasks

You can use the settings on the **Make it easier to focus on tasks** page in the Ease of Access Center in Windows 7 and Windows Vista to reduce the amount of information on the screen and to help people with learning disabilities focus on reading and typing tasks.

In Windows 7 or Windows Vista, open the Make it easier to focus on tasks page: Click the **Start** button, click **Control Panel**, click **Ease of Access**, click **Ease of Access Center**, and then click **Make it easier to focus on tasks**.

### Check spelling and grammar in Office programs

In Microsoft Office 2010, the **Spelling & Grammar** feature is on the **Review** tab. Also on the **Review** tab are the Research, Thesaurus, and Translate features, which also may be helpful for people with learning disabilities.

**Figure 2-9** The features on the Office 2010 **Review** tab can be helpful for people with learning disabilities.



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## Assistive technology products for people with learning impairments

The following list includes assistive technology products used with computers by people with learning impairments:

- **Word prediction programs** allow the user to select a desired word from an on-screen list located in the prediction window. The program predicts words from the first one or two letters typed by the user. The word can then be selected from the list and inserted into the text by typing a number, clicking the mouse, or scanning with a switch. These programs help support literacy, increase written productivity and accuracy, and increase vocabulary skills through word prompting. ClaroRead Standard and TextHelp Read & Write Standard are just two examples of such programs.
- **Reading tools and learning disabilities programs** include software designed to make text-based materials more accessible for people who struggle with reading. Options can include scanning, reformatting, navigating, or speaking text out loud. These programs help people who have difficulty seeing or manipulating conventional print materials; people who are developing new literacy skills or who are learning English as a foreign language; and people who comprehend better when they hear and see text highlighted simultaneously. The Universal Reader is an example of assistive technology that can make reading easier.
- **Speech synthesizers** (also known as *text-to-speech*) speak information aloud in a computerized voice. Speech synthesizers can be helpful for people with learning, language, or vision impairments. Products, such as Scan and Read Pro, produce natural-sounding speech synthesis that can support reading skills development.
- **Speech recognition programs** allow computer navigation by voice rather than entering data by keyboard or mouse. In addition to voice, you can still use a mouse and keyboard to enter data, write text, and navigate applications. People who have difficulty typing or reading text because of a learning, language, or mobility impairment can often successfully work on a computer with the use of speech recognition. Speech Recognition is available in Windows 7 and Windows Vista. Some may prefer or require a more robust speech recognition program, such as Dragon NaturallySpeaking.

# Age-related impairments

Age-related impairments occur as part of the natural aging process. They may include any of the various types of impairments already discussed in this guide.

As people age, they may experience vision or hearing loss, mobility or dexterity impairments, or difficulties with learning or language. For example, by the time we reach our fifties, two-thirds of us will have developed vision, hearing, or dexterity impairments that may affect our computer use, such as changes in vision that make it harder to read online text or arthritis in our hands that makes typing difficult or painful.[8]

As the age of the population increases —and more people experience the disabilities, impairments, and other functional limitations that often come with age—providing products and services that meet the needs of older people will become increasingly important. Because of accessible technology, businesses will be able to tap into an expanding market of underserved consumers, governments and other organizations will offer better access to services to more people, and consumers will have greater access to essential services and information.

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[8] Chappell NL, Cooke HA. 2011. Age Related Disabilities - Aging and Quality of Life. In: JH Stone, M Blouin, editors. International Encyclopedia of Rehabilitation. Available online: http://cirrie.buffalo.edu/encyclopedia/en/article/189/



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## Accessibility features in Windows

Many of the accessibility features in Windows 7 and Windows Vista can be helpful in addressing age-related impairments. For specific types of limitations, such as low vision, hearing loss, or dexterity impairments, consult the sections of the guide that deal specifically with those disabilities or use the Ease of Access Center in Windows 7 and Windows Vista to learn which built-in accessibility features best meet the needs of an individual.

The Ease of Access Center also includes a questionnaire that poses questions about one's experience with a variety of everyday life activities—such as watching television and writing with a pencil or pen—and makes recommendations for accessibility settings based on the answers. This can be especially helpful for people who are beginning to experience age-related limitations and who may not identify themselves as having an impairment or disability. Whether they have trouble seeing images on TV or hearing conversations in a crowded room, Windows can provide accessibility suggestions based on actual experiences rather than on impairment language or labels.

## Assistive technology products for people with age-related impairments

Most age-related impairments do not require specialized assistive technology products and can be aided by customization options, such as font size, contrast, or other customization options within the operating system. If an age-related impairment becomes serious enough to warrant specialized assistive technology, the relationship to age is no longer the primary technology consideration and solutions are identified in this guide by the type of disability or impairment experienced.

## Related resources:

- Computing Guide for Boomers (www.microsoft.com/enable/aging/)
- Ten tips for the awkward age of computing (www.microsoft.com/enable/aging/tips.aspx)
- Save time with quick computer shortcuts (www.microsoft.com/athome/organization/compshortcuts.aspx)
- 5 ways to make your keyboard easier to use (www.microsoft.com/athome/setup/keyboard.aspx)
- Visualize it: 5 ways to make your PC easier to see (www.microsoft.com/athome/setup/magnify.aspx)
- Always looking for your mouse pointer? (www.microsoft.com/athome/setup/cursor.aspx)
- Customize your PC (www.microsoft.com/athome/setup/customize.aspx)



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# Chapter 3: Selecting accessible technology

When selecting technology for your company or organization, it is important to consider accessibility features and assistive technology products that will be helpful to individuals with specific disabilities. It is also important to plan for the onset of temporary disabilities that will inevitably occur.

At Microsoft, for example, we provide ergonomic hardware and assistive technology consultation so our employees can be productive, comfortable, and injury-free at work. We are a more diverse company because of our efforts to recruit and employ top-quality people, including those who happen to have disabilities, and we recognize that our employees with disabilities make an added contribution by helping us more effectively recognize, understand, and reach a broader market for our products. Accommodating and enabling employees to perform the necessary functions of their jobs ultimately enhances our ability to develop great products and services for everyone. For more information, see Accessibility at Microsoft (www.microsoft.com/enable/microsoft/).

This chapter includes guidance on how to go about identifying accessibility solutions, details about accessibility settings in Microsoft products, a starter guide to assistive technology hardware and software, and a needs assessment tool.

## Identifying the right mix of accessibility solutions

Improving the work experience can mean different things to different individuals—having a multisensory experience of audio paired with a visual representation may benefit one person, and reducing visual and auditory distractions may be better for another. There are hundreds of types of accessibility solutions available—both built-in features and assistive technology hardware and software products—so it is important to take the time to identify the right mix of accessibility solutions for each individual.

### Needs assessments

Identifying the best assistive technology solution often requires an in-depth needs assessment to understand how a difficulty or impairment impacts computer use. It is important to take the time to evaluate an individual's needs through an assessment tool or to provide assistive technology consultation with an assistive technology expert before purchasing products.

Some organizations have staff trained in accessibility assessment. If your organization doesn't have such resources available, this guide includes an Assistive Technology Decision Tree tool to help you. In addition, many accessibility consultants are available through various organizations, including those listed here.



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## Accessibility consultants

Many assistive technology centers and occupational therapists have accessibility consultants to help individuals identify the right mix of accessibility features and products. Some centers offer computer training, and many organizations have lending libraries, so you can try a product before committing to purchase it.

### In the United States

- **Microsoft Accessibility Resource Centers** (www.microsoft.com/enable/centers) are available in the United States. These centers provide expert consultation on assistive technology and accessibility features built into Microsoft products.
- **The Alliance for Technology Access** (www.ataccess.org) and the **Association of Assistive Technology Act Programs** (www.ataporg.org/) are other U.S. networks dedicated to providing information and technology support services to people with disabilities.
- **The Rehabilitation Engineering and Assistive Technology Society of North America**, known as RESNA (www.resna.org), offers certification programs for assistive technology practitioners. RESNA is another source for identifying assistive technology experts who can assist organizations in North America.

### In Asia

- **Tokyo Information Technology Regional Support Center** for persons with disabilities (www.tokyo-itcenter.com/) delivers training, organizes IT support, and has an exhibition room for people with disabilities.
- **Osaka IT Station** (www.itsapoot.jp/) provides work-related training, organizes IT support, and has an exhibition room for people with disabilities.
- **National Information Society Agency (NIA), Korea** (www.nia.or.kr/koil/default.asp) is a statutory agency founded by Article 10 of the Framework Act on Informatization Promotion for the purpose of promoting informatization and to support development of related policies for national agencies and local autonomies. NIA has been making efforts to improve web accessibility in Korea, including developing web accessibility standards, operating web accessibility education and certification programs and portal sites (www.wah.or.kr), supporting development and purchase of assistive technologies, and promoting awareness on web accessibility issues through campaigns and seminars.

### In Latin America

- **POETA Accessible Centers** in Latin America (www.poetaweb.org) deliver training in information and communications technology, civic education, and job readiness to thousands of at-risk youth and people with disabilities across Latin America and the Caribbean.

### In Europe

- **AbilityNet** in the United Kingdom (www.abilitynet.org.uk/) helps ensure that people with disabilities in the United Kingdom, whether as individuals or through supporting organizations, have accessible IT that enables and improves their lives. AbilityNet is the leading U.K. charity for computing and disability and has a network of centers. A range of free resources is available from their website. AbilityNet also offers advice on web and software accessibility, including user testing.
- **ONCE**, the Spanish National Organization for the Blind (www.once.es) and its foundation, ONCE Foundation for Cooperation and the Social Integration of People with Disabilities in Spain (www.fundacionONCE.es), provide work-related training and employment for people with disabilities. They also aim for universal accessibility, promoting the creation of universally accessible environments, products, and services.



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- **Enable Ireland** (www.enableireland.ie/) works in partnership with those who use its services to achieve maximum independence, choice, and inclusion in their communities. Enable Ireland runs a national assistive technology training service specializing in electronic assistive technology, providing advice and training on assistive technology products to Enable Ireland service users and staff.
- **Charta 77/PCs without Barriers** in the Czech Republic (en.kontobariery.cz/) provides technology knowledge and support to those living with disabilities through 16 PC centers across the Czech Republic.
- **The Organization of People with Disabilities and Their Friends APEIRONS** in Latvia (www.apeirons.lv/) has a goal to integrate people with disabilities into society, in addition to creating more accepting attitudes toward them from the general public. The organization operates a lab in downtown Riga where people can take classes, learn about accessible technologies, and test various options.
- **The eCentrum project** in Poland (www.idn.org.pl/) specializes in the use of modern technologies in education and mobilization for those living with disabilities, creating e-learning and blended learning educational programs, along with desktop training at several locations throughout Poland.

### In Australia

- **Vision Australia** (www.visionaustralia.org) works in partnership with Australians who are blind or have low vision to help achieve the possibilities they choose in life. Vision Australia services include assistive technology assessment, computer training, and expertise in web and software accessibility testing, training, and advice.

## Online training

In addition, online training and web seminars are available for learning specific types of assistive technology products. Primary sources for online training include:

- Accessibility for Businesses and Organizations (www.microsoft.com/enable/business/).
- The Assistive Technology Industry Association (www.atia.org).
- The HP Guide to Selecting Assistive Technology (www.hp.com/hpinfo/abouthp/accessibility/atproduct.html).

# Accessibility in Microsoft products

Following is a list of accessibility features of these products:

- Windows 7
- Internet Explorer 8
- Office 2010

Tip
Demos and tutorials for accessibility features can be found at www.microsoft.com/enable/.

Accessibility features are found in current and earlier versions of Microsoft products including Windows, Office, and Internet Explorer. Find more information at www.microsoft.com/enable/products/.



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## Accessibility in Windows 7

Windows 7 includes accessibility options and programs that make it easier to see, hear, and use your computer, including ways to personalize your PC.

Windows 7 includes significant accessibility improvements. Magnifier now includes a lens mode and full-screen mode. On-Screen Keyboard can be resized to make it easier to see and includes text prediction. Windows 7 also gives you more ways to interact with your PC by taking advantage of new strides in speech recognition and touch technology.

Find more information at www.microsoft.com/enable/products/windows7/.

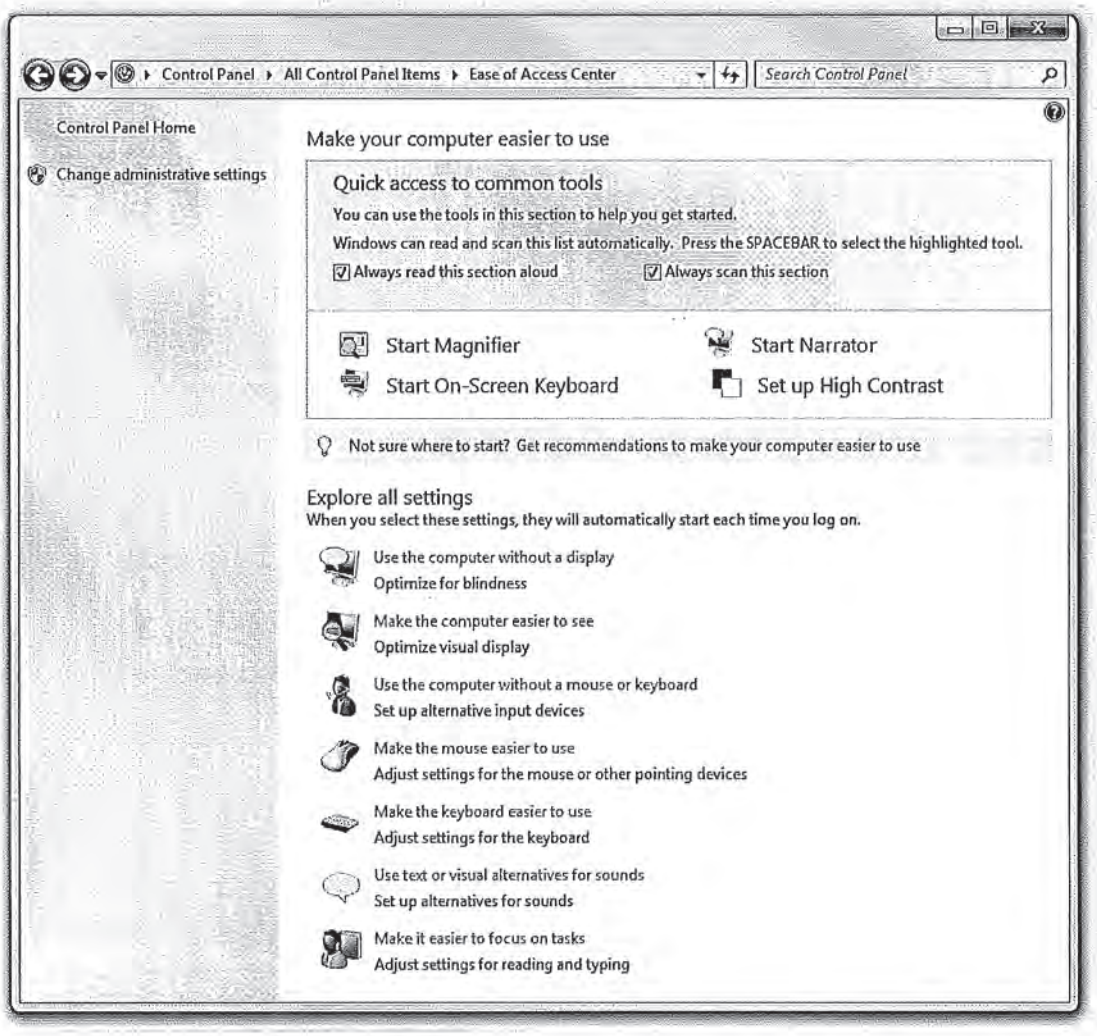


**Figure 3-1** The Windows 7 Ease of Access Center gives you quick access to common tools.



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## Overview of accessibility features in Windows 7

| Feature | Description |
|---|---|
| Ease of Access Center | A central location to explore accessibility settings and programs to make your computer easier to use. The Ease of Access Center can be found in the Control Panel by selecting Windows logo key + U and when logging on to Windows.<br><br>The Ease of Access Center includes:<br>▪ **Quick access to common tools.** Start Magnifier, On-Screen Keyboard, Narrator, and High Contrast quickly.<br>▪ **Get recommendations to make your computer easier to use.** An optional questionnaire provides a personalized list of recommended settings, based on your answers to a series of questions about your eyesight, dexterity, hearing, and more. A custom list of recommended settings is provided so you can choose which options to try.<br>▪ **Explore all settings by category.** Instead of looking for accessibility settings in various places, settings are organized so you can explore how to:<br>o Use the computer without a display.<br>o Make the computer easier to see.<br>o Use the computer without a mouse or keyboard.<br>o Make the mouse easier to use.<br>o Make the keyboard easier to use.<br>o Use text or visual alternatives to sounds.<br>o Make it easier to focus on tasks. |
| Magnifier | Enlarges portions of the screen, making it easier to view text and images and to see the whole screen more easily. Magnifier in Windows 7 now includes full-screen mode, lens mode, and docked mode.<br><br>The magnification quality is improved, and you can set the magnification level up to 16 times the original size and choose to track what you magnify by movement of your mouse, the keyboard, or text editing. Options include:<br>▪ Choose where Magnifier focuses so that it follows the movement of the mouse cursor, keyboard focus, or text editing.<br>▪ Change the zoom level.<br>▪ Set the zoom increment.<br>▪ Set the lens size.<br>▪ Turn on color inversion for better screen legibility.<br>▪ Display the Magnifier toolbar. |
| Make items on the screen appear larger | Make the text and other items, such as icons, on your screen easier to see by making them larger. You can do this without changing the screen resolution of your monitor or laptop screen. This allows you to increase or decrease the size of text and other items on your screen while keeping your monitor or laptop set to its optimal resolution. |



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| Feature | Description |
| --- | --- |
| On-Screen Keyboard | Displays a visual keyboard with all the standard keys. Instead of relying on the physical keyboard to type and enter data, you can use On-Screen Keyboard to select keys by using the mouse or another pointing device.<br><br>On-Screen Keyboard in Windows 7 can be resized and customized to make it easier to see and use. On-Screen Keyboard now also includes text prediction in eight languages. When text prediction is enabled, as you type, On-Screen Keyboard displays a list of words that you might be typing. Options include:<br><br>▪ Change how information is entered.<br>▪ Set On-Screen Keyboard to use audible clicks.<br>▪ Use a numeric keypad.<br>▪ Enable text prediction. |
| Speech Recognition | Command your PC with your voice, including the ability to dictate into almost any application. You can dictate documents and email and surf the web by saying what you see. An easy setup process and an interactive tutorial are available to familiarize you with the speech commands and to train your computer to better understand you. Options include:<br><br>▪ Dictate text using Speech Recognition.<br>▪ Use the dictation scratchpad.<br>▪ Add or edit words in the Speech Dictionary.<br>▪ Use common commands. |
| Windows Touch | Although great for a lot of tasks, using a keyboard and mouse is not always the easiest way to do things. With Windows 7, if you've got a touchscreen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom. |
| Narrator | Windows comes with a basic screen reader, called Narrator, which reads text on the screen aloud and describes some events (such as the appearance of an error message) that happen while you're using the computer. You can find Narrator in the Ease of Access Center. Options include:<br><br>▪ Choose which text Narrator reads aloud.<br>▪ Change the Narrator voice.<br>▪ Start Narrator minimized. |
| Keyboard shortcuts | Keyboard combinations of two or more keys that, when pressed, can be used to perform a task that would typically require a mouse or other pointing device. Keyboard shortcuts can make it easier to interact with your computer, helping to save you time and effort. |
| Mouse Keys | Instead of using the mouse, you can use the arrow keys on the numeric keypad to move the pointer. |
| Sticky Keys | Instead of having to press three keys at once (such as when you must press the Ctrl, Alt, and Delete keys simultaneously to log on to Windows), you can press one key at a time, when Sticky Keys is turned on. |



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| Feature | Description |
|---|---|
| Filter Keys | Ignore keystrokes that occur in rapid succession and keystrokes that are held down for several seconds unintentionally. |
| Visual Notifications | Replace system sounds with visual cues, such as a flash on the screen, so system alerts are announced with visual notifications instead of sounds. |
| Captions | Get information via animations and video that some programs use to indicate that activity is happening on your computer. |

**Tip**
**Replacement for Serial Keys**
Windows 7 does not include Serial Keys. In previous versions of Windows, Serial Keys provided support so that alternative input devices, such as augmentative communication devices, could be plugged into the computer's serial port. For individuals who use these devices, it is important to install an alternative solution prior to upgrading to Windows 7. Recommended solutions: AAC Keys from AAC Institute (www.aacinstitute.org/) and SKEYS from Eyegaze (www.eyegaze.com/).

## Accessibility in Internet Explorer 8

The Internet is easier to see and explore with accessibility settings and features in Internet Explorer 8. Internet Explorer 8 lets you select text and move around a webpage with the keyboard, makes it easier to copy and paste text from webpages, and lets you zoom in on a webpage. Enhanced keyboard access can also be found in the toolbar buttons, search box items, address bar, and tabs. Find more information, including tutorials, for how to use these features at www.microsoft.com/enable/products/ie8/.

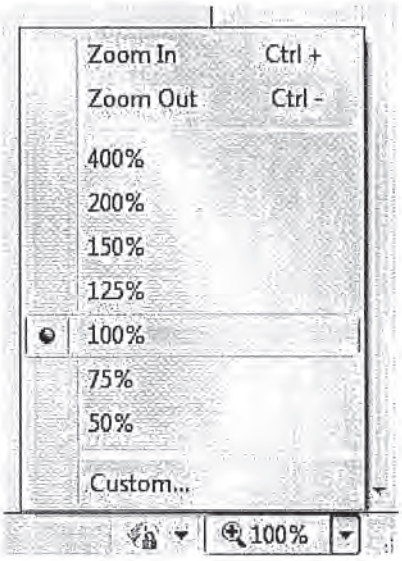


**Figure 3-2** Zoom adjustment in Internet Explorer 8 can make webpages easier to see.



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## Overview of accessibility features in Internet Explorer 8

| Feature | Description |
|---|---|
| Zoom in on a webpage | Zoom lets you enlarge or reduce the view of a webpage. Unlike changing font size, zoom enlarges or reduces everything on the page, including text and images. |
| Select text and move around a webpage with the keyboard | Rather than using a mouse to select text and move around within a webpage, you can use standard navigation keys on your keyboard—Home, End, Page Up, Page Down, and the Arrow keys. This feature is called *Caret Browsing* and is named after the *caret*—or cursor. This makes it easier to select, copy, and paste text to another document with a keyboard instead of a mouse. |
| Simplify common tasks with Accelerators | Make tasks like copying, navigating, and pasting easier by using accelerators to save time and keystrokes. Accelerators help you quickly perform tasks without navigating to other websites to get things done. Highlight text from any webpage, and then click the blue **Accelerator** icon that appears above your selection to obtain driving directions, translate and define words, send email content, or search. |
| Choose colors used on webpages | Make webpages easier to see by changing the text, background, link, and hover colors. Internet Explorer 8 supports the system link color, so High Contrast mode and color preferences you have chosen in Windows will work in Internet Explorer too. |
| Choose font, colors, and advance accessibility formatting options | Under **Tools/Internet Options**, you can choose your own font style, size, and colors for links and webpages or choose advanced accessibility formatting options that let you use your own customized style sheet. |
| Choose advanced settings | Make webpages easier to see and work with by adjusting accessibility settings for browsing, multimedia, printing, alternative text, and more in **Tools/Internet Options**. |
| Find text on a webpage | As you type words into the text box, the matching words are highlighted on the webpage, making it easy to quickly scroll the page and see all the instances of the words you're searching for. |



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## Accessibility in Microsoft Office 2010

Microsoft Office 2010 makes it easier for everyone to create documents, spreadsheets, and presentations with rich content. Finding the commands you need is easier with the completely redesigned user interface. Find more information at www.microsoft.com/enable/products/office2010/.

### Overview of accessibility features in Office 2010

| Feature | Description |
|---|---|
| Accessibility Checker | Word 2010, Excel 2010, and PowerPoint 2010 include an Accessibility Checker that identifies areas which could be challenging for users with disabilities to view or use. With the task pane, users can fix potential content problems. |
| The Ribbon | The menus and toolbars in all Office 2010 programs have been replaced with the Ribbon, designed to help you quickly find the commands that you need to complete a task. To move through the ribbon with a keyboard instead of a mouse, you can press Ctrl+Right Arrow or Ctrl+Left Arrow on a Ribbon tab to move to the next or previous Ribbon group tab. |
| Zoom | The Zoom tool makes resizing your work area faster and easier. |
| Produce professional-looking results quickly and easily | Galleries simplify the process of creating great-looking documents, presentations, and spreadsheets by showing a set of potential design choices. No complex dialog boxes are needed. |
| Live Preview | Live Preview lets you see exactly how your gallery selection will look when it is applied. |
| Create diagrams and charts without a mouse | Organizational charts, process diagrams and other graphics can be created with SmartArt® graphics tools, which are completely accessible from the keyboard or assistive technology devices. |
| Compose documents by talking to your computer | Office 2010 works with Speech Recognition in Windows 7 so you can navigate the user interface, compose documents, open email, and more—without using a mouse or keyboard. |
| Create accessible portals with SharePoint Designer 2010 | SharePoint Designer 2010 includes a built-in compatibility checker for common accessibility standards to help make sure websites are easy to use for everyone. More Accessible mode in SharePoint Services provides greater accessibility for custom controls. |
| Scroll, zoom, listen, and automate | Zoom and scroll directly with a Microsoft IntelliMouse®, and let Microsoft Narrator read text and commands aloud. |
| Correct Mistakes as you type | Correct capitalization and spelling as you type, plus formatting, punctuation marks, symbols, and lists. |
| Use Full Screen Reading view | Word 2010 includes a Full Screen Reading view that improves the resolution and display of text for reading on the screen. |



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# Assistive Technology Product Starter Guide

The following tables provide lists of assistive technology hardware and software products by category. Specific examples of the assistive technology products are provided. The tables are by no means exhaustive or an endorsement of these products but are provided as a sampling of what is available today. These types of assistive technology products are also referenced in the Assistive Technology Decision Tree which follows.

## Assistive technology: hardware products

| | Vision | Mobility | Hearing | Language | Learning | Example |
|---|---|---|---|---|---|---|
| Amplified phone | | | ● | | | Ameriphone Dialogue XL |
| Augmentative communication device | | | | ● | | GoTalk 4+ |
| Alternative input | | ● | | | | HeadMouse Extreme and Tracker Pro |
| Alternative keyboard | ● | ● | | | | ZoomText large-print keyboard and Orbitouch keyless keyboard |
| Alternative mouse or pointing device | | ● | | | | BIGtrack |
| Braille display | ● | | | | | Eurobraille Esys 12 Braille Display |
| Braille printer | ● | | | | | Emprint SpotDot |
| DAISY reader | ● | | | | | Victor Reader Wave |
| Ergonomic keyboard | | ● | | | | Microsoft Wireless Laser Desktop 4000 |
| Foot mouse | | ● | | | | Footime Foot Mouse |
| Hands-free telephone | | ● | | | | QualiPHONE* |
| High-resolution monitor | ● | | | | | HP w1858 18.5-inch diagonal monitor |
| Large-button phone | ● | ● | | | | Ameriphone Dialogue XL |
| Listening aid | | | ● | | | Motiva Personal FM System |
| Monitor glare guard | ● | | | | | Fellowes anti-glare screen |
| Movable numeric keypads | | ● | | | | Maxim Low-Force Keypad (USB) |
| Notetaker | ● | | | | ● | Livescribe Pulse Smartpen and GW Sense Navigation |
| One-handed keyboard | | ● | | | | Maltron One-Handed Keyboard |
| Optical character recognition system | ● | | | | ● | Scan and Read Pro** |
| Oversized or undersized keyboard | | ● | | | | BigKeys LX and WinMini |
| Oversized monitor | ● | | | | | HP w2338h 23-inch diagonal monitor |
| Scanner | ● | | | | ● | Scan N Talk Ultra |



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| | Vision | Mobility | Hearing | Language | Learning | Example |
|---|---|---|---|---|---|---|
| Screen magnifier/magnifier | ● | | | | | Desktop SenseView DSV, SmartView Graduate, and ColorMouse |
| Switch | | ● | | ● | | Big Red Twist Switch |
| Talking calculators | ● | | | | ● | Sci-Plus 300 large display talking calculator |
| Touchscreens | | ● | | ● | ● | Magic Touch Add-On Touch Screens |
| TTY | | | ● | | | Compact/C |
| Voice synthesizer/ Speech to text | ● | | ● | ● | ● | TextSpeak TS Wireless AAC Speech Generator and iCommunicator*** |

*Requires PC to phone line connection; **Requires flatbed scanner (such as Scan N Talk Ultra); ***Requires installation on a PC

## Assistive technology: software products

| | Vision | Mobility | Hearing | Language | Learning | Example |
|---|---|---|---|---|---|---|
| Braille translator | ● | | | | | Duxbury Braille Translator |
| Communication aid | | | | ● | | Overboard |
| Graphical idea trees | | | | | ● | Read&Write GOLD |
| Macro writing software | | | | | ● | ClaroRead Standard |
| On-screen keyboard | | ● | | | | ScreenDoors and SofType |
| Reading aid | ● | | | | | gh Player 2.2 |
| Scanner software | ● | | | | ● | Scan N Talk Ultra |
| Screen magnifier | ● | | | | | ZoomText v9.1 |
| Screen readers | ● | | | | | Window-Eyes v7.2 |
| Speech recognition/ Voice dictation | | | | | ● | Dragon Naturally Speaking Preferred |
| Talking calculators | ● | | | | ● | Sci-Plus 300 large-display talking calculator* |
| Task organizer software | ● | ● | ● | ● | ● | MyLifeOrganized |
| Voice synthesizer/ Speech to text | ● | | ● | ● | ● | TextSpeak TS Wireless AAC Speech Generator and iCommunicator |
| Word prediction software | | | | | ● | Read&Write GOLD and ClaroRead Standard |

*Includes a large-display calculator

## Purchasing assistive technology

The Enablemart website (www.enablemart.com) is one source where you can purchase assistive technology products. Governments and large businesses or organizations might be eligible for volume pricing.



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# Assistive Technology Decision Tree

The UnumProvident **Assistive Technology Decision Tree** (www.microsoft.com/enable/download/default.aspx#righttech), shown in Figure 3-3, leads you through questions based on the type of impairment to identify assistive technology products that you might consider. By asking questions regarding the extent and type of impairment (including range of motion, quadriplegia, back impairment, vision impairment, hearing/auditory impairment, speech impairment, and psychological impairment), the decision tree narrows down technology that might be helpful for an individual.

**Figure 3-3a** Assistive Technology Decision Tree

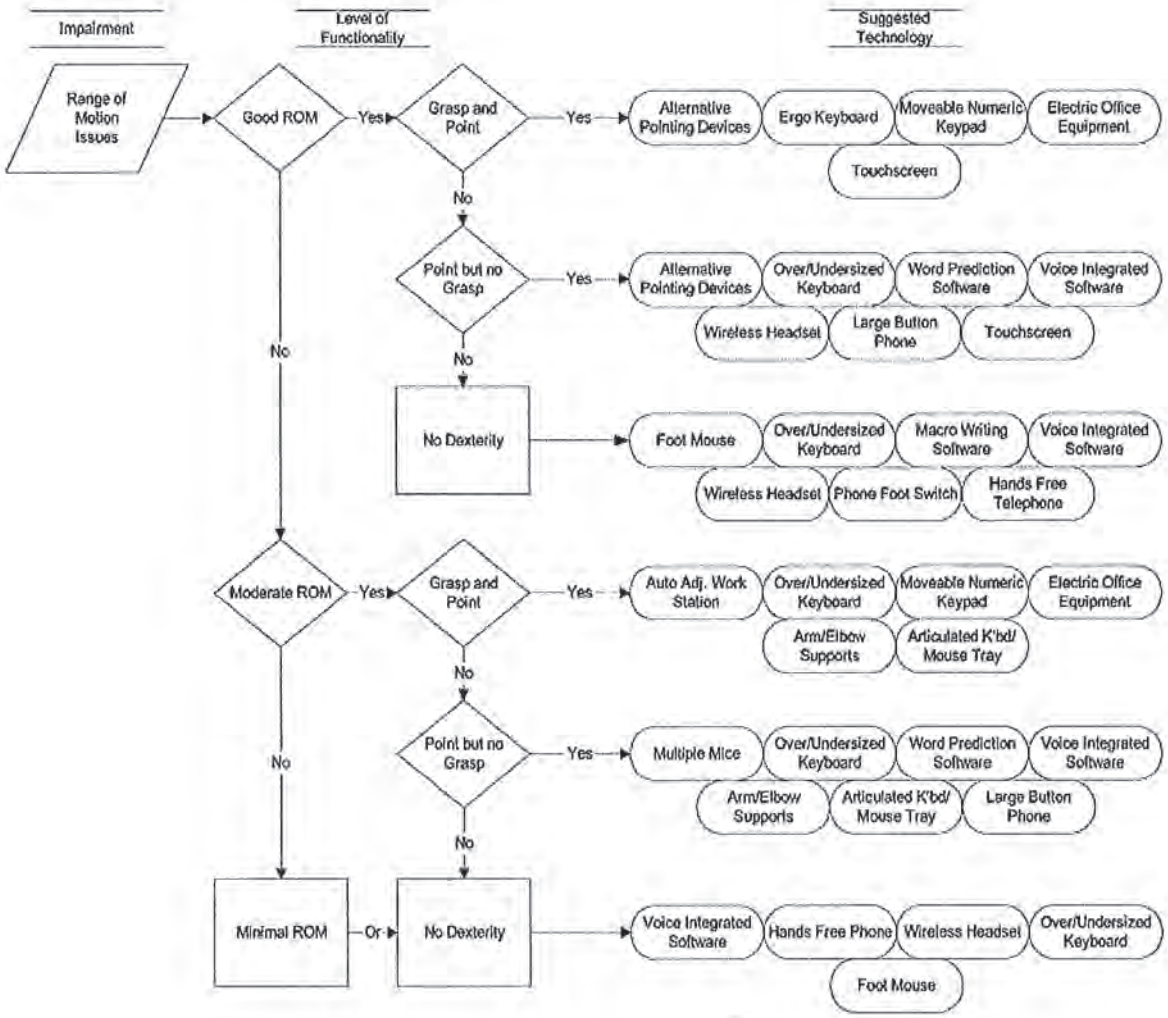




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Figure 3-3b Assistive Technology Decision Tree

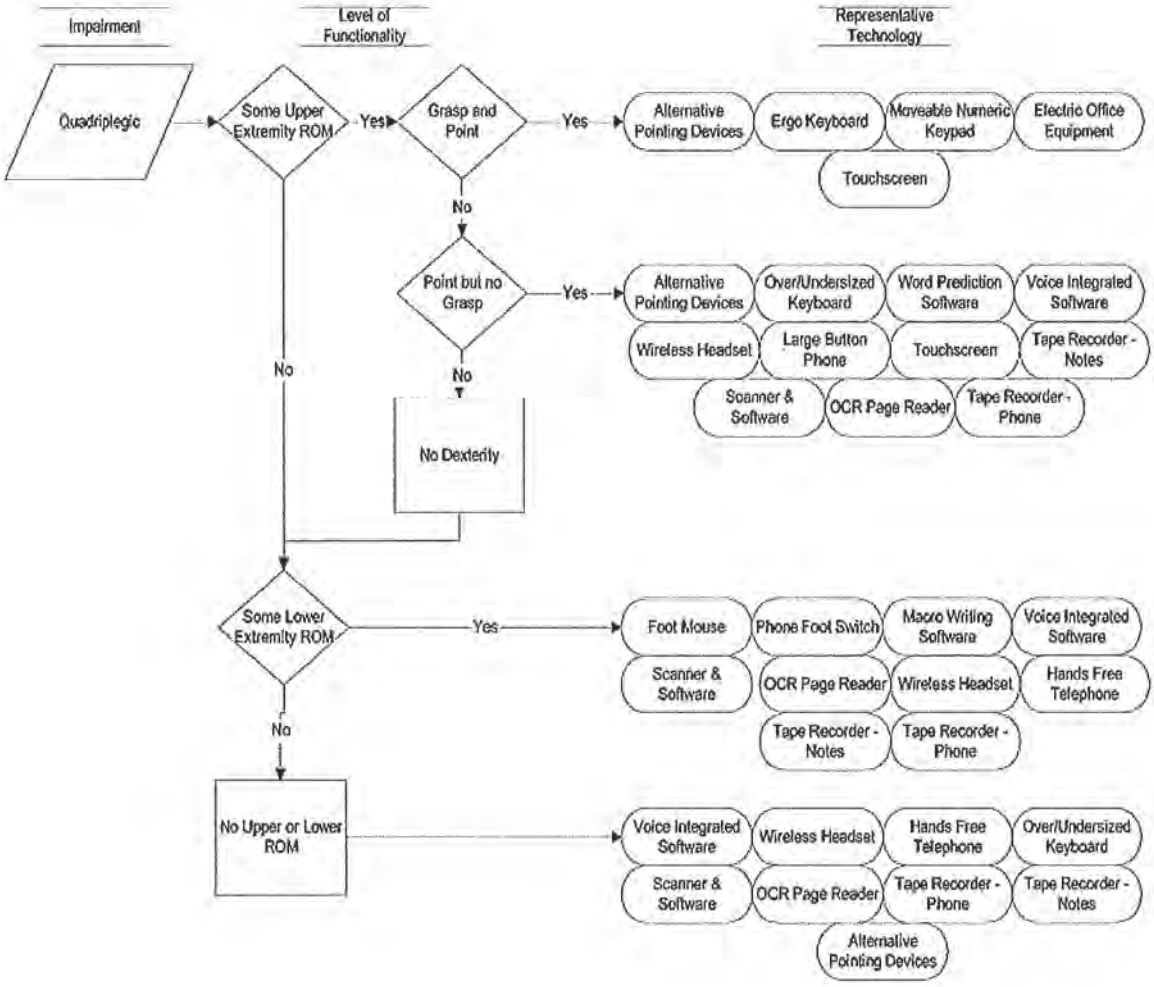




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Figure 3-3c Assistive Technology Decision Tree

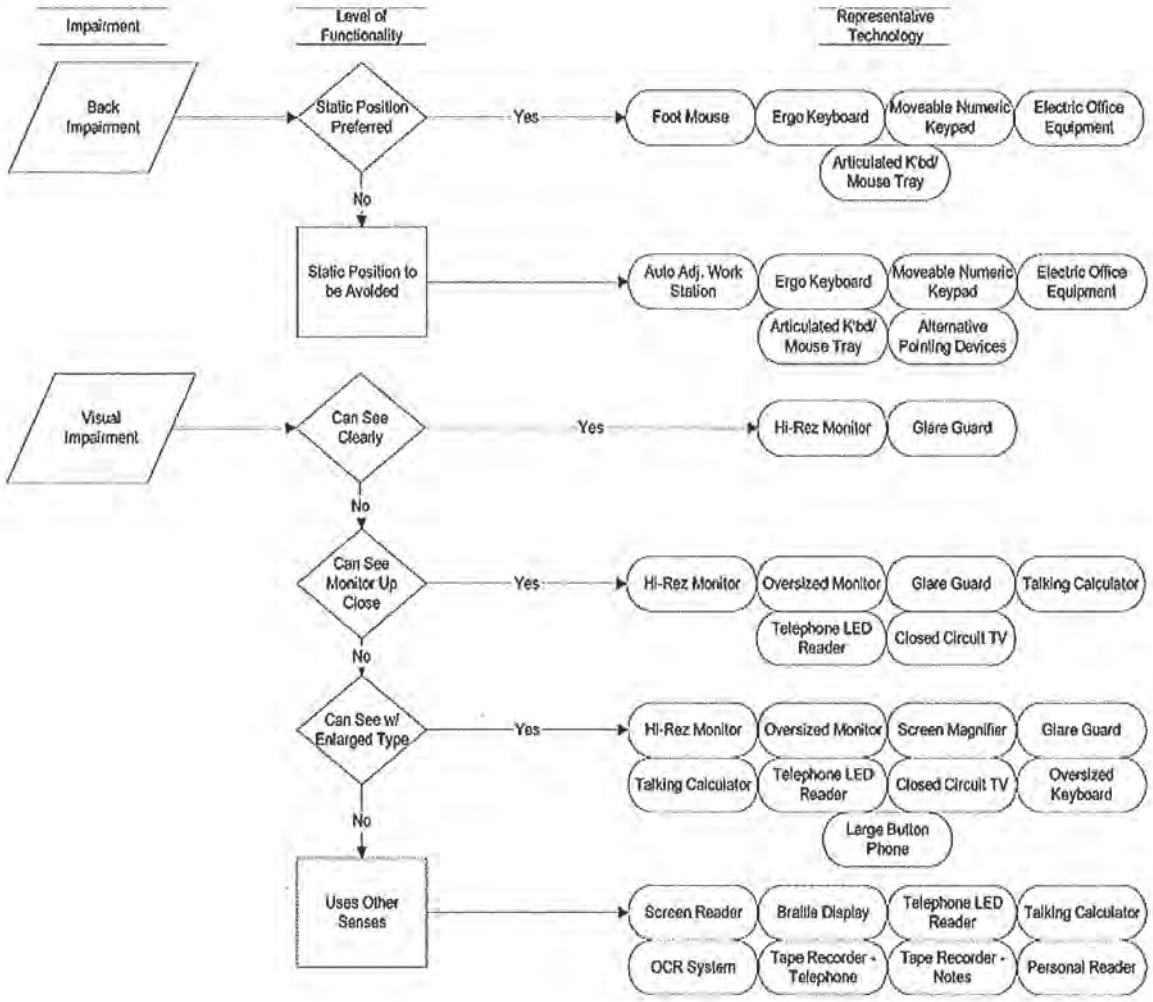




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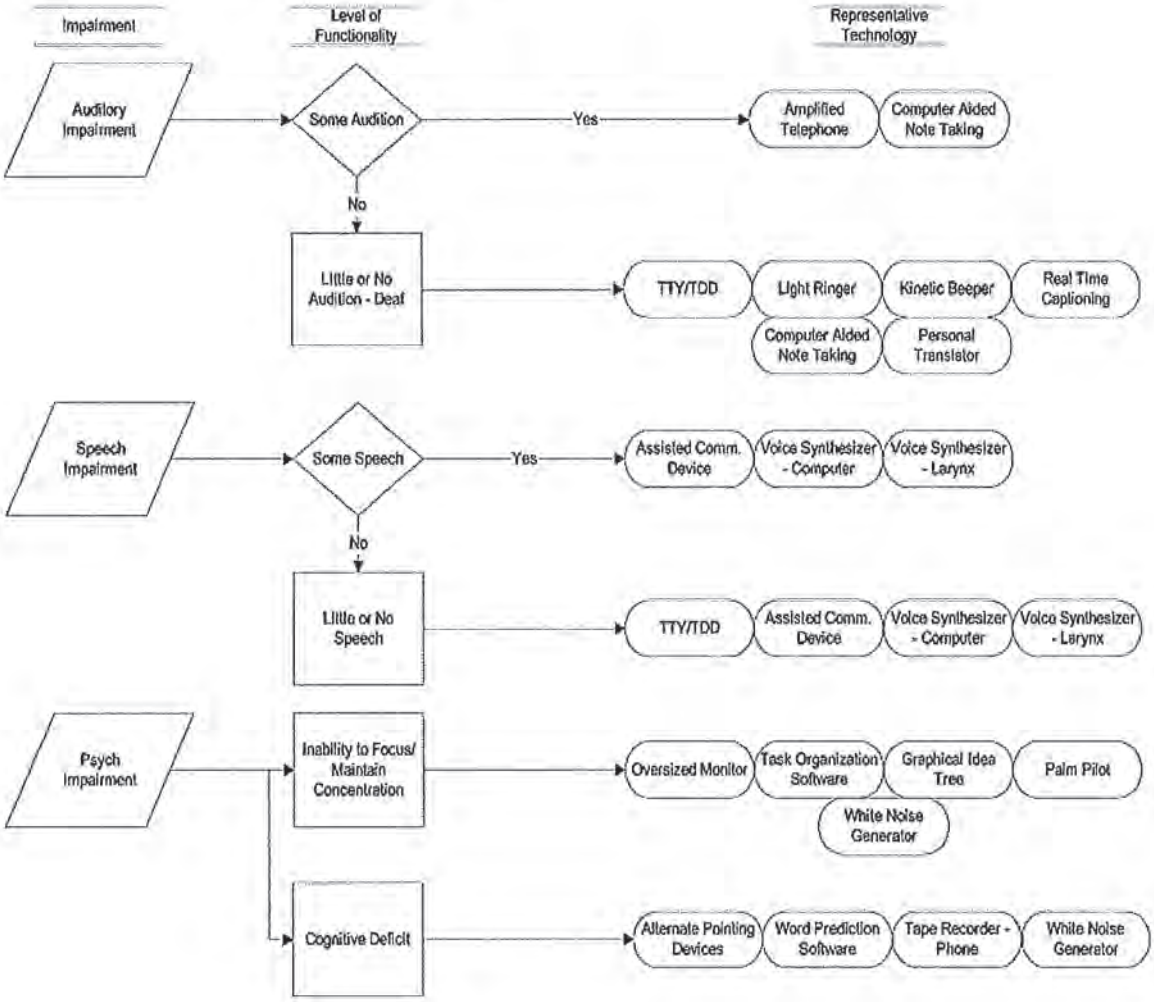
Figure 3-3d Assistive Technology Decision Tree



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# Chapter 4: Planning and training for accessibility

Microsoft has developed Accessibility Training Courses designed to help organizations create more accessible software products using the Windows platform. Online developer training courses are designed to help large organizations train their web development teams on how to make software applications and websites more accessible.

## Developing an accessible technology plan

For organizations that want to increase the accessibility of their technology, there are a few key steps and considerations. Start by developing an accessible technology plan for your organization that enables you to integrate accessibility into your existing processes and product life cycles. The accessible technology plan should include specific steps:

- Set your accessibility goals.
- Assess your accessibility needs and current level of accessibility.
- Identify requirements.
- Lay out an implementation and execution strategy to meet your goals.

To carry out the plan, you need to:

- **Purchase accessible IT.** Lay a solid foundation for accessibility by purchasing an operating system, productivity suite, browser, and other information technology that is accessible and includes built-in features and settings for added accessibility. Accessible IT also provides a platform you can use to develop internal systems and applications that are not only accessible themselves but also compatible and interoperable with other accessible technology and assistive devices.
- **Train employees** on why building more accessible products makes good sense and how to use the accessibility features included in your internal systems. Train web developers on how to create more accessible websites to help users benefit from increased accessibility choices.
- **Make websites and internal tools accessible.** Use established guidelines and best practices to make your organization's websites and internal tools accessible to all employees.
- **Evaluate and update legacy and proprietary systems for greater accessibility.** Determine whether your current legacy and proprietary systems have built-in accessibility options, features, shortcuts and toolbars you could be using. Do employees with disabilities, impairments, or age-related limitations have trouble accessing your systems?
- **Design and develop accessible technology.** Make accessibility an integral part of your product design and development process in a programmatic way, right from the start of the product development cycle.



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# Accessibility training for web developers and testers

Microsoft has developed online Accessibility Training Courses designed to help organizations train their IT professionals on how to build accessible technology and improve the accessibility of their websites and in-house technologies.

The training modules (available on a CD that comes with this guide and available online at http://msdn.microsoft.com/accessibility) are valuable resources you can use to help inspire you to learn more about creating accessible products and thereby incorporate accessibility in a programmatic way as a part of the product development cycle.

Each training module listed contains a description of the training and the intended audience. For screen readers that do not recognize Microsoft Silverlight™, there is an alternative version of each course that presents all the information without using Silverlight. There is also a third, text-only version available on the companion CD and online at http://msdn.microsoft.com/accessibility.

| Training module | Delivery method | Description | Target audience |
|---|---|---|---|
| Introduction to accessibility | Online<br>Self-paced | Opportunity to hear stories of people whose lives are enhanced by accessible technology products and to understand the importance of making accessibility a systematic component of the product life cycle | Chief executive officer<br>Chief technical officer<br>Chief operating officer<br>HR director<br>IT professionals<br>Developers<br>Testers |
| General accessibility for developers | Online<br>Self-paced | How to plan and access costs for creating accessible applications using a logical hierarchy | Developers<br>Testers |
| Windows (Win 32) accessibility for developers | Online<br>Self-paced | How to use MSAA and UIA in Win32 to create programmatic access for users of assistive technology | Developers<br>Testers |
| WinForms accessibility for developers | Online<br>Self-paced | How to use WinForms common controls to create more accessible applications | Developers<br>Testers |
| Windows Presentation Foundation (WPF) accessibility for developers | Online<br>Self-paced | How to use the WPF UI Automation application to create access for users of assistive technology | Developers<br>Testers |
| Silverlight accessibility for developers | Online<br>Self-paced | How to use WPF UI Automation to create more accessible Silverlight applications | Developers<br>Testers |
| Accessible Web Applications for developers | Online<br>Self-paced | How to use the Web to create more accessible applications | Developers<br>Testers |



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## Resource Materials

Along with the training course, Microsoft has developed resource materials to further raise awareness within organizations about building more accessible products and services in a programmatic way. The materials include additional resources to help developers to make their online products more accessible using the Windows operating system and a guide that specifically addresses software engineering for accessibility. The materials are available online, in a downloadable PDF format, at www.microsoft.com/enable/business/.

## Deploying accessible technology

After you have purchased or developed technology, you still have to deploy it throughout your organization. To realize the greatest productivity benefits from accessible technology, train all employees so that they understand and can use the accessibility features in any technology you purchase or develop in-house.

Avoid common mistakes in deploying accessible technology, including:

- Centralized lockout of accessibility options.
    - Employees can be shut out of built-in features, such as high-contrast settings, when system administrators use group policies that do not allow them to have access to these features. (For example, an administrator may bar user access to options in the system control panel where most of the accessibility tools can be activated).
- Lack of keyboard access to all features.
    - One accessibility best practice is to make sure the keyboard is able to perform the same tasks as a mouse device. It is also important to document the keyboard user interface in the product manual and through online Help.
- Applications that do not honor system settings.
    - When set correctly, system settings indicate when applications should change their default behavior. For example, when the Show Sounds setting is on, an application that typically uses sound to convey important information should also show the information visually. By not honoring this setting, a person with hearing difficulty may not know if an audible alert has been activated.

In the training modules (available on a CD that comes with this guide and available online at http://msdn.microsoft.com/accessibility) you will find more direction on common developer mistakes and how to avoid them.

Finally, make sure your IT department can provide high-quality, ongoing support for employees who are relying on accessible technology, in addition to others who may want or need to use it.

## In closing

Thank you for your interest in learning more about accessibility in the workforce, why it is important to your organization, and how it can help your employees, customers, and partners realize their full potential. We hope you find the Accessibility Training Course CD included in this guide, and available online at http://msdn.microsoft.com/accessibility helpful in creating software products that are more accessible.



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# Resources

## Resources from Microsoft

The Microsoft mission is to enable people and businesses throughout the world to realize their full potential. Computer technology is an important and powerful tool that enables and empowers individuals of all abilities. At Microsoft, we strive to develop technology that is accessible and usable by everyone, including individuals who experience the world in different ways because of impairments, disabilities, or age-related limitations.

**Microsoft Government Accessibility website** www.microsoft.com/govaccessibility

**Microsoft Accessibility website** www.microsoft.com/enable/

- Accessibility for Businesses and Organizations http://www.microsoft.com/enable/business/
- Accessibility for Educators www.microsoft.com/enable/education/
- Accessibility Update newsletter www.microsoft.com/enable/news/subscribe/
- Accessibility in Microsoft products www.microsoft.com/enable/products/
- Accessibility tutorials www.microsoft.com/enable/training/
- Accessibility demos www.microsoft.com/enable/demos/
- Assistive technology products www.microsoft.com/enable/at/
- Microsoft Accessibility Resource Centers www.microsoft.com/enable/centers/
- The business value of integrating accessible technology into business organizations www.microsoft.com/enable/business/value.aspx
- Developing an accessible technology plan www.microsoft.com/enable/business/plan.aspx
- Business accessibility case studies www.microsoft.com/enable/casestudy/default.aspx

**Microsoft Accessibility Developer Center** http://msdn.microsoft.com/accessibility

- Accessibility training http://msdn.microsoft.com/en-us/windows/bb735024.aspx
- WPF Introduction http://msdn.microsoft.com/en-us/library/aa663364.aspx
- UI automation control types http://msdn.microsoft.com/en-us/library/ms749005.aspx
- Control pattern mapping for UI http://msdn.microsoft.com/en-us/library/ms750574.aspx
- UI automation control patterns http://msdn.microsoft.com/en-us/library/ms743073.aspx
- UI automation events http://msdn.microsoft.com/en-us/library/ms748252.aspx#Types_of_Events
- UIA verify http://uiautomationverify.codeplex.com/



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# Additional resources and events

The following organizations offer additional accessibility resources or host annual accessible technology events:

- Access Technology Higher Education Network (ATHEN) www.athenpro.org
- Assistive Technology Industry Association www.atia.org
- Australian Government Web Publishing Guide: Accessibility http://webpublishing.agimo.gov.au/Accessibility.html
- Illinois Center for Information Technology and Web Accessibility www.cita.uiuc.edu/
- Industry Canada: Accessible Procurement Toolkit www.apt.gc.ca/
- Knowbility www.knowbility.org
- Montgomery College, Maryland, accessibility resources www.montgomerycollege.edu/standards/webstandardstraining/
- OCAD University, Inclusive Design Research Centre http://idrc.ocad.ca/
- Rehabilitation Engineering and Assistive Technology Society of North America www.resna.org
- SIGACCESS: ACM Special Interest Group on Accessible Computing http://portal.acm.org/sig.cfm?id=SP1530
- Technology and Persons with Disabilities Conference at CSUN www.csun.edu/cod/conf/
- Techshare India http://techshare.barrierbreak.com/
- Trace Research and Development Center http://trace.wisc.edu/sitehelp/
- U.K. web accessibility basics www.webcredible.co.uk/user-friendly-resources/web-accessibility/basics.shtml
- United States Access Board www.access-board.org
- University of Australia Accessibility Resources www.unisa.edu.au/footer/accessibility/resources.asp
- W3C policies and guidelines www.w3.org/WAI/Policy/
- W4A www.w4a.info
- WebAIM www.webaim.org



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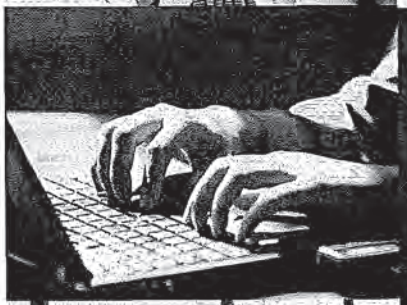

This guide from Microsoft provides information about accessibility and accessible technology to help organizations worldwide ensure that everyone has equal access to information and services.

For organizations new to accessibility and working with people with disabilities, accessibility can sometimes seem overwhelming. To help your organization meet the needs of people with all types of abilities, you will find specific information about many types of impairments and some of the accessible technology solutions that address them.

This guide provides

- An understanding of accessibility and how it impacts organizations
- Definitions of impairment types and technology solutions for each type of impairment
- Guidance on choosing accessible technology solutions
- Resources for more information

**www.microsoft.com/enable/business/**

**http://msdn.microsoft.com/accessibility**

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I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

- Shop and Select Assistive Technology Products
- Types of Assistive Technology Products
- Assistive Technology Products for Windows

Accessibility Developer Center

msdn

# Guides

Guides

## Accessibility in Education

Educators today are faced with the challenge of both integrating technology into the classroom and teaching students of all learning styles and abilities—including students with disabilities. Microsoft is dedicated to building accessibility into our products and to providing accessibility resources for educators.

### Accessibility Guide for Educators

This guide provides information on:

- Accessibility and how it impacts the classroom
- Types of impairments, disabilities, and specific accessibility solutions
- Selecting assistive technology for students
- Additional resources

### More Information

Video: Best Practices of Accessibility in Schools

### Guide for Windows 8

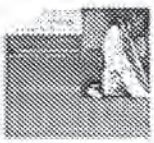
Accessibility: A Guide for Educators – English

### Guide for Windows 7 and Windows Vista

Accessibility: A Guide for Educators – English

Guía de Accesibilidad para Educadores – Spanish

### Guide for Windows XP



Accessibility: A Guide for Educators – English

Guía de Accesibilidad para Educadores – Spanish

### Curriculum resources

This curriculum resource shows how the PC can be personalized for students with learning style differences or physical disabilities. It also shows how to use Microsoft

### Teacher training workshop

This workshop shows educators how to use accessibility features on PCs to help students with disabilities use computers.

Accessibility in Education Workshop

I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

- Shop and Select Assistive Technology Products
- Types of Assistive Technology Products
- Assistive Technology Products for Windows

Accessibility Developer Center

msdn

## Guides

Guide:

# Guide for Individuals with Language and Communication Impairments

Microsoft products include accessibility features and options that can be adjusted to address language and communication preferences as well as difficulties and impairments ranging from aphasia (loss or impairment of the power to use or comprehend words), delayed speech, and other conditions resulting in difficulties remembering, solving problems, or perceiving sensory information.

This guide describes accessibility features built into Windows 8 and Office 2013 which are available at your option to address language and communication impairments and preferences. You can also learn about the types of assistive technology products available to further assist you.

**In this section:**

- Make Windows 8 easier to use
- Adjust accessibility settings from the Ease of Access Center
- Make it easier to focus on tasks
- Use Office features to focus on tasks
- Surf the web more easily with Internet Explorer 10
- Find assistive technology for language and communication impairments

## Make Windows 8 easier to use

With Windows 8 you can easily access the most commonly used accessibility options right from the sign-in screen. Select the **Ease of Access** button in the lower-left corner of your screen, or press the **Windows logo key+U**, to choose the settings for your PC that you want to have available each time it starts.

### Adjust accessibility settings from the Ease of Access Center

The **Ease of Access Center** is a convenient, central location where you can set up all of the accessibility settings and programs available in Windows, and "get recommendations" for suggested settings to fit your individual learning needs and preferences.

After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.

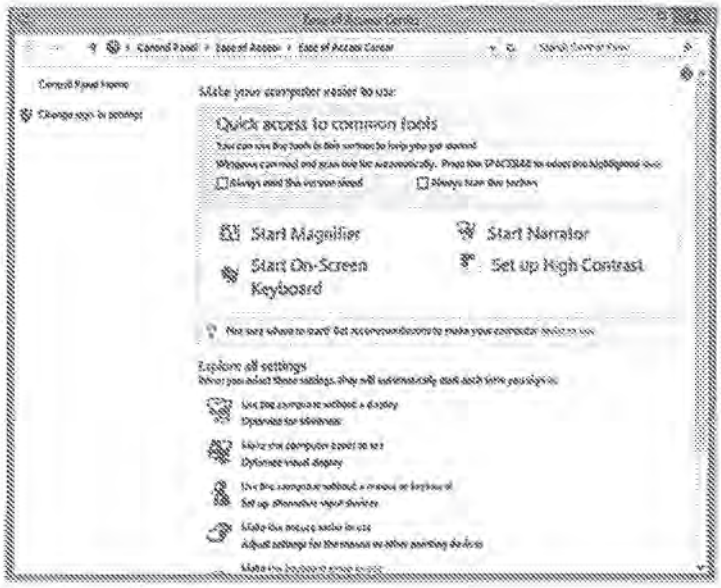
After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the

**More Information**

Shop for communication products

Site Index | Subscribe | Worldwide | Microsoft © 2014 Microsoft
Accessibility
Contact Us | Terms of Use | Trademarks | Privacy Statement

search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.




*Ease of Access Center in Control Panel*

### Make it easier to focus on tasks

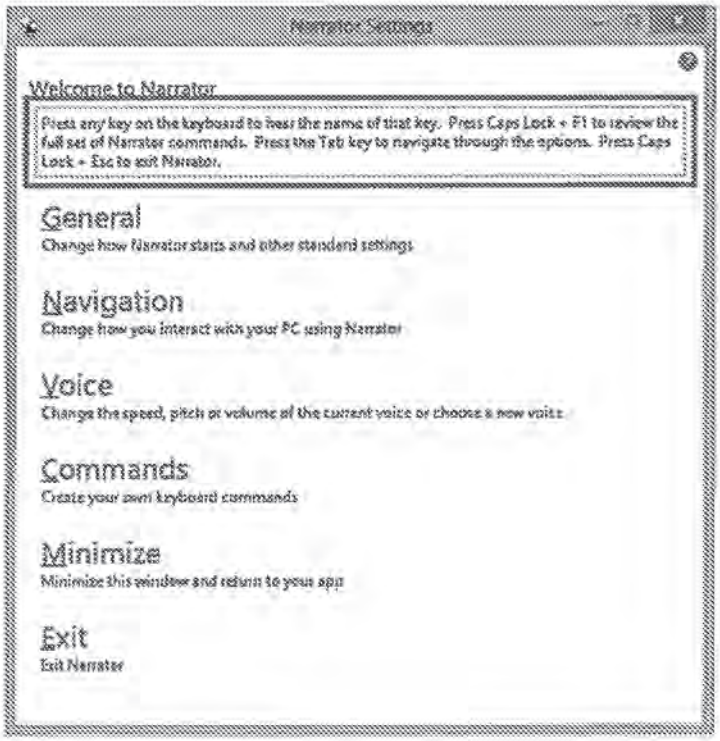
The Windows accessibility options most helpful for people with learning impairments and special needs are grouped into the **Make it easier to focus on tasks** section. A number of settings can help make it easier to focus on reading and typing. You can have Narrator read information on the screen, adjust how the keyboard responds to certain keystrokes, and control whether certain visual elements are displayed.

#### Hear text read aloud with Narrator

Windows comes with a basic screen reader called Narrator that reads aloud on-screen text and describes some events such as an error message appearing on screen. This feature may be useful for people with learning impairments who benefit from both visual and auditory information being presented simultaneously.

Narrator in Windows 8 is substantially faster and supports many new features. By default on touch-only devices, Narrator can be launched by simply holding down the **Windows logo button** and pressing the **Volume Up** button. Once Narrator is running, you can use Narrator's built-in touch commands to explore the screen and control your device.

There are also some new configuration options for Narrator in Windows 8. You can select one of several voices, change the speed at which Narrator speaks, create customizable keyboard commands, and specify many other settings to suit your preferences.




*Narrator Settings options dialog box*

**Turn on Sticky Keys, Toggle Keys, and Filter Keys**

Several options you can turn on in Windows can simplify the way you type information into your computer thereby making it easier to stay focused.

These options include:

- **Sticky Keys**—Instead of having to press three keys at once (such as when you must press the Ctrl, Alt, and Delete keys together to log on to Windows), you can use one key by turning on Sticky Keys and adjusting the settings. This way, you can press a modifier key and have it remain active until another key is pressed.
- **Toggle Keys**—Toggle Keys can play an alert each time you press the Caps Lock, Num Lock, or Scroll Lock keys. These alerts can help prevent the frustration of inadvertently pressing a key and not realizing it.
- **Filter Keys**—You can set Windows to ignore keystrokes that occur in rapid succession, or keystrokes that are held down for several seconds unintentionally.

**Reduce visual distractions**

- **Remove background images.** This option turns off all unimportant, overlapped content and background images to help make the screen easier to see.
- **Turn off all unnecessary animations.** This option turns off animation effects, such as fading effects, when windows and other elements are closed.
- **Choose how long Windows notification dialog boxes stay open.** With this option, you can choose how long notifications are displayed on the screen before they close.
- **Prevent windows from being automatically arranged when moved to the edge of the screen.** This option prevents windows from automatically resizing and docking along the sides of your screen when you move them there.

**Note:** Remember, you can access these options at any time after log-in by opening the Ease of Access Center by pressing the **Windows logo key+U**. Then, select **"Make it easier to focus on tasks."**

### Interact with your computer by touch

Using a keyboard and mouse is not always possible or desirable for many people. With Windows 8, if you have a touch-screen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom. See also: How to use the touch keyboard

*Desktop with video launch icon and link to video on how to use the touch keyboard*

## Use Office features to focus on tasks

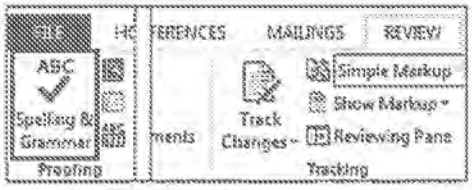
A number of accessibility options in Microsoft Office products make it easier for people with language and communication impairments to interact with their computers while creating Word documents, Excel spreadsheets, PowerPoint presentations, and more.

### Spelling and grammar checker in Office programs

All Microsoft Office programs can check the spelling and grammar of your files. In Microsoft Word 2013, start the Spelling and Grammar checker by clicking **Review > Spelling and Grammar.**

Then, choose from these options as the spelling and grammar checker reviews your document:

- Check the spelling and grammar all at once.
- Check spelling and grammar automatically, as you type.
- Recheck the words you previously checked and chose to ignore (but changed your mind).




*Screen shot of Spelling and Grammar button on the Word 2013 ribbon*

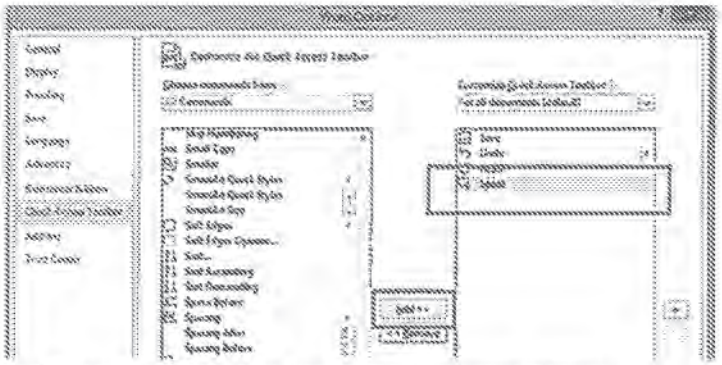
### Use the Speak text-to-speech feature

Text-to-speech (TTS) is the ability of your computer to play back written text as spoken words. Depending upon your configuration and installed TTS

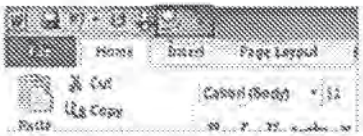
engines, you can hear most text that appears on your screen in Word 2013, Outlook 2013, PowerPoint 2013 and OneNote 2013.

**Add Speak to the Quick Access Toolbar**

1. Next to the Quick Access Toolbar, click **Customize Quick Access Toolbar**.
2. Click **More Commands**.
3. In the **Choose commands from** list, select **All Commands**.
4. Scroll down to the **Speak command**, select it, and then click **Add**.
5. Click **OK**.
6. When you want to use the text-to-speech command, click the icon on the Quick Access Toolbar.



*Word Options dialog box where the Speak command is selected to add to the Quick Access Toolbar*



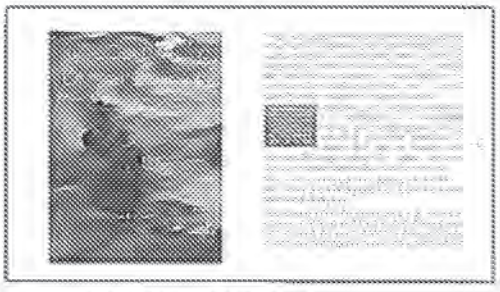
*Quick Access Toolbar with Speak command added and highlighted*

**Use Read Mode for a clearer view**

Use the new Read Mode in Word 2013 for a beautiful, distraction-free reading experience. Read Mode hides most of the buttons and tools so you can get absorbed in your reading without distractions. Press ALT+W, and then press F to open Read Mode. To move from page to page in a document, do one of the following:

- Click the arrows on the left and right sides of the pages.
- Press page down and page up or the spacebar and backspace on the keyboard. You can also use the arrow keys or the scroll wheel on your mouse.
- If you're on a touch device, swipe left or right with your finger.

Also while in Read Mode you can double-click a picture to get an enlarged view. Click outside the image to return to reading.



*Document in Read Mode of Office 2013*

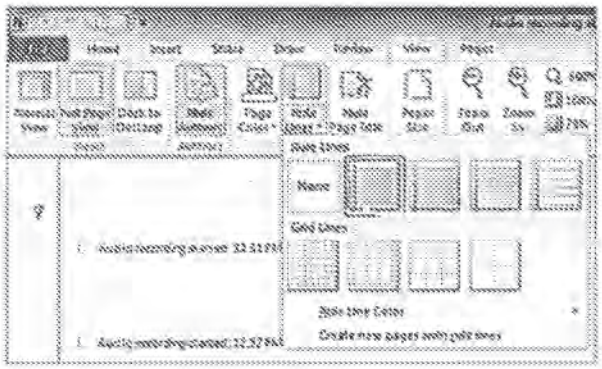
### Hear text read aloud with Mini Translator

With the Microsoft Office 2013 Mini Translator, you can point to a word or selected phrase with your mouse and the translation displays in a small window. The Mini Translator also includes a Play button so you can hear an audio pronunciation of the word or phrase, and a Copy button so you can paste the translation into another document.

### Use Microsoft OneNote to stay organized

Microsoft OneNote can make taking and organizing notes a lot easier. Students with dyslexia, for example, can benefit from many features in OneNote that can help them take notes faster and in different ways, stay organized, and meet literacy challenges, such as spelling and grammar.

See also: Upgrading to Microsoft OneNote 2013 from a previous version.



*OneNote ribbon*

### Move around webpages with the keyboard

With learning impairments and disabilities it's sometimes difficult to find links on webpages. Some people find it easier and quicker to move around webpages using the keyboard in Web Apps.

- Keyboard shortcuts in Word Web App
- Keyboard shortcuts in Excel Web App
- Keyboard shortcuts in PowerPoint Web App
- Keyboard shortcuts in OneNote Web App

## Surf the web more easily with Internet Explorer 10

Accessibility in Internet Explorer 10 lets you select text and move around a webpage with the keyboard. Keyboard access to the toolbar buttons, search box items, address bar, and tabs makes surfing the web quicker and easier for people with learning impairments.

### Use keyboard shortcuts to navigate webpages

Press the Tab key to move forward between screen elements and **Shift+Tab** to move backward. By pressing **Tab** or **Shift+Tab**, you can navigate through the parts of the screen. Learn more keyboard shortcuts.

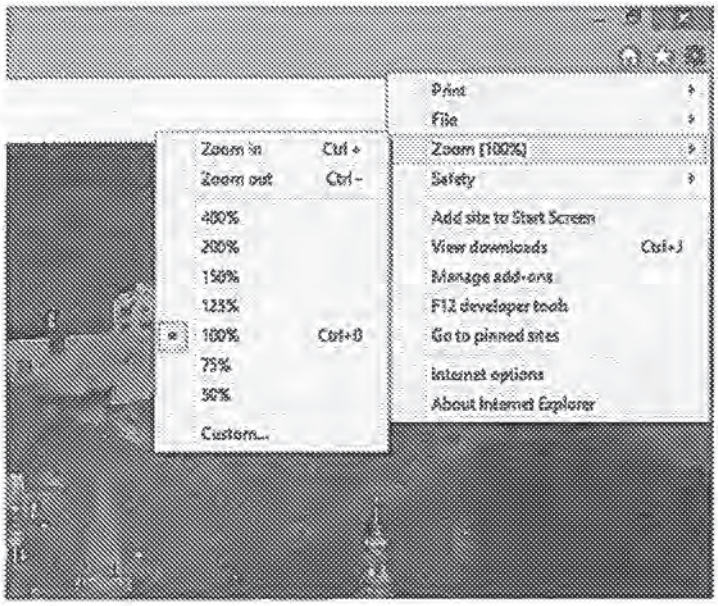
### Zoom in on a webpage

To make everything on a webpage easier to see you can zoom in or enlarge the whole page including images and text. You can zoom from 10% to 1000%. Press **Ctrl+Plus** sign (+) to zoom in, or **Ctrl+Minus** sign (-) to zoom out.

Or, while viewing your Internet Explorer window from the desktop, select the **Tools** icon at the top of the window, select **Zoom**, then select **Zoom in**.

or Zoom out, or the desired percentage. You can also select Custom to set a percentage up to 1000 percent.

*Tools button in Internet Explorer 10*



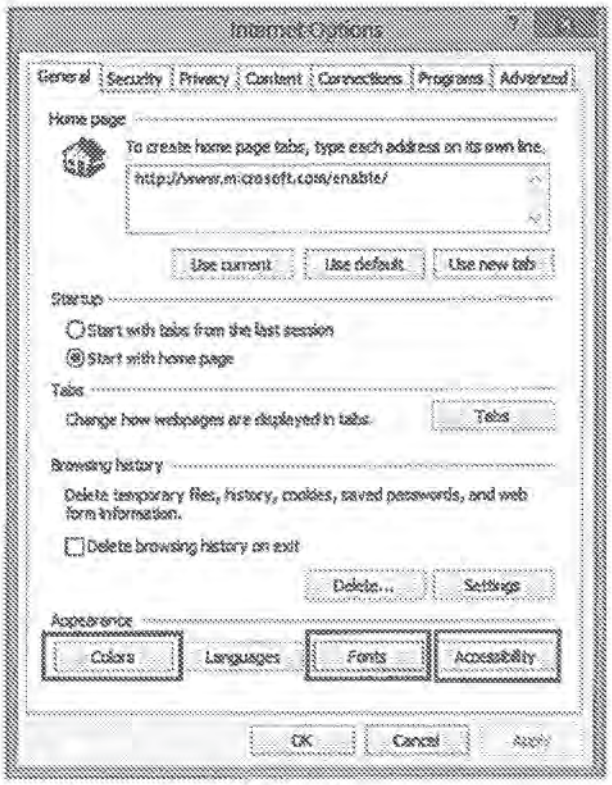

*Internet Options Tools menu open to Zoom level options*

You can specify the font type and size and the foreground and background colors that are used to display webpages. You can also specify the color used for links in webpages.

### Change the font size, formatting, and screen colors

To make webpages easier to see, you can change the font type and size, and the foreground and background colors that are used to display webpages. You can also specify the color used for links in webpages, and override colors used on webpages.

With an Internet Explorer window open on the Desktop, select Internet Options from the Tools menu.

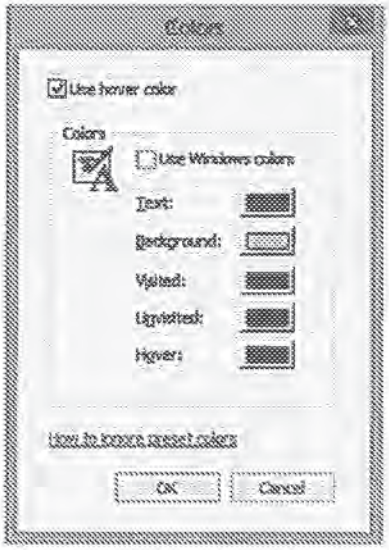



*Internet Options dialog box Colors, Fonts, Accessibility buttons*

Then, select one of the buttons at the bottom of the dialog box:

- **Fonts**—to change the font type and size used on webpages.
- **Colors**—to change the font colors used on webpages.
- **Accessibility**—to make Internet Explorer ignore colors, font styles and font sizes used on webpages, or to format webpages using your own style sheet.

*Fonts dialog box where font preferences are selected*




*Colors dialog box where webpage color preferences are selected*

### Find assistive technology for language and communication impairments

You can shop for assistive technology products compatible with Microsoft Windows made by independent assistive technology companies. People who have language or communication difficulties and impairments may be interested in the following assistive technology:

- **Augmentative and assistive communication (AAC) devices** are used by individuals who cannot speak or who find speaking difficult. The user types in a word, phrase, or sentence to communicate—or selects a series of symbols or pictures on the device—and the device "speaks" aloud for the user. Often these devices are used to replace a PC keyboard. In these cases the user is able to use one device for both communicating and computer input.
- **Touch screens** are devices placed on the computer monitor (or built into it) that allow direct selection or activation of the computer by touching the screen. The ability to touch the computer screen to make a selection is advantageous for people with language and learning disabilities because it is a more simple, direct, and intuitive process than making a selection using a mouse or keyboard. With Windows and a touch-screen, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom.
- **Speech synthesizers** provide the user with information through a computer voice. Also known as text-to-speech (TTS), the speech synthesizer receives information in the form of letters, numbers, and punctuation marks, and then "speaks" it out loud to the user in a computer voice.

I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

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- Types of Assistive Technology Products
- Assistive Technology Products for Windows

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# Guides

Guides

## Guide for Individuals with Vision Impairments

Microsoft products include accessibility features that make it easier to see your computer if you have low vision or colorblindness. Or, if you are blind, Windows allows you to receive information through sound or touch rather than the display.

This guide describes accessibility features built into Windows 8 and Microsoft Office that are available to address vision impairments and preferences. You can also learn about the types of assistive technology products available to further assist you.

**In this section:**

- Make Windows 8 easier to see
- Adjust accessibility settings from the Ease of Access Center
- Make Microsoft Office programs easier to use
- Make Office documents, presentations, and spreadsheets more accessible
- See webpages more clearly with Internet Explorer
- Find assistive technology for vision impairments

### Make Windows 8 easier to see

With Windows 8 you can easily access the most commonly used accessibility options right from the sign-in screen. Select the **Ease of Access** button in the lower-left corner of your screen, or press the **Windows logo key+U**, to choose the settings for your PC that you want to have available each time it starts.

### Adjust accessibility settings from the Ease of Access Center

The **Ease of Access Center** is a convenient, central location where you can set up all of the accessibility settings and programs available in Windows, and "get recommendations" for suggested settings to fit your individual vision needs and preferences.

After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.

**More Information**

Shop for vision products

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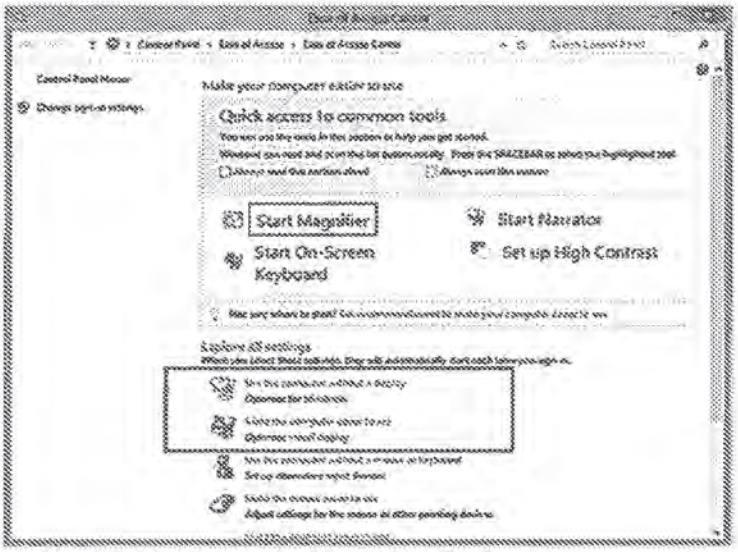
Trademarks | Privacy Statement



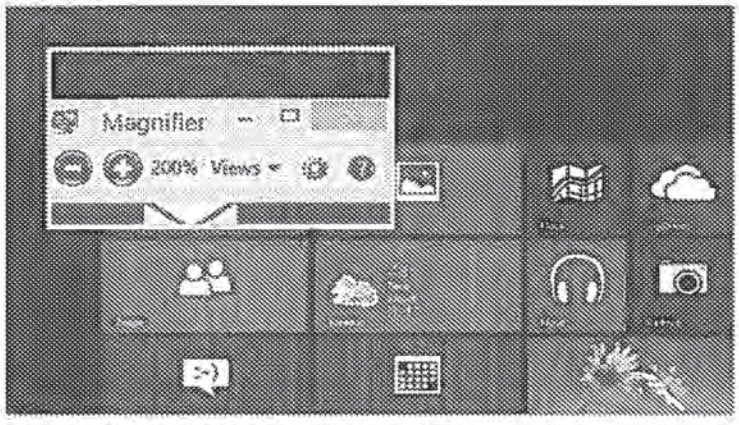

*Ease of Access Center in Control Panel with the vision settings links highlighted*

**Make the computer easier to see**

All of the Windows accessibility options most helpful for people with vision impairments are grouped under "Make the computer easier to see," and, one designed for people who are blind named, "Use the computer without a display." You can choose a High Contrast theme, turn on Narrator and Magnifier, change the size of text and icons, set the thickness of the blinking cursor, turn off unnecessary animations, remove background images, and more.

**Make items on screen appear bigger with Magnifier**

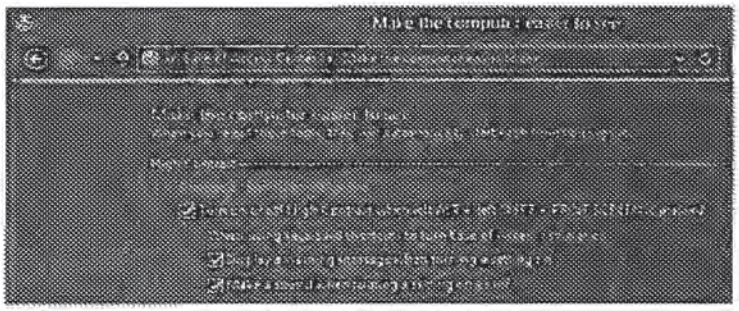
Magnifier enlarges portions of the screen making it easier to view text and images and to see the whole screen more easily. You have the choice of viewing with Magnifier using the full screen, or just a portion, and you can move Magnifier where you want it on your desktop—whatever fits your needs. You can magnify up to 16 times the original size and choose to track what you magnify by movement of your mouse, the keyboard, or text editing.




*Start screen with Magnifier window at 200% magnification.*

### Use High Contrast to improve visibility

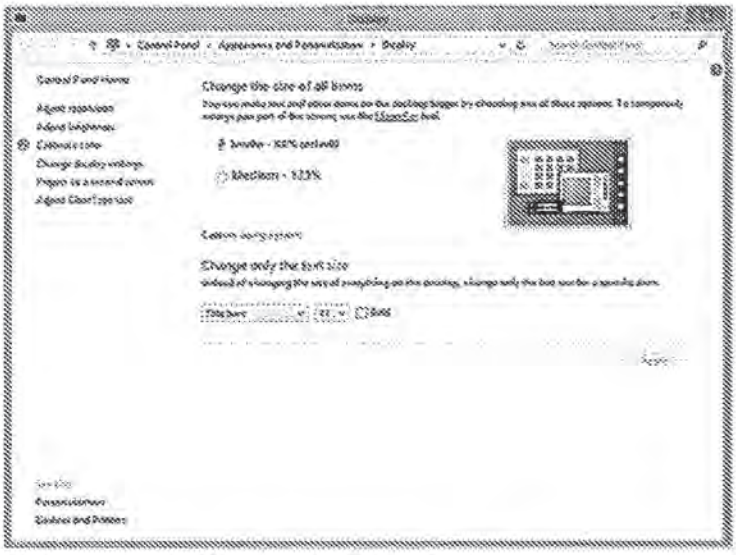
High Contrast is a popular feature used to heighten the color contrast of some text and images on your computer screen, making those items more distinct and easier to identify.



*"Make the computer easier to see" screen in high contrast mode*

### Make the text on your screen larger or smaller

You can make the text (and other things like icons) larger without changing the screen resolution of your monitor or laptop screen. That way, you can make text easier to see and still keep your monitor or laptop set to the best possible resolution.



*Display screen showing "Change the size of all items" options*

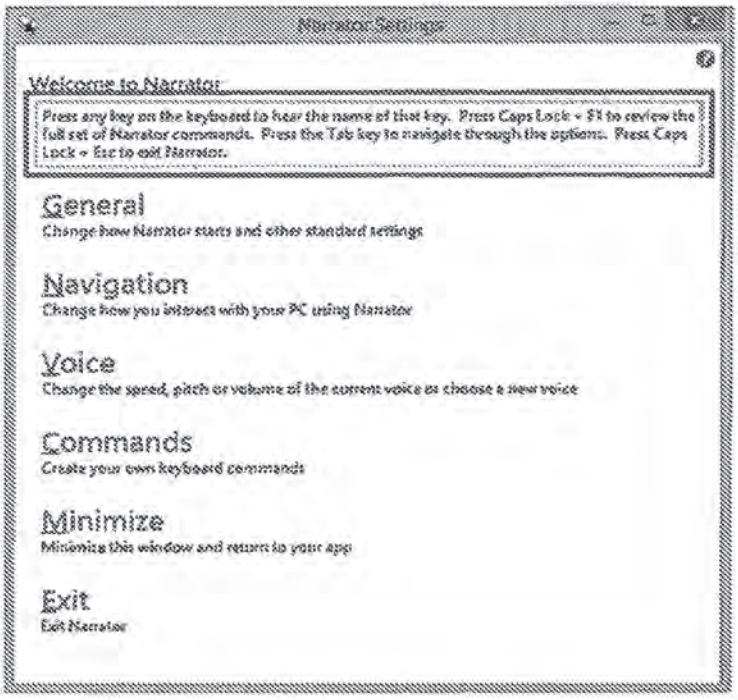
### Hear text read aloud with Narrator

Narrator, a basic screen reader that reads aloud the text that appears on screen, and describes events such as error messages, has been redesigned in Windows 8 to be substantially faster, and to support many new features. Whether you're an individual who is blind, has low vision, or, are fully sighted, you will be able to use Windows 8 from the first time you start your device.

By default on touch-only devices, Narrator can be launched by simply holding down the **Windows logo button** and pressing the **Volume Up** button (to stop Narrator from reading, tap once with two fingers). Once Narrator is running, you can use Narrator's built-in touch commands to explore the screen and control your device.

Ford Ex. 1002 Page 395 of 746

There are also some new configuration options for Narrator in Windows 8 and Windows RT. You can select one of several voices, change the speed at which Narrator speaks, create customizable keyboard commands, and specify many other settings to suit your preferences.




*Narrator Settings dialog box showing available settings*

### Use speech recognition to operate windows and programs

Speech Recognition in Windows 8 allows you to command your PC with your voice–including the capability to dictate into almost any application. You can dictate documents and email and surf the web by saying what you see. An easy setup process and an interactive tutorial are available to familiarize you with the speech commands and train your computer to better understand you.

Learn what you can do with Speech Recognition and how to set up Speech Recognition including how to set up your microphone, teach yourself how to talk to your computer, and train your computer to recognize your speech.

### Make Microsoft Office programs easier to use

A number of accessibility options in Microsoft Office products make it easier for people with vision impairments to interact with their computers while creating Word documents, Excel spreadsheets, PowerPoint presentations, and more.

#### Use Read Mode for a clearer view

Use the new Read Mode in Word 2013 for a beautiful, distraction-free reading experience. Read Mode hides most of the buttons and tools so you can get absorbed in your reading without distractions. To open Read Mode, press ALT+W, and then press F. To move from page to page in a document, do one of the following:

- Click the arrows on the left and right sides of the pages.

- Press page down and page up or the spacebar and backspace on the keyboard. You can also use the arrow keys or the scroll wheel on your mouse.
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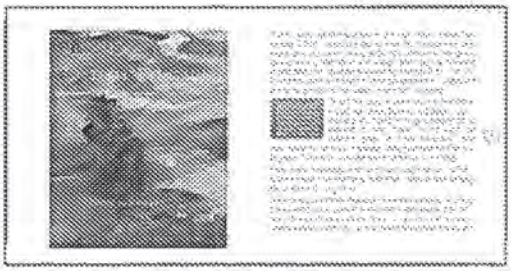
Also while in Read Mode you can double-click a picture to get an enlarged view. Click outside the image to return to reading.



*Document in Read Mode of Office 2013*

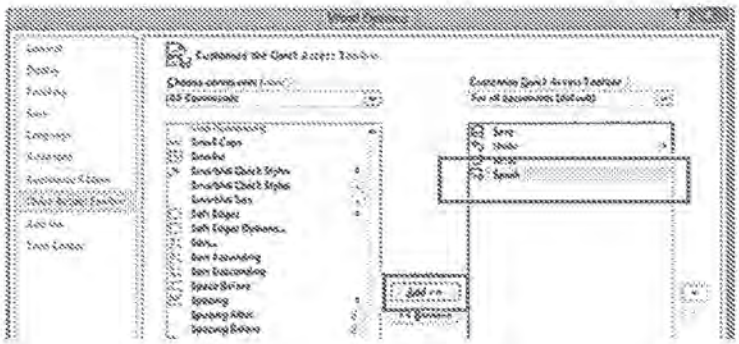
**Use the Speak text-to-speech feature**

Text-to-speech (TTS) is the ability of your computer to play back written text as spoken words. Depending upon your configuration and installed TTS engines, you can hear most text that appears on your screen in Word 2013, Outlook 2013, PowerPoint 2013 and OneNote 2013.

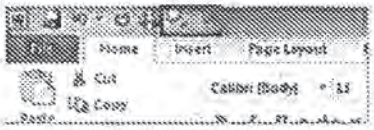
**Add Speak to the Quick Access Toolbar**

You can add the Speak command to your Quick Access Toolbar by doing the following:

1. Next to the Quick Access Toolbar, click **Customize Quick Access Toolbar**.
2. Click **More Commands**.
3. In the **Choose commands from** list, select **All Commands**.
4. Scroll down to the **Speak** command, select it, and then click **Add**.
5. Click **OK**.
6. When you want to use the text-to-speech command, click the icon on the Quick Access Toolbar.



*Word Options dialog box where the Speak command is selected to add to the Quick Access Toolbar*




*Quick Access Toolbar with Speak command added and highlighted*

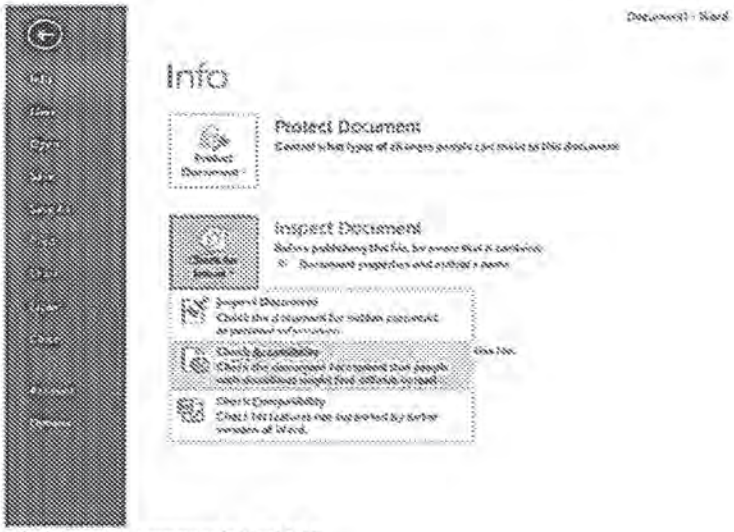
### Make Office documents, presentations, and spreadsheets more accessible

A number of accessibility options in Microsoft Office products help you as the content author make your documents, spreadsheets, and presentations easier for people with vision impairments to interact with. To learn more, see Creating accessible Office files.

#### Accessibility Checker

Word 2013, Excel 2013, and PowerPoint 2013 include an Accessibility Checker that helps users create more accessible content. By identifying areas that might be challenging for users with disabilities to view or use, and providing a task pane to review those areas, users can fix potential problems with their content before finalizing.

See also: Add alternative text to a picture, shape, chart, table, or SmartArt graphic




*Check Accessibility command in Word 2013*

*Check Accessibility command in Word 2013*

#### Office Web Apps support assistive technology and speech recognition software

Office Web Apps provide support for assistive technologies such as screen readers and speech recognition software. Find more information on accessibility features in Office Web Apps.

#### Internet Explorer accessibility features available in Web Apps

Because Office Web Apps run in the browser, you can use your web browser's features that improve the readability of pages. Find out about vision related accessibility features in Internet Explorer.

#### Move around webpages with the keyboard

If you have low vision it's sometimes difficult to see links on webpages, and if you're blind you'll use the keyboard rather than the mouse or display to work with your computer. You can move around webpages quickly using the keyboard in Web Apps.

- Keyboard shortcuts in Word Web App
- Keyboard shortcuts in Excel Web App
- Keyboard shortcuts in PowerPoint Web App

- Keyboard shortcuts in OneNote Web App

### See webpages more clearly with Internet Explorer

For better visibility of webpages you can change the fonts, font sizes, text and background colors, or zoom in on a webpage to enlarge it, or zoom out to see more of the page on screen.

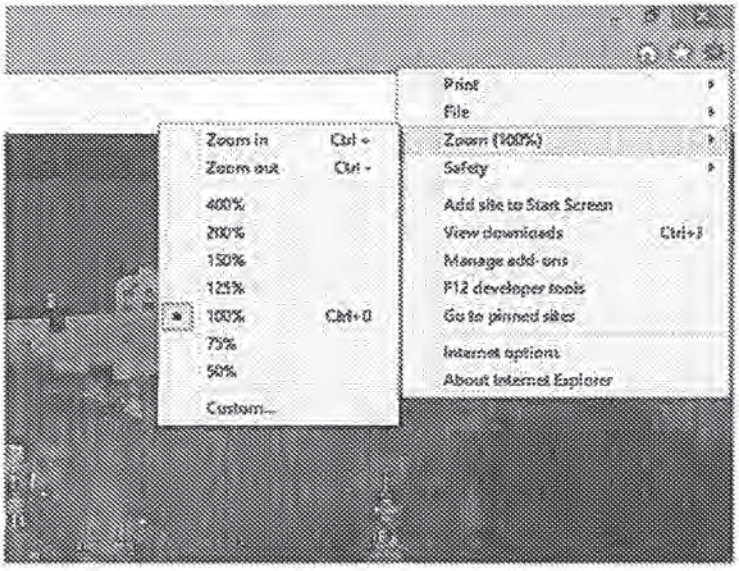
#### Zoom in on a webpage

Make everything on a webpage easier to see by zooming in, or enlarging the whole page including images and text. You can zoom from 10% to 1000%.

Press Ctrl+Plus sign (+) to zoom in, or Ctrl+Minus sign (-) to zoom out.

Or, while viewing your Internet Explorer window from the desktop, select the Tools icon at the top of the window, select Zoom, then select **Zoom in**, or **Zoom out**, or the desired percentage. You can also select **Custom** to set a percentage up to 1000 percent.

*Tools button in Internet Explorer 10*




*Internet Options Tools menu open to Zoom level options*

Learn more about Internet Explorer 10.

### Find assistive technology for vision impairments

You can shop for assistive technology products compatible with Microsoft Windows made by independent assistive technology companies. People who have vision impairments may be interested in the following assistive technology:

- **Screen magnifiers** work like a magnifying glass. They enlarge a portion of the screen as the user moves the focus—increasing legibility for some users. Some screen enlargers (software or hardware) allow a user to zoom in and out on a particular area of the screen. Learn about Magnifier in Windows 8, Windows 7, Windows Vista, and the built-in zoom and magnify features in Microsoft mouse and keyboard products.

- **Screen readers** are software programs that present graphics and text as speech. A screen reader is used to verbalize, or "speak," everything on the screen including names and descriptions of control buttons, menus, text, and punctuation.
- **Braille printers** (or embossers) transfer computer generated text into embossed Braille output. Braille translation programs convert text scanned in or generated via standard word processing programs into Braille, which can be printed into raised Braille.
- **Braille displays** provide tactile output of information represented on the computer screen. The user reads the Braille letters with his or her fingers, and then, after a line is read, refreshes the display to read the next line.
- **Braille notetakers** enable a person who is blind to capture notes and then transfer them to a PC. Braille notetakers take advantage of refreshable Braille technology. In some cases, Braille notetakers replace or supplement a standard keyboard.
- **Book readers.** Some people use a PC configuration for book reading assistance, or a dedicated reading device. A person who is blind might have printed material scanned and read aloud through a text-to-speech software program on the PC. Books are available in digital formats through various commercial and not-for-profit organizations.

I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

- Shop and Select Assistive Technology Products
- Types of Assistive Technology Products
- Assistive Technology Products for Windows

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## Guides

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### Guide for Individuals with Age-Related Impairments

Having trouble seeing things on your computer screen? By the time we reach our fifties, two-thirds of us have vision, hearing, or dexterity impairments that will impact our computer use. Discover easy ways to customize your computer without downloading or purchasing anything.

More Web Sites

- Search with Bing
- Play games online
- Get financial advice
- Find travel deals
- Find everything on the Web with MSN

#### Customizing Your PC

- Five ways to make your keyboard easier to use
- Five ways to make your PC easier to see
- Magnify your computer screen: 6 ways to make it easier to see
- 10 tips from a fellow aging computer user on the awkward age of computing
- Helping your parents choose a PC
- Helping your parents customize their PC

#### Videos that Fit Your Life

I've learned how to make my computer easier to use
No need to squint—as you get older, get wiser too and learn how to customize your PC to make it easier to see and use.

Finally, I found someone who would listen to me!
Discover Speech Recognition and you'll love how your PC listens to you

A great grandma, and a great techy too
It's easier than you think to stay in touch, share photos, and play games online. If this grandma can do it, so can you.

Ergonomic! What's so funny about that?
It's all about comfort with Microsoft ergonomic keyboards and mice that fit your style.

I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

- Shop and Select Assistive Technology Products
- Types of Assistive Technology Products
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## Guides

Guides

# Guide for Individuals with Learning Impairments

Microsoft products include accessibility features and options that can be adjusted to address learning preferences as well as difficulties and impairments ranging from dyslexia and attention deficit disorder to retardation. Many individuals with learning difficulties and impairments are perfectly capable of learning if information is presented to them in a form and at a pace that is appropriate to them individually. Providing a multisensory experience of audio speech paired with a visual representation, for example. And, reducing visual and auditory distractions can aid the learning process for many people.

This guide describes accessibility features built into Windows 8 and Microsoft Office 2013 that are available to address learning impairments and preferences. You can also learn about the types of assistive technology products available to further assist you.

**In this section:**

- Make Windows 8 easier to use
- Adjust accessibility settings from the Ease of Access Center
- Make it easier to focus on tasks
- Use Office features to focus on tasks
- Surf the web more easily with Internet Explorer 10
- Find assistive technology for learning impairments

## Make Windows 8 easier to use

With Windows 8 you can easily access the most commonly used accessibility options right from the sign-in screen. Select the **Ease of Access** button in the lower-left corner of your screen, or press the **Windows logo key+U**, to choose the settings for your PC that you want to have available each time it starts.

## Adjust accessibility settings from the Ease of Access Center

The **Ease of Access Center** is a convenient, central location where you can set up all of the accessibility settings and programs available in Windows, and "get recommendations" for suggested settings to fit your individual learning needs and preferences.

After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.

**More Information**

- Shop for learning products
- Shop for communication products
- Accessibility in Education

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- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

Assistive Technology Products

- Shop and Select Assistive Technology Products
- Types of Assistive Technology Products
- Assistive Technology Products for Windows

Accessibility Developer Center

msdn

## Guides

Guides

# Guide for Individuals with Dexterity and Mobility Impairments

Microsoft products include accessibility features and options that are useful, and sometimes essential, to people with dexterity and mobility impairments.

This guide describes accessibility features built into Windows 8 and Microsoft Office that are available to address mobility and dexterity impairments and preferences. You can also learn about the types of assistive technology products available to further assist you.

**In this section:**

- Make your computer easier to use
  - Adjust accessibility settings from the Ease of Access Center
  - Make the mouse easier to use
  - Make the keyboard easier to use
  - Type without using the keyboard (On-Screen Keyboard)
  - Use speech recognition to operate windows and programs
- Make Microsoft Office programs easier to use
- Move around webpages easier with Internet Explorer
- Find assistive technology for mobility and dexterity impairments

## Make your computer easier to use

With Windows 8 you can easily access the most commonly used accessibility options right from the sign-in screen. Select the **Ease of Access** button in the lower-left corner of your screen, or press the **Windows logo key+U**, to choose the settings for your PC that you want to have available each time it starts.

### Adjust accessibility settings from the Ease of Access Center

The Ease of Access Center is a convenient, central location where you can set up all of the accessibility settings and programs available in Windows, and "get recommendations" for suggested settings to fit your individual mobility and dexterity needs and preferences.

After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.

### More Information

- Shop for mobility products
- Shop for ergonomic products
- Microsoft comfort and ergonomic keyboards and mice

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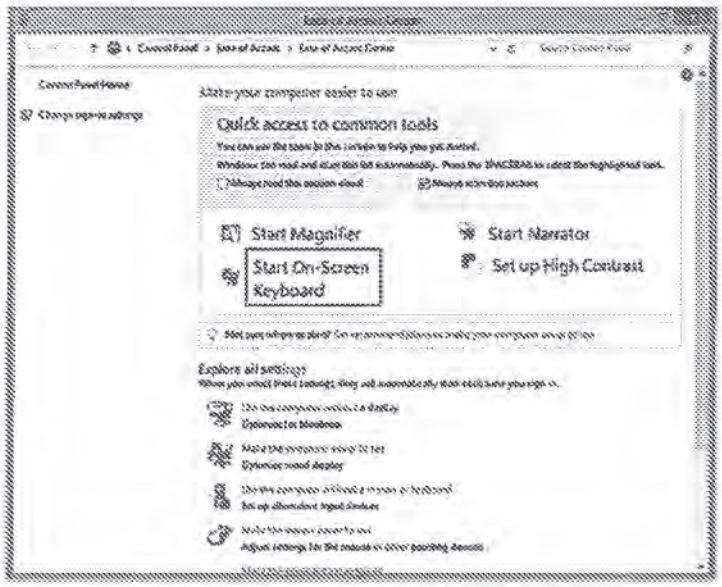
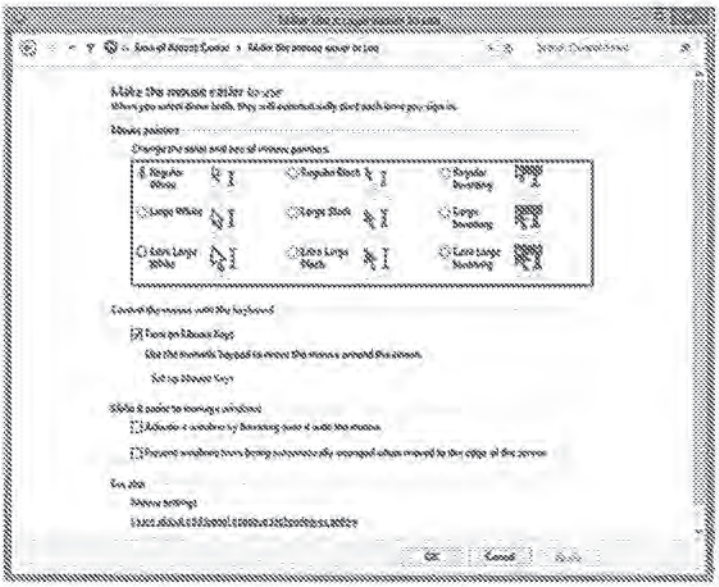



*"Make your computer easier to use" screen in the Ease of Access Center*

### Make the mouse easier to use

All of the Windows accessibility options most helpful for people with mobility and dexterity impairments who use the mouse are grouped into the **Make the mouse easier to use** section. You can learn how to choose the color and size of mouse pointers, turn on Mouse Keys, activate a window by hovering over it rather than clicking the mouse, and more.




*"Make the mouse easier to use" screen in the Ease of Access Center*

### Change mouse settings

You can customize your mouse in a variety of ways. For instance, you can swap the functions of your mouse buttons, make the mouse pointer more visible, and alter the scroll speed of the mouse wheel.

### Use Mouse Keys to move the mouse pointer

If you have restricted arm, hand, or wrist movement you may benefit from Mouse Keys. With Mouse Keys, you can use the numeric keypad on your keyboard—instead of the mouse—to move the pointer.

### Make the keyboard easier to use

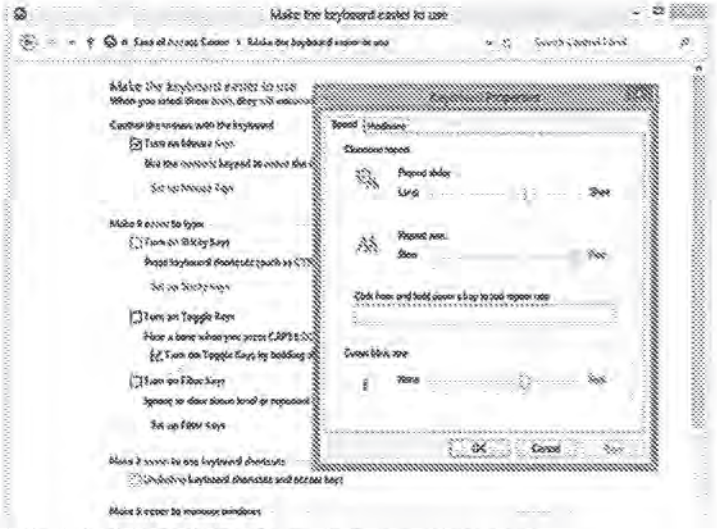
Windows options helpful for people with mobility and dexterity impairments who use the keyboard are grouped in the **Make the keyboard easier to use** section. You can learn how to turn on Mouse Keys, Sticky Keys, Toggle Keys, and Filter Keys, and how to select additional options.

### Use Windows keyboard shortcuts

Keyboard shortcuts are combinations of two or more keys that, when pressed, can be used to perform a task that would typically require a mouse or other pointing device. Keyboard shortcuts can make it easier to interact with your computer, saving you time and effort as you work with Windows and other programs.

### Change keyboard settings

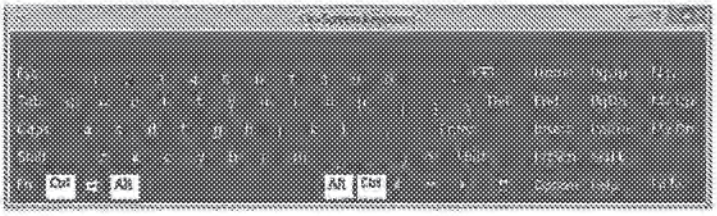
Customizing your keyboard settings can help you work more efficiently. By customizing the settings, you can select how long you need to press a key before the keyboard character starts repeating, the speed at which keyboard characters repeat, and the rate at which the cursor blinks.



*"Make the keyboard easier to use" screen in the Ease of Access Center*

### Type without using the keyboard (On-Screen Keyboard)

On-Screen Keyboard displays a visual keyboard with all of the standard keys. Instead of relying on the physical keyboard to type and enter data, you can use On-Screen Keyboard to select keys using the mouse or another pointing device. On-Screen Keyboard in Windows can be resized and customized to make it easier to see and use. On-Screen Keyboard also includes text prediction in eight languages. When text prediction is enabled, as you type, On-Screen Keyboard displays a list of words that you might be typing. You can select the appropriate one. See also How to use the touch keyboard.



*On-Screen Keyboard*

### Use speech recognition to operate windows and programs

Speech Recognition in Windows 8 and Windows RT allows you to command your PC with your voice–including the capability to dictate into almost any application. You can dictate documents and email and surf the web by saying what you see. An easy setup process and an interactive tutorial are available to familiarize you with the speech commands and train your computer to better understand you.

Learn what you can do with Speech Recognition and how to set up Speech Recognition including how to set up your microphone, teach yourself how to talk to your computer, and train your computer to recognize your speech.

*Speech Recognition screen in Control Panel, Ease of Access*

### Interact with your computer by touch

Using a keyboard and mouse is not always possible or desirable for many people. With Windows 8 and Windows RT, if you've got a touch-screen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom. See also: How to use the touch keyboard.

*Desktop with video launch button and link to video on using a touch keyboard*

### Make Microsoft Office programs easier to use

Keyboard shortcuts in Microsoft Office products make it easier for people with mobility and dexterity impairments to interact with their computers while creating Word documents, Excel spreadsheets, PowerPoint presentations, and more.

- Keyboard shortcuts for Word 2013
- Keyboard shortcuts for Outlook 2013
- Keyboard shortcuts for Excel 2013
- Keyboard shortcuts for PowerPoint 2013

- Keyboard shortcuts for Access 2013
- Keyboard shortcuts for Project 2013

### Office Web Apps support assistive technology and speech recognition software

Office Web Apps provide support for assistive technologies such as screen readers and speech recognition software. Find more information on accessibility features and issues with Office Web Apps.

### Internet Explorer accessibility features available in Web Apps

Because Office Web Apps run in the browser, you can use your web browser's features that improve the readability of pages. Find out about vision related accessibility features in Internet Explorer.

### Move around webpages with the keyboard

You can move around webpages quickly using the keyboard in Web Apps.

- Keyboard shortcuts in Word Web App
- Keyboard shortcuts in Excel Web App
- Keyboard shortcuts in PowerPoint Web App
- Keyboard shortcuts in OneNote Web App

## Move around webpages easier with Internet Explorer

Accessibility in Internet Explorer lets you select text and move around a webpage with the keyboard. Enhanced keyboard access is found in the toolbar buttons, search box items, address bar, and tabs making surfing the Web quicker and easier for people with mobility and dexterity impairments.

### Use keyboard shortcuts to navigate webpages

Press the Tab key to move forward between screen elements and Shift+Tab to move backward. By pressing Tab or Shift+Tab, you can navigate through the parts of the screen. Learn more keyboard shortcuts.

## Find assistive technology for mobility and dexterity impairments

You can shop for assistive technology products compatible with Microsoft Windows made by independent assistive technology companies. People who have dexterity and mobility impairments may be interested in the following assistive technology:

- **Ergonomic keyboards and mice** are designed to be more comfortable than a standard keyboard and mouse. To improve the quality and health of your PC experience, Microsoft designers and ergonomists created industry-leading keyboard and mouse products to encourage healthier hand and wrist positions. Microsoft Natural keyboards and mice have set the industry standard for comfort, and can significantly reduce carpal tunnel syndrome symptoms. Microsoft keyboards and mice also have built-in zoom and magnifier options.
- **Joysticks** can be plugged into the computer's mouse port and used to control the cursor on the screen. Joysticks benefit users who need to operate a computer with or without the use of their hands. For example, some people might operate the joystick with their feet or with the use of a cup on top of the joystick that can be manipulated with their chin.
- **Trackballs** look like an upside down mouse with a movable ball on top of a stationary base. The ball can be rotated with a pointing device or a hand. People who have fine motor skills but lack gross motor skills can use these devices more easily and comfortably than a traditional mouse.

- **On-screen keyboards** provide an image of a standard or modified keyboard on the computer screen. The user selects the keys with a mouse, touch screen, trackball, joystick, switch, or electronic pointing device. On-screen keyboards often have a scanning option. With the scanning capability turned on, the individual keys on the on-screen keyboard are highlighted. When a desired key is highlighted, the user is able to select it by using a switch positioned near a body part that he or she has under voluntary control. Learn about the On-Screen Keyboard features in Windows 8, Windows 7 and Windows Vista.
- **Keyboard filters** include typing aids, such as word prediction utilities and add-on spelling checkers. These products can often be used to reduce the number of required keystrokes. Keyboard filters enable users to quickly access the letters they need and to avoid inadvertently selecting keys they don't want.
- **Touch screens** are devices placed on the computer monitor (or built into it) that allow direct selection or activation of the computer by touching the screen. These devices can benefit some users with mobility impairments because they present a more accessible target. It is easier for some people to select an option directly rather than through a mouse movement or keyboard. Moving the mouse or using the keyboard for some might require greater fine motor skills than simply touching the screen to make a selection. Other users might make their selections with assistive technology such as mouth sticks. With Windows 7 and a touch-screen monitor, you can just touch your computer screen for a more direct and natural way to work. Use your fingers to scroll, resize windows, play media, and pan and zoom. Learn about Touch technology in Windows 8 and Windows RT, Windows 7 and Windows Vista.
- **Alternative PC hardware and all-access workstations**. In some cases, alternative PC hardware is needed. Some individuals with mobility impairments find it challenging to open the monitor of a laptop because the laptop latch isn't accessible for them. Or some students might need a laptop to be mounted on a wheelchair. Such assistive technology solutions are referred to as "all-access workstations."
- **Alternative input devices** (including alternative keyboards, electronic pointing devices, sip-and-puff systems, wands and sticks) allow individuals to control their computers through means other than a standard keyboard or pointing device.

I'm looking for:

Windows

- Windows 8
- Windows 7

Office

- Office 365
- Office 2013
- Office 2010

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- Types of Assistive Technology Products
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## Guides

Guides

### Guide for Individuals with Hearing Impairments

Hearing impairments encompass a range of conditions—from slight hearing loss to deafness. It is estimated that 1 in 5 computer users has some form of hearing loss.

This guide describes accessibility features built into Windows 8 that are available to address hearing impairments and preferences including adjusting computer volume, changing computer sounds, and using text or visual alternatives for sounds. You can also learn about the types of assistive technology products available to further assist you.

**In this section:**

- Make Windows 8 easier to use
- Adjust accessibility settings from the Ease of Access Center
- Use text or visual alternatives to sounds
- Adjust computer volume
- Change computer sounds
- Use Office features for hearing solutions
- Find assistive technology for hearing impairments

**More Information**

Shop for hearing products

### Make Windows 8 easier to use

With Windows 8 you can easily access the most commonly used accessibility options right from the sign-in screen. Select the **Ease of Access** button in the lower-left corner of your screen, or press the **Windows logo key+U**, to choose the settings for your PC that you want to have available each time it starts.

#### Adjust accessibility settings from the Ease of Access Center

The Ease of Access Center is a convenient, central location where you can set up all of the accessibility settings and programs available in Windows, and "get recommendations" for suggested settings to fit your hearing and sound needs and preferences.

After log-in, you can access the Ease of Access Center by pressing the **Windows logo key+U**. On a touch-enabled device, swipe in from the right edge of the screen, and then tap **Search**. Enter **Ease of Access Center** in the search box, tap or click **Settings**, and then tap or click **Ease of Access Center** in the results.

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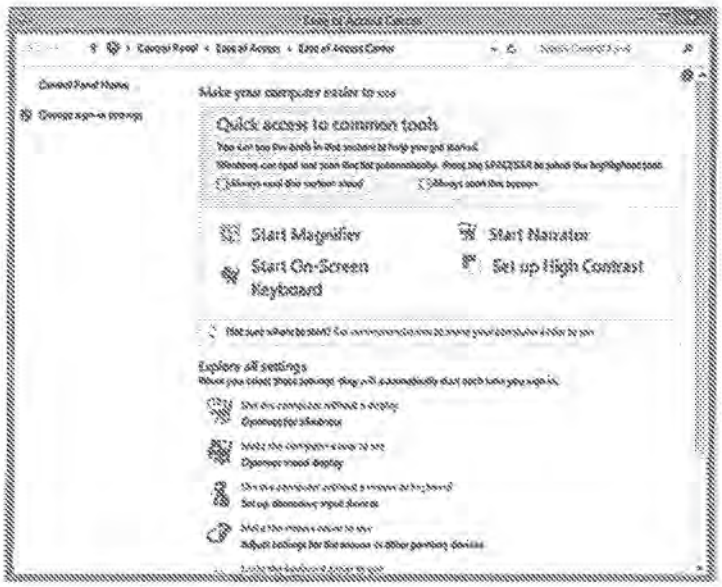
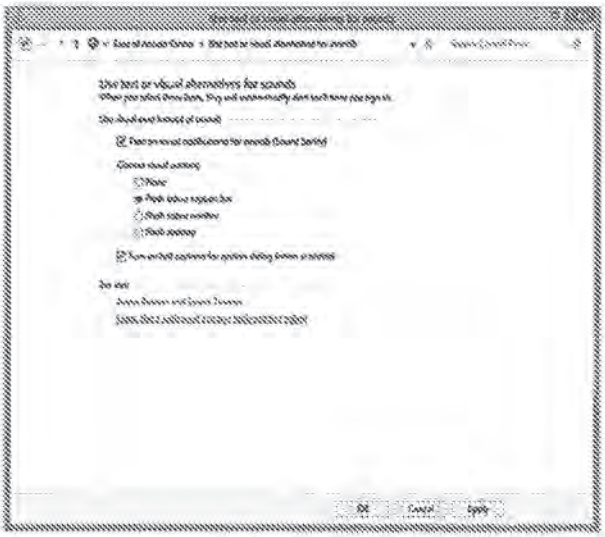



*Ease of Access Center in Control Panel*

### Use text or visual alternatives for sounds

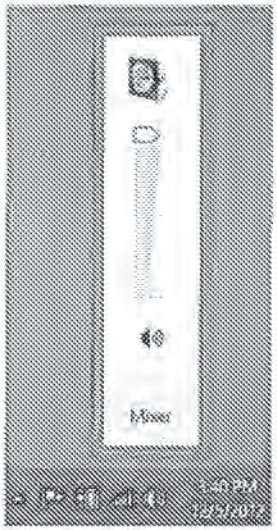
Under **Use text or visual alternatives for sounds** in the Ease of Access Center you will find options for using visual cues to replace sounds in many programs, and access to the audio sound themes control panel.



*"Use text or visual alternatives for sounds" screen in Control Panel*

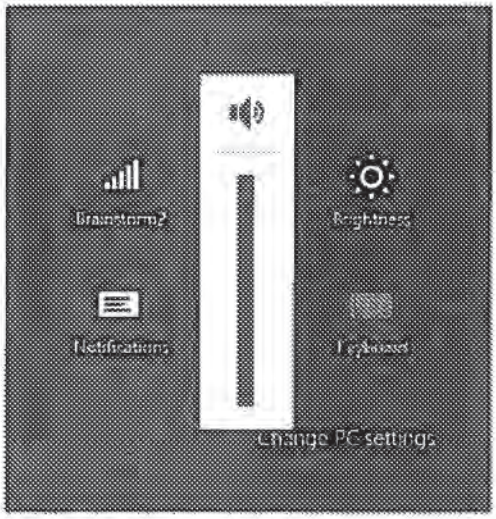
### Adjust computer volume

Although most speakers have a volume control, you can also control speaker volume using Windows. The quickest way to change the speaker volume for your computer is to click the **Speakers** button in the notification area of the taskbar while in desktop view, and then to move the slider up or down to increase or decrease the speaker volume.




*Computer volume control slider*

While on the **Start** screen, swipe in from the top right of the screen and select **Settings**. Then click the **Speakers** icon and adjust the slider bar up or down to increase or decrease the computer volume.




*Volume control in Windows 8 Settings*

**Change computer sounds**

You can have your computer play a sound when certain events occur on your computer. (An event can be an action that you perform, such as logging on to your computer, or an action that your computer performs, such as alerting you when you receive new email.) Windows comes with several sound schemes (a collection of related sounds) for common events. Additionally, some desktop themes have their own sound schemes. To change sound schemes, press the **Windows logo key+U**, while in the desktop view to open the Ease of Access Center. Select **Use text or visual alternatives for sounds**. Then select **Audio Devices and Sounds**. In the **Sound** dialog box, select the **Sounds** tab. Select the program events and associated sounds you want to comprise a new sound scheme.

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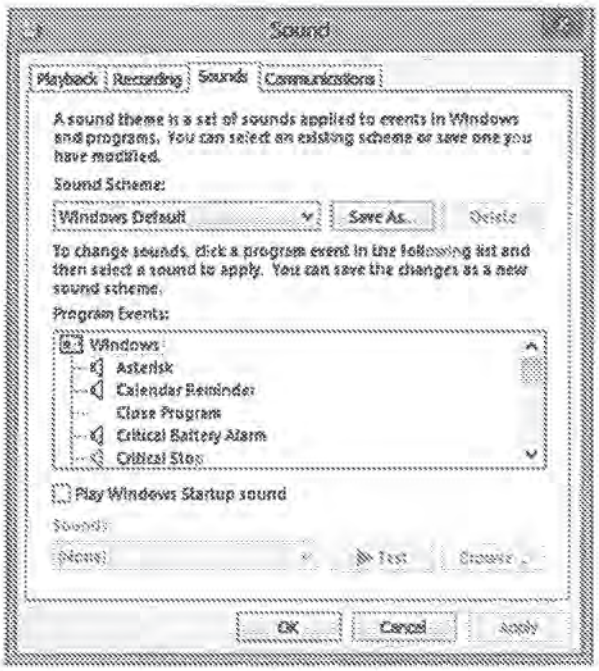
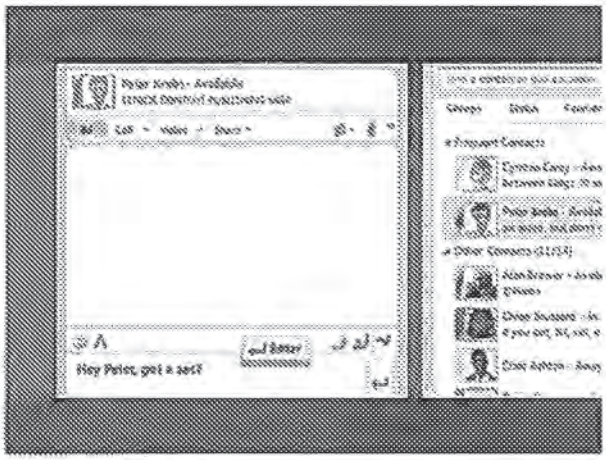



*Sound dialog box open to the Sounds tab*

## Use Office features for hearing solutions

Depending on the learning or work environment, individuals may be able to use a combination of Windows, Microsoft Outlook, and Microsoft Lync, to communicate via text rather than spoken dialogue with classmates or workmates in real time.




*Instant messaging using Lync*

Microsoft Lync 2013 provides a single interface that unites voice communications, instant messaging, and audio, video, and web conferencing.

People who are deaf or have hearing impairments can communicate effectively using email, text messaging on phones and other devices, and communications interfaces such as Microsoft Lync.

## Find assistive technology for hearing impairments

You can shop for assistive technology products compatible with Microsoft Windows made by independent assistive technology companies. People who

have hearing impairments may be interested in the following assistive technology:

- **Sign language interpretation** is useful for students and others with hearing impairments to enable them to actively communicate in the classroom and other settings.
- **Personal listening devices** and personal amplifying products can also be helpful for people with some hearing.
- **Sign language translators** such as iCommunicator which is a graphical sign language translator that converts speech to sign language in real time can enable people who are deaf to communicate more easily with hearing people.

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CNET › Mobile › Mobile accessories › Samsung AllShare Cast Hub

Samsung AllShare Cast Hub review:

# Meet Samsung's version of Apple AirPlay

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WHERE TO BUY / SEE ALL PRICES

Samsung AllShare Cast Hub
Part Number: EAD-T10JDEGSTA /

MSRP: $99.99
LOW PRICE: $54.99

Amazon.com $55.48 SEE IT

Best Buy $56.99 SEE IT

eBay

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PCT/US2014/034098 15.09.2014

0 / f / t / p / g+ / more +

Review Date: October 10, 2012 Updated on: October 10, 2012

**The Good** / The **Samsung AllShare Cast Hub** pushes phone media to HDTVs without wires. The device also mirrors what's displayed on phone screens for HDTV viewing.

**The Bad** / Setting up the Samsung AllShare Cast Hub isn't intuitive. The device only supports a few recent Samsung devices.

**The Bottom Line** / The Samsung AllShare Cast Hub is worthwhile only for select Samsung mobile device owners absolutely dying to view mobile content on their HDTVs.


$54.99 SEE IT

Walmart.com

$56.61 SEE IT

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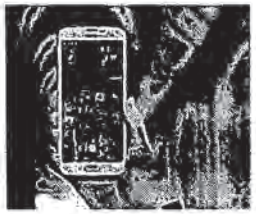
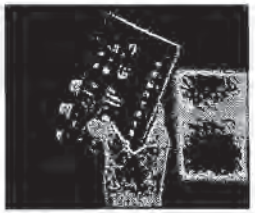


Samsung Galaxy S5
Starting at: **$99.00**
★★★★½



Nokia Lumia Icon (Verizon Wireless)
Starting at: **$149.99**
★★★★☆

Samsung Galaxy S5 Active
Starting at: **$199.99**
★★★★½

Sony Xperia Z2
Starting at: **$548.14**
★★★★½


MSRP:
$99.99
LOW PRICE:
$54.99

Amazon.com [redacted]

Apple's AirPlay feature has bridged the living room/mobile handset divide for a while now, but Android smartphones have become extremely capable multimedia devices in their own right too. Equipped with high-resolution cameras, advanced audio and video players plus plenty of memory for storage, they now tackle the same multimedia tricks as the vaunted iPhone. Factor in how modern **Android phones** connect to myriad online

QUICK SPECIFICATIONS / SEE ALL

| | |
|---|---|
| CE Product Type | Wireless media hub |

ABOUT THE AUTHOR / f t g+

Brian Bennett

Brian Bennett is senior editor for appliances at CNET and reviews a wide range of household and smart-home products. These include everything from microwave ovens, blenders, ranges and coffee makers to personal weather stations. An NYC native, Brian now resides in bucolic Louisville, Kentucky where he dreams of someday owning the sparkling house of the future.

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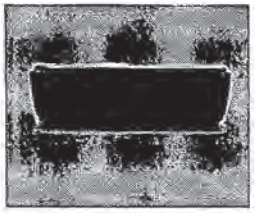
entertainment services, and it's easy to see the appeal of a product like the $99.99 Samsung AllShare Cast Hub. The AllShare is built to push audio and video content from Samsung's latest handsets, including the Galaxy S III, to HDTVs without wires. While the accessory isn't cheap, and initial setup tricky, the AllShare Cast Hub gets the job done.

**SAMSUNG'S ALLSHARE HUB MIRRORS PHONE MEDIA (PICTURES)** SEE FULL GALLERY



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# Design

A rather nondescript black box, the small Samsung AllShare Cast Hub sports smoothly curved edges with no visible markings or controls. Weighing a mere 1.6 ounces, the AllShare's light weight could conceivably qualify it as a mobile product. A full-size HDMI port and connection to an AC power adapter around the back of the device though say otherwise. Also placed on back of the AllShare Cast is a tiny reset button and is the device's only physical control.

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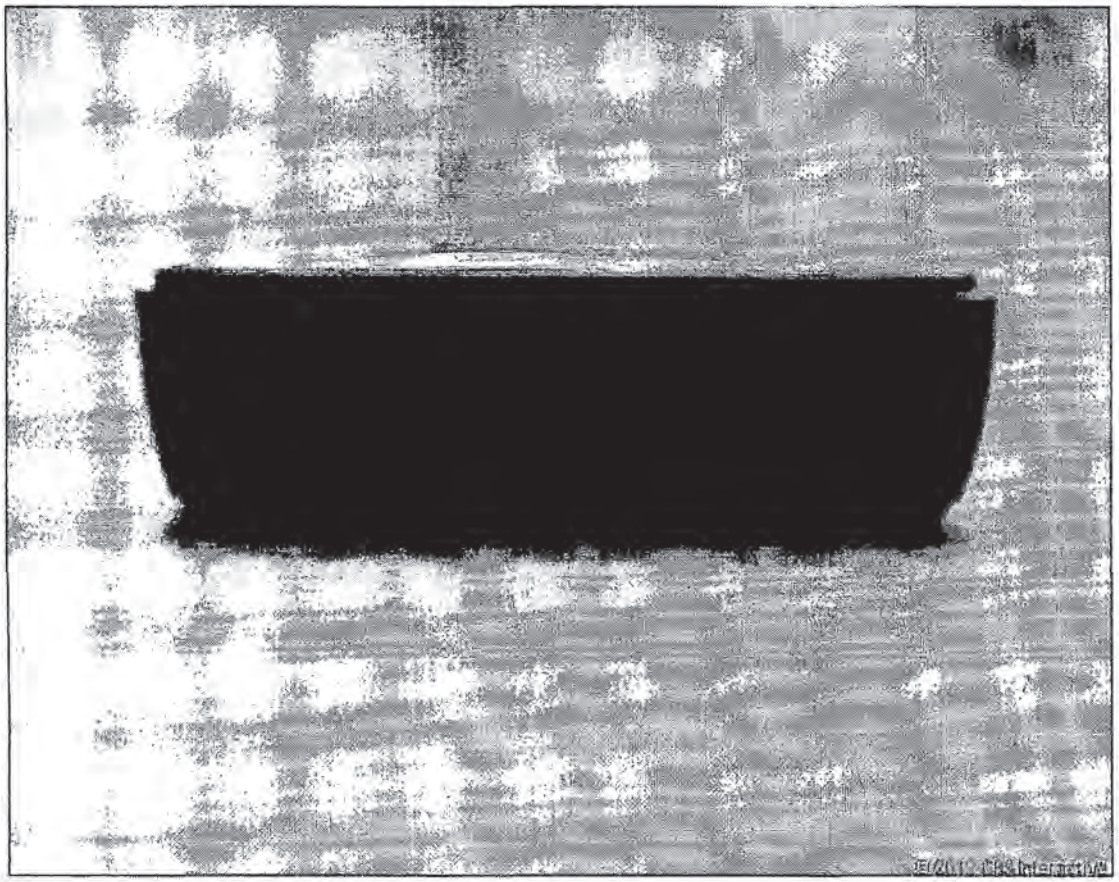

On back is a lone HDMI port, power connecter, and reset button.

Sarah Tew/CNET

# Features and performance

Essentially the AllShare Cast Hub is a very simple accessory made to accomplish one primary task. Using Wi-Fi direct technology, it mirrors what is displayed on the Samsung handset's screen to a compatible HDTV. The AllShare also does this in real time and without stringing wires between phone and display. Keep in mind that the product is only compatible with Samsung's **Galaxy S III**, **Galaxy Note 2**, and **Galaxy Note 10.1** devices.

Physically setting up the AllShare was a snap. First I connected the supplied AC adapter and HDMI cable to the back of the Hub. Next I plugged the Hub's power source to an AC outlet and then attached its HDMI cable to a free port on my test TV, the 55-inch Philips PFL5907.

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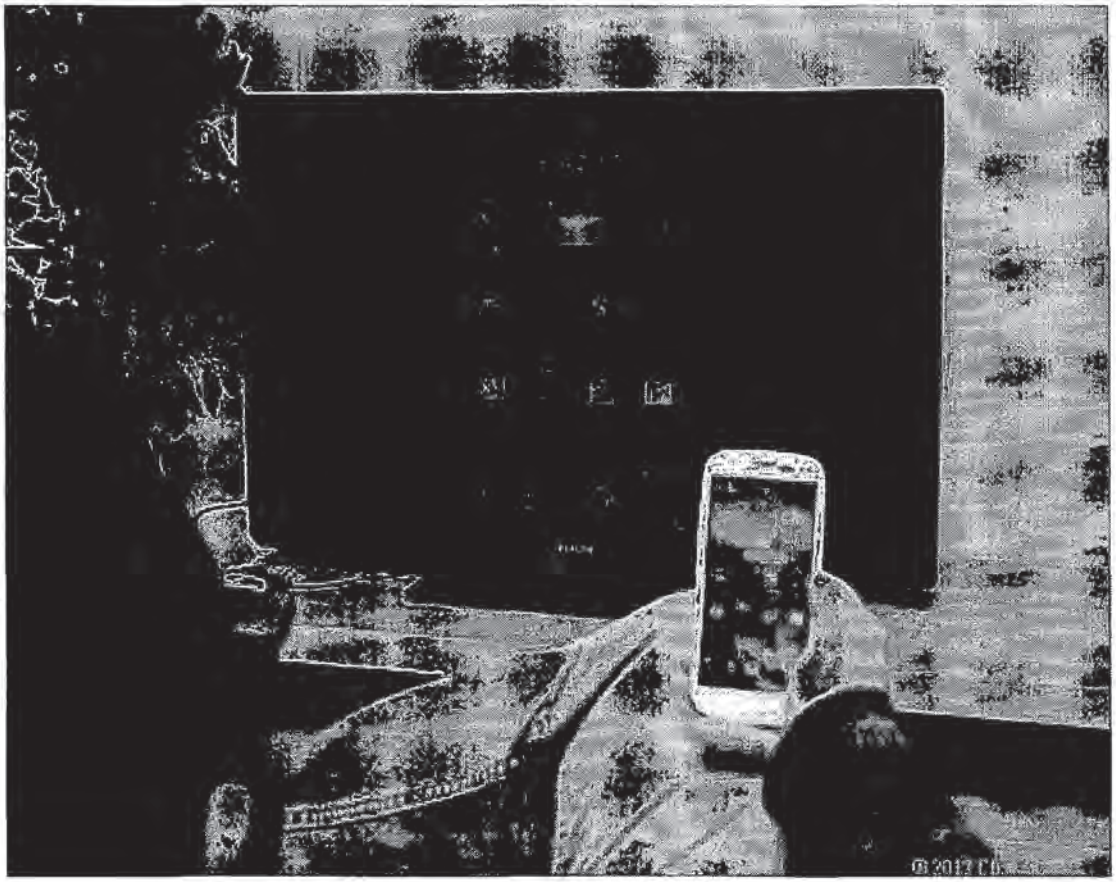

Mirror your Galaxy S3 interface on big HDTV screens.

Sarah Tew/CNET

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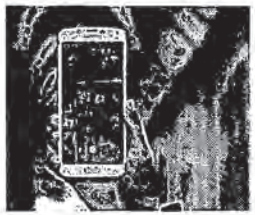
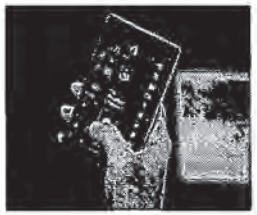

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Samsung Galaxy S5
Starting at: **$99.00**
★★★★½

Nokia Lumia Icon (Verizon Wireless)
Starting at: **$149.99**
★★★★☆

Samsung Galaxy S5 Active
Starting at: **$199.99**
★★★★½

Sony Xperia Z2
Starting at: **$548.14**
★★★★½

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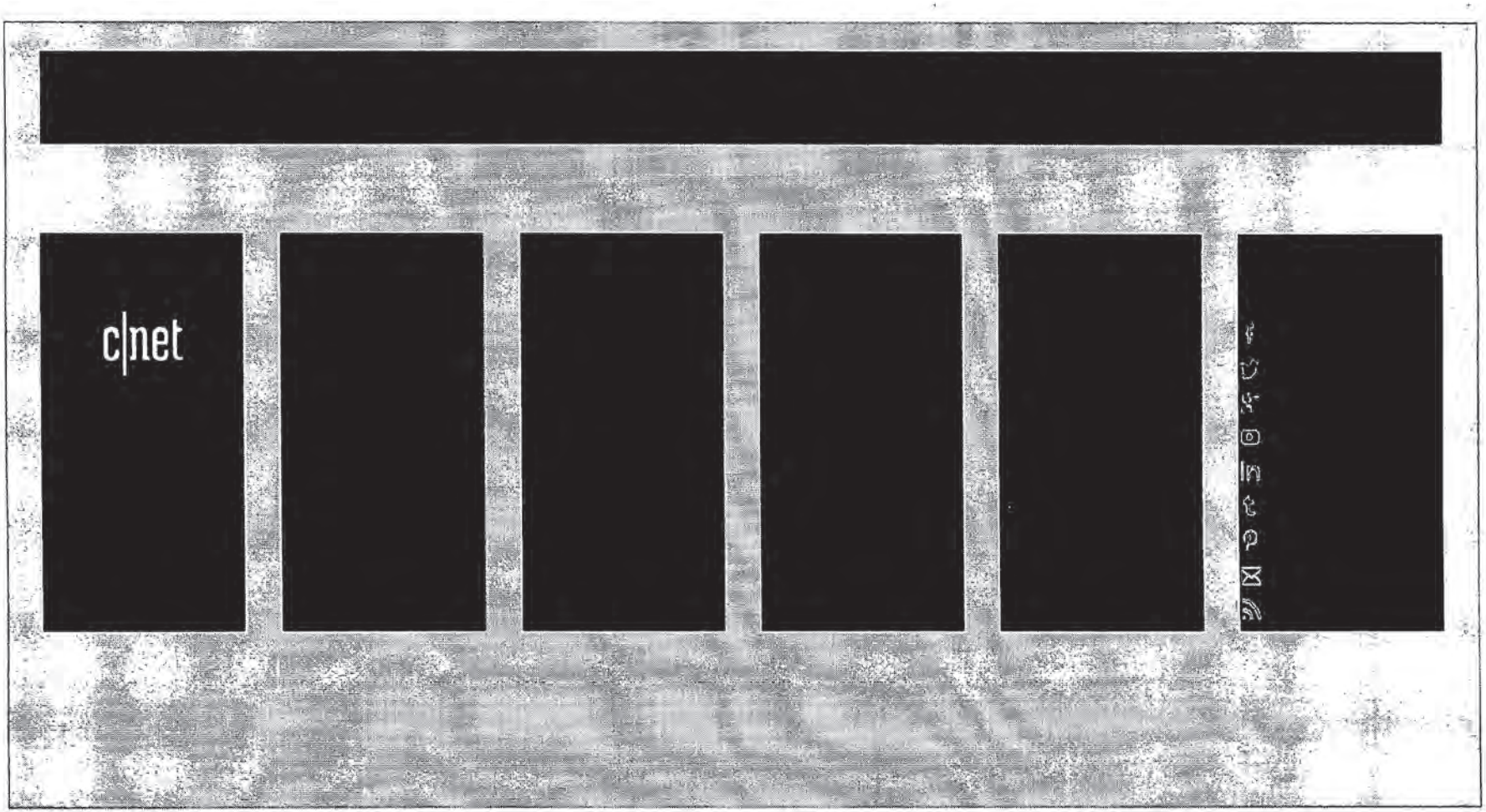


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Samsung AllShare Cast Hub review:

# Meet Samsung's version of Apple AirPlay

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After I switched the TV set to the correct input, I was greeted by a slick setup animation that cycled through various steps to get the AllShare Cast Hub up and running. Unfortunately, while the graphics were stylish and clearly indicated what I had to do visually, their accompanying written captions were anything but straightforward.

For example I easily understood that I had to navigate to my Samsung Galaxy S III handset's settings menu to enable the AllShare wireless function. I found onscreen directions to "press the reset key of the dongle when the red indicator starts blinking" completely mystifying. No reason for doing this action was given aside from that it was, "To connect new AllShare device."

It wasn't until I consulted the included printed documents that I learned I had to press the reset button for almost 30 seconds until the AllShare Cast's indicator light shifted from a blinking red to a steady blue. It's then and only then that I could successfully link my phone to the Hub.

WHERE TO BUY / SEE ALL PRICES

Samsung AllShare Cast Hub
Part Number: EAD-T10JDEGSTA /

MSRP: $99.99 LOW PRICE: $54.99

Amazon.com $55.48 SEE IT

Best Buy $56.99 SEE IT

eBay

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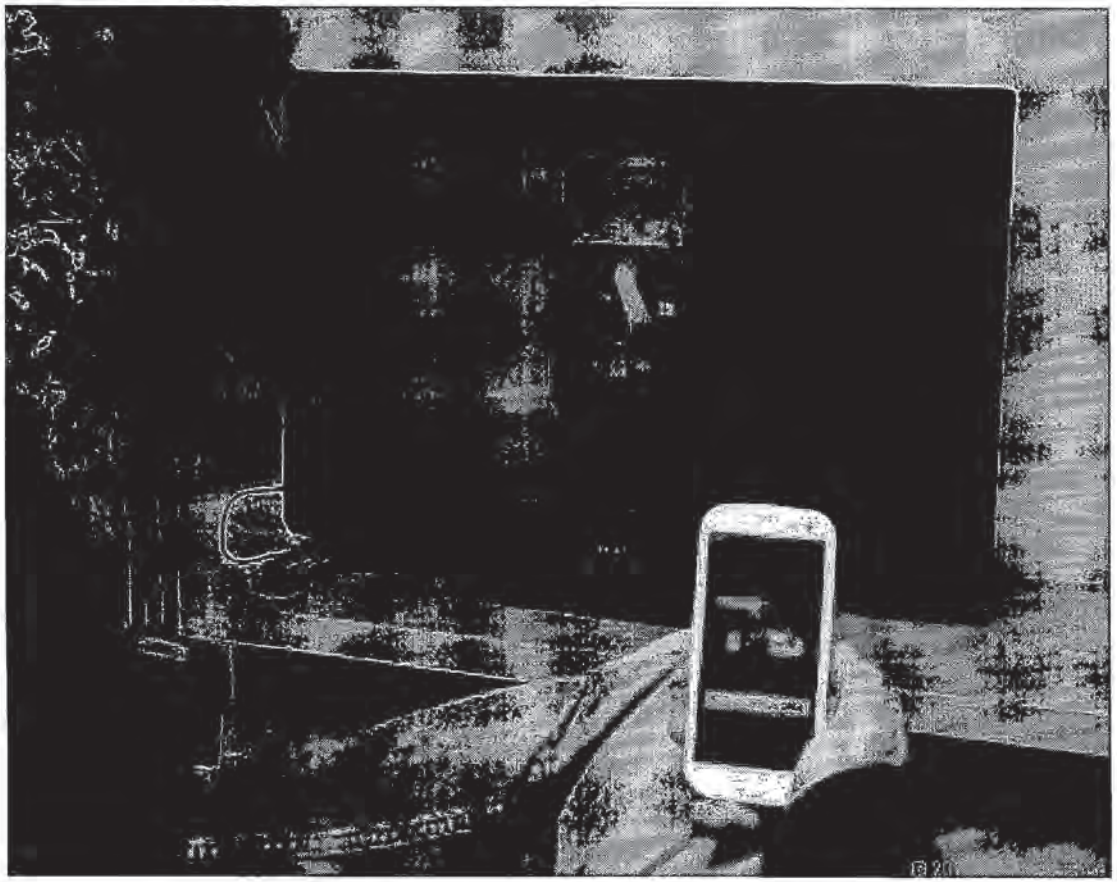

The Hub displays fancy setup instructions on your HDTV.

Sarah Tew/CNET

Once connected properly, I saw everything the Galaxy S III's screen displayed replicated on my HDTV. This included **Android** menus, apps, and even games. I successfully listened to music and HD video streamed to my TV screen via my test phone. It was also mildly entertaining to play a few rounds of Angry Birds across a 55-inch canvas. One potential issue, though, is that the AllShare Cast Hub lacks discrete audio ports of any kind, so connecting the gadget to older home theater receivers (non HDMI) isn't possible.

Video and audio quality was clean overall with clear high-resolution images and no hiccups. I did experience lag between phone screen and TV, though, especially within the Wi-Fi-saturated CNET offices in New York. In fact, a few times I lost the connection between phone and TV completely, forcing me to reconnect. Moving to a location with less Wi-Fi interference, however, cleared up the problem.

$54.99 SEE IT

Walmart.com

$56.61 SEE IT

See all prices »

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| | |
|---|---|
| CE Product Type | Wireless media hub |

ABOUT THE AUTHOR /

Brian Bennett

Brian Bennett is senior editor for appliances at CNET and reviews a wide range of household and smart-home products. These include everything from microwave ovens, blenders, ranges and coffee makers to personal weather stations. An NYC native, Brian now resides in bucolic Louisville, Kentucky where he dreams of someday owning the sparkling house of the future.

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Enjoy phone-based music streamed to the living room sans wires.

Sarah Tew/CNET

## Conclusion

While the Samsung AllShare Cast Hub performs its core function of porting smartphone content to HDTVs adequately, its $99.99 price isn't cheap. That premium is especially daunting considering the gadget only works with a handful of recent Samsung products. Also, if all you want to do is stream basic audio to living room components, the $39.99 **Logitech Wireless Speaker Adapter** tackles the job for a lot less. There's also the $49.99 **BlackBerry Music Gateway** that's built for RIM handsets but does work with any phone with using Bluetooth stereo audio. HTC also sells its $89.99 Media Link HD device that performs many of the same tricks but only for HTC handsets. Of course for owners of shiny new Galaxy S IIIs who want to enjoy both their phone's audio and video on the big screen, the AllShare Cast Hub is the only game in town.

**WHAT YOU'LL PAY**

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MSRP:
**$99.99**

LOW PRICE:
**$54.99**

AVERAGE PRICE:
**$56.02**

| | |
|---|---|
| Amazon.com<br>$55.48 | Best Buy<br>$56.99 |
| eBay<br>$54.99 | Walmart.com<br>$56.61 |

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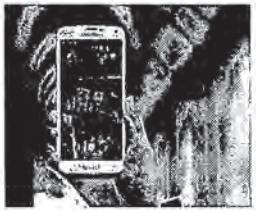
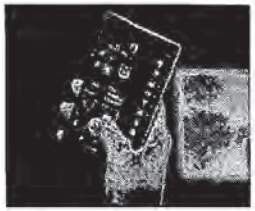


Samsung Galaxy S5
Starting at: **$99.00**
★★★★½



Nokia Lumia Icon (Verizon Wireless)
Starting at: **$149.99**
★★★★½

Samsung Galaxy S5 Active
Starting at: **$199.99**
★★★★½

Sony Xperia Z2
Starting at: **$548.14**
★★★★½

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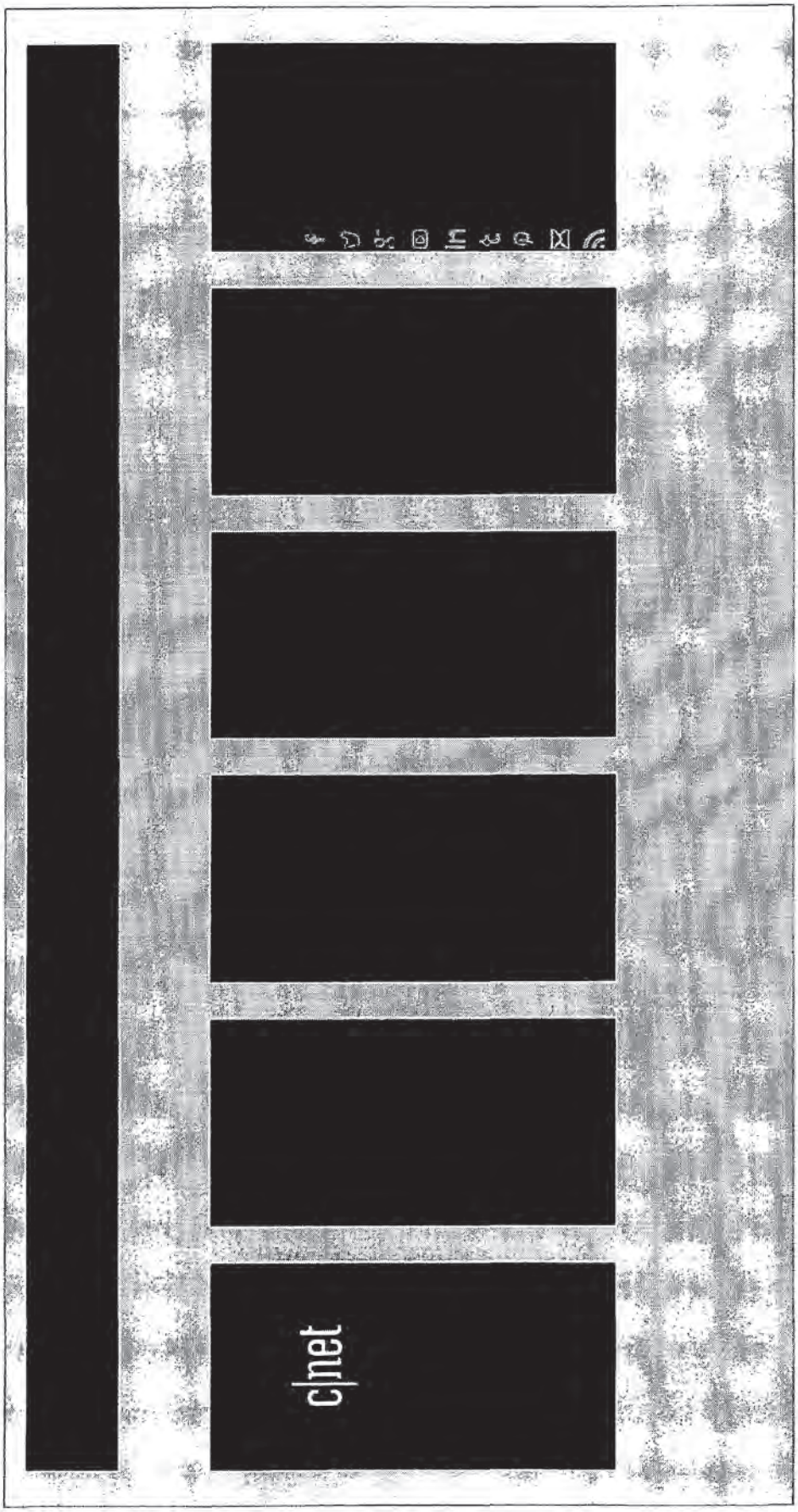


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