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(54) CENTRALIZED MANAGEMENT OF MOTOR VEHICLE SOFTWARE APPLICATIONS AND SERVICES

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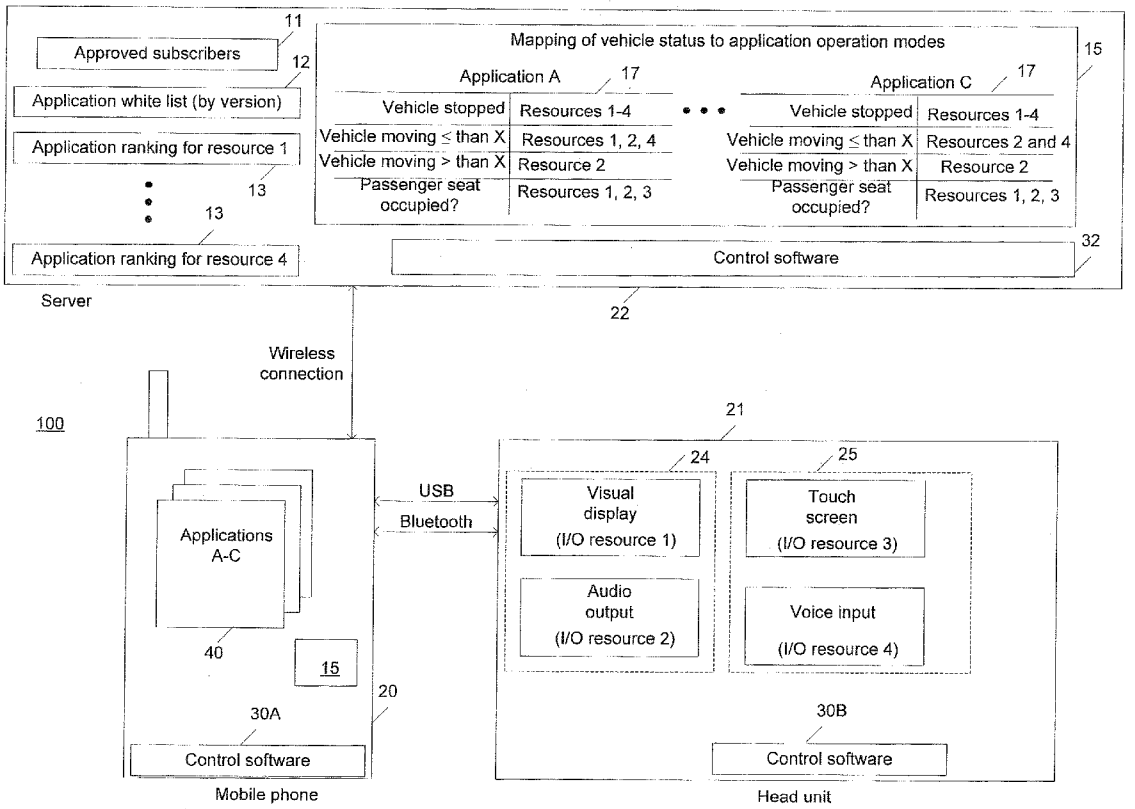
(57) **ABSTRACT**

In one example, a network device stores a mapping of application operation modes to vehicle conditions such as a first condition of the vehicle powered but not moving and a second condition of the vehicle moving. The network device receives a wirelessly transmitted request for a particular application to utilize an interface powered by the vehicle. The network device compares an application identifier specified by the received request to the mapping. The network device then identifies a portion of the vehicle interface according to the comparison and signals control software on the vehicle to grant the particular application access to only the identified portion of the vehicle interface itself. The application can reside on the mobile device and utilize the vehicle interface as an extended interface, or the application can reside on the vehicle.



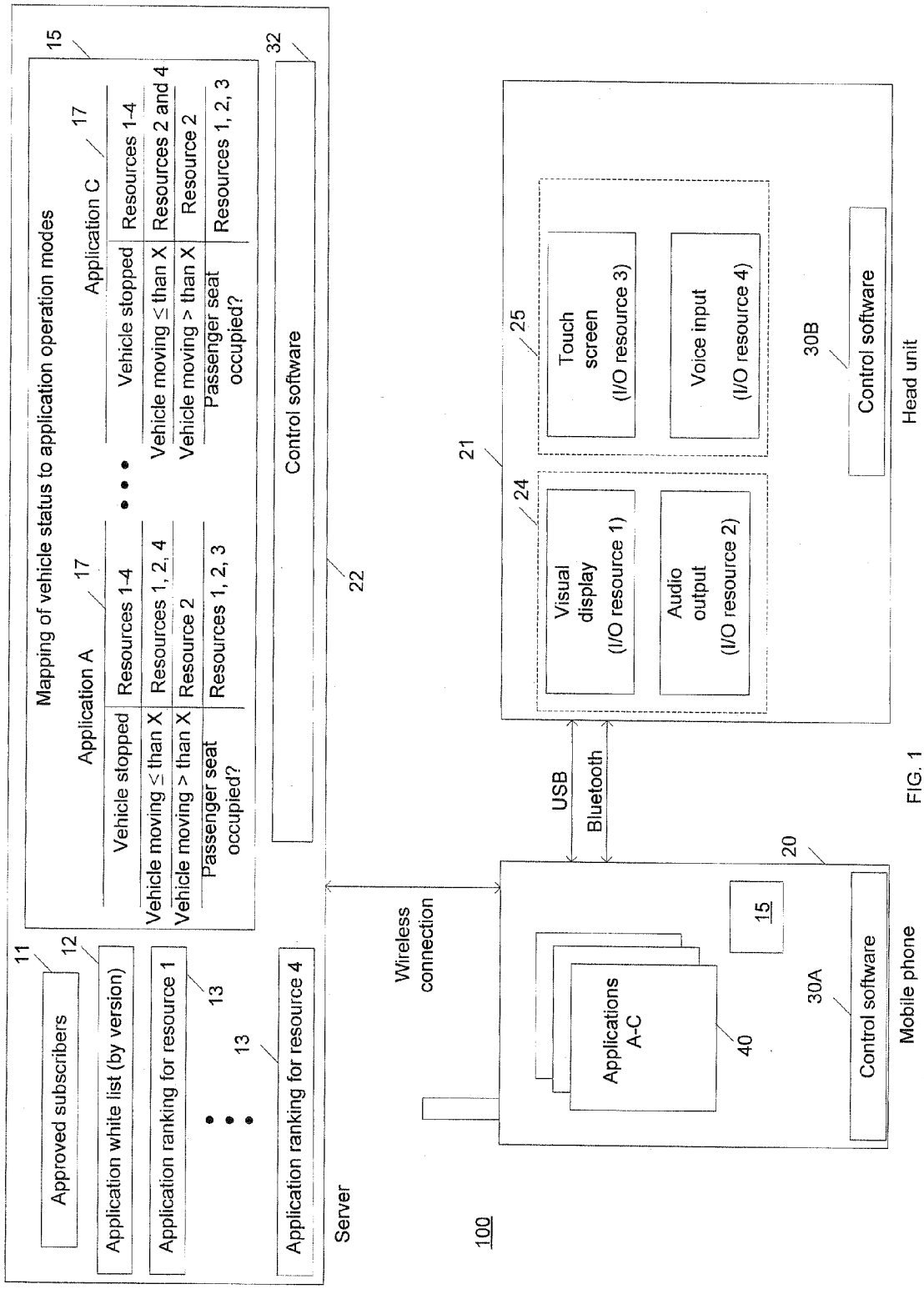

Server
11
Approved subscribers
12
Application white list (by version)
13
Application ranking for resource 1
13
Application ranking for resource 4
15
Mapping of vehicle status to application operation modes
Application A
17
Vehicle stopped
Resources 1-4
Vehicle moving ≤ than X
Resources 1, 2, 4
Vehicle moving > than X
Resource 2
Passenger seat occupied?
Resources 1, 2, 3
Application C
17
Vehicle stopped
Resources 1-4
Vehicle moving ≤ than X
Resources 2 and 4
Vehicle moving > than X
Resource 2
Passenger seat occupied?
Resources 1, 2, 3
32
Control software
22
Wireless connection
100
USB
Bluetooth
Applications A-C
40
15
20
30A
Control software
Mobile phone
21
24
Visual display (I/O resource 1)
Audio output (I/O resource 2)
25
Touch screen (I/O resource 3)
Voice input (I/O resource 4)
30B
Control software
Head unit

FIG. 1

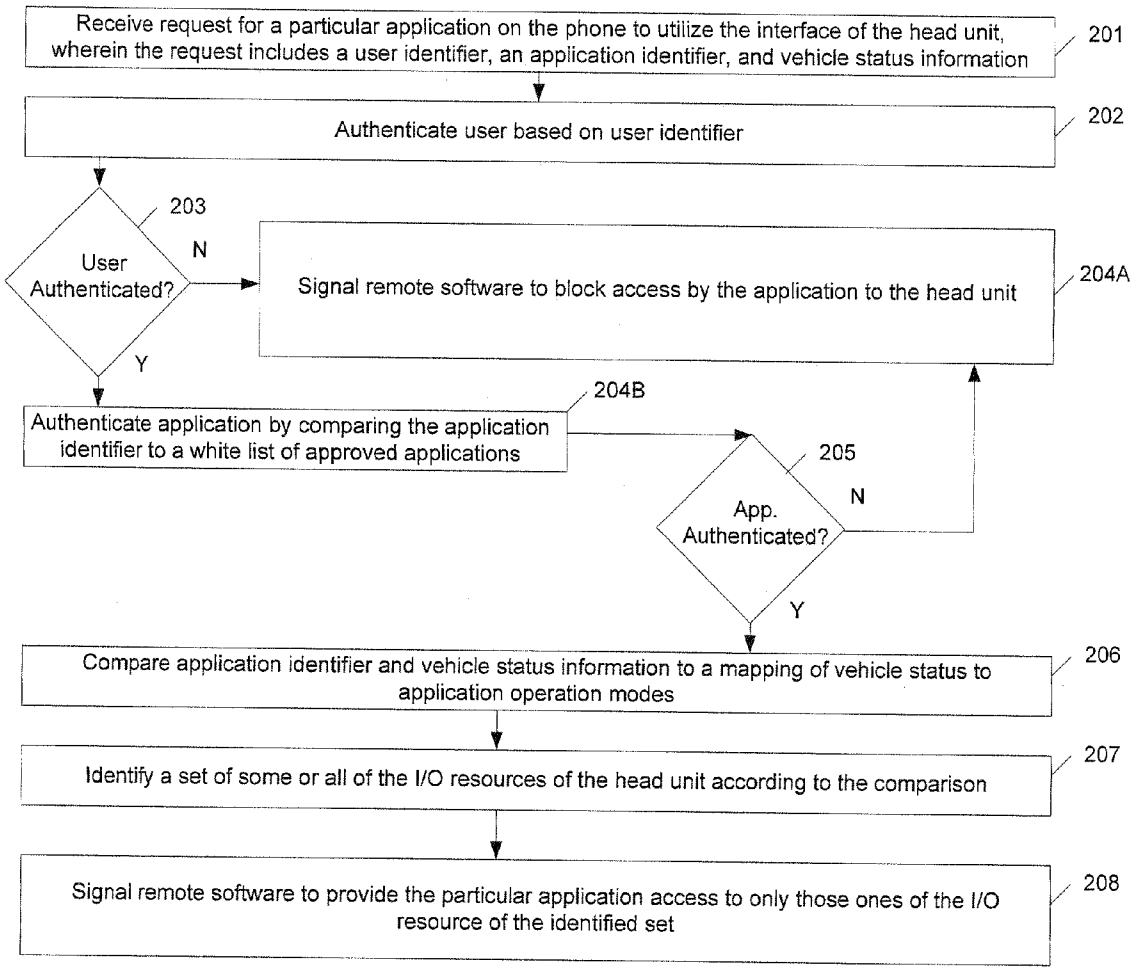

Receive request for a particular application on the phone to utilize the interface of the head unit, wherein the request includes a user identifier, an application identifier, and vehicle status information
201
Authenticate user based on user identifier
202
203
User Authenticated?
N
Signal remote software to block access by the application to the head unit
204A
Y
204B
Authenticate application by comparing the application identifier to a white list of approved applications
205
App. Authenticated?
N
Y
Compare application identifier and vehicle status information to a mapping of vehicle status to application operation modes
206
Identify a set of some or all of the I/O resources of the head unit according to the comparison
207
Signal remote software to provide the particular application access to only those ones of the I/O resource of the identified set
208

FIG. 2A

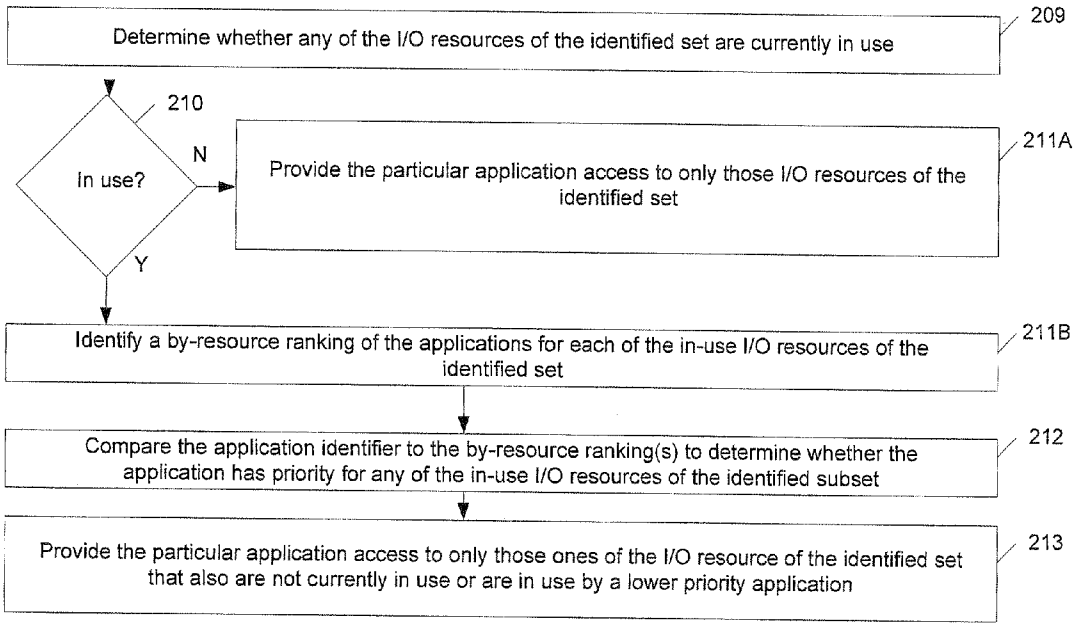

Determine whether any of the I/O resources of the identified set are currently in use
209
210
In use?
N
Y
Provide the particular application access to only those I/O resources of the identified set
211A
Identify a by-resource ranking of the applications for each of the in-use I/O resources of the identified set
211B
Compare the application identifier to the by-resource ranking(s) to determine whether the application has priority for any of the in-use I/O resources of the identified subset
212
Provide the particular application access to only those ones of the I/O resource of the identified set that also are not currently in use or are in use by a lower priority application
213

FIG. 2B

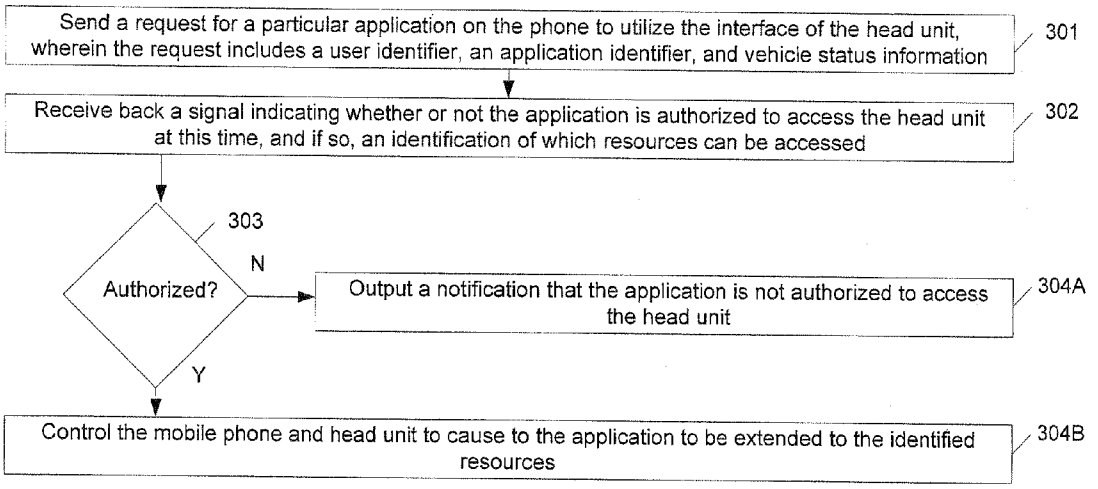

Send a request for a particular application on the phone to utilize the interface of the head unit, wherein the request includes a user identifier, an application identifier, and vehicle status information
301
Receive back a signal indicating whether or not the application is authorized to access the head unit at this time, and if so, an identification of which resources can be accessed
302
303
Authorized?
N
Output a notification that the application is not authorized to access the head unit
304A
Y
Control the mobile phone and head unit to cause to the application to be extended to the identified resources
304B

FIG. 3

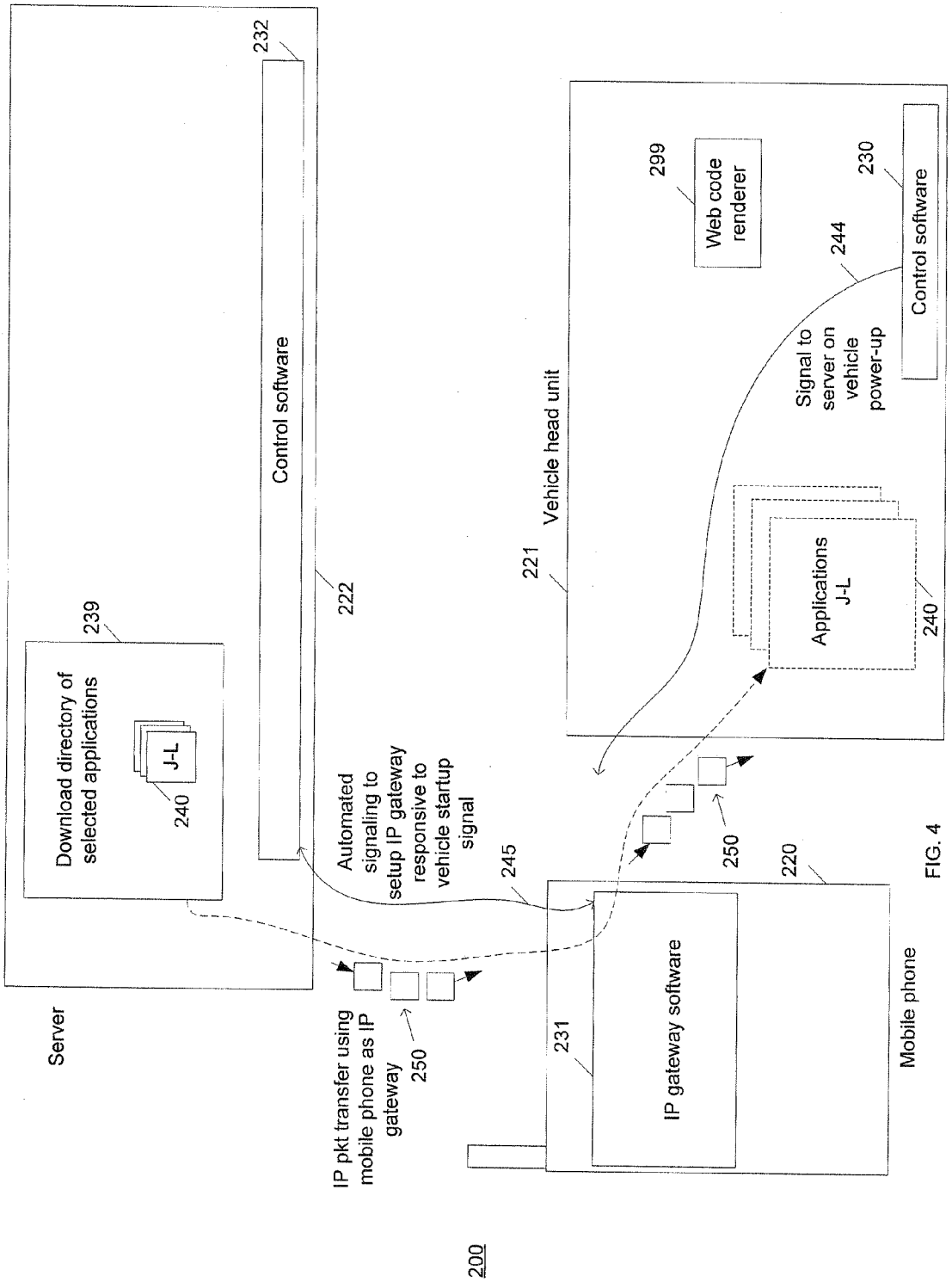

Server
Download directory of selected applications
J-L
240
239
Control software
232
222
IP pkt transfer using mobile phone as IP gateway
250
Automated signaling to setup IP gateway responsive to vehicle startup signal
245
Vehicle head unit
221
Web code renderer
299
Control software
230
244
Signal to server on vehicle power-up
Applications J-L
240
250
IP gateway software
231
Mobile phone
220
200

FIG. 4

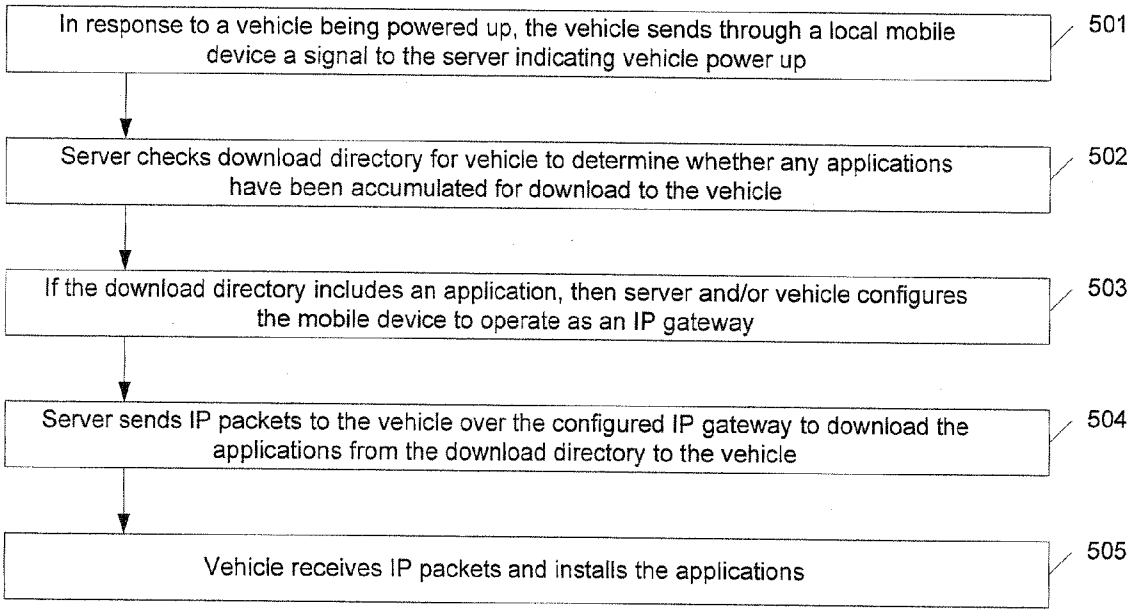

In response to a vehicle being powered up, the vehicle sends through a local mobile device a signal to the server indicating vehicle power up
501
Server checks download directory for vehicle to determine whether any applications have been accumulated for download to the vehicle
502
If the download directory includes an application, then server and/or vehicle configures the mobile device to operate as an IP gateway
503
Server sends IP packets to the vehicle over the configured IP gateway to download the applications from the download directory to the vehicle
504
Vehicle receives IP packets and installs the applications
505

FIG. 5

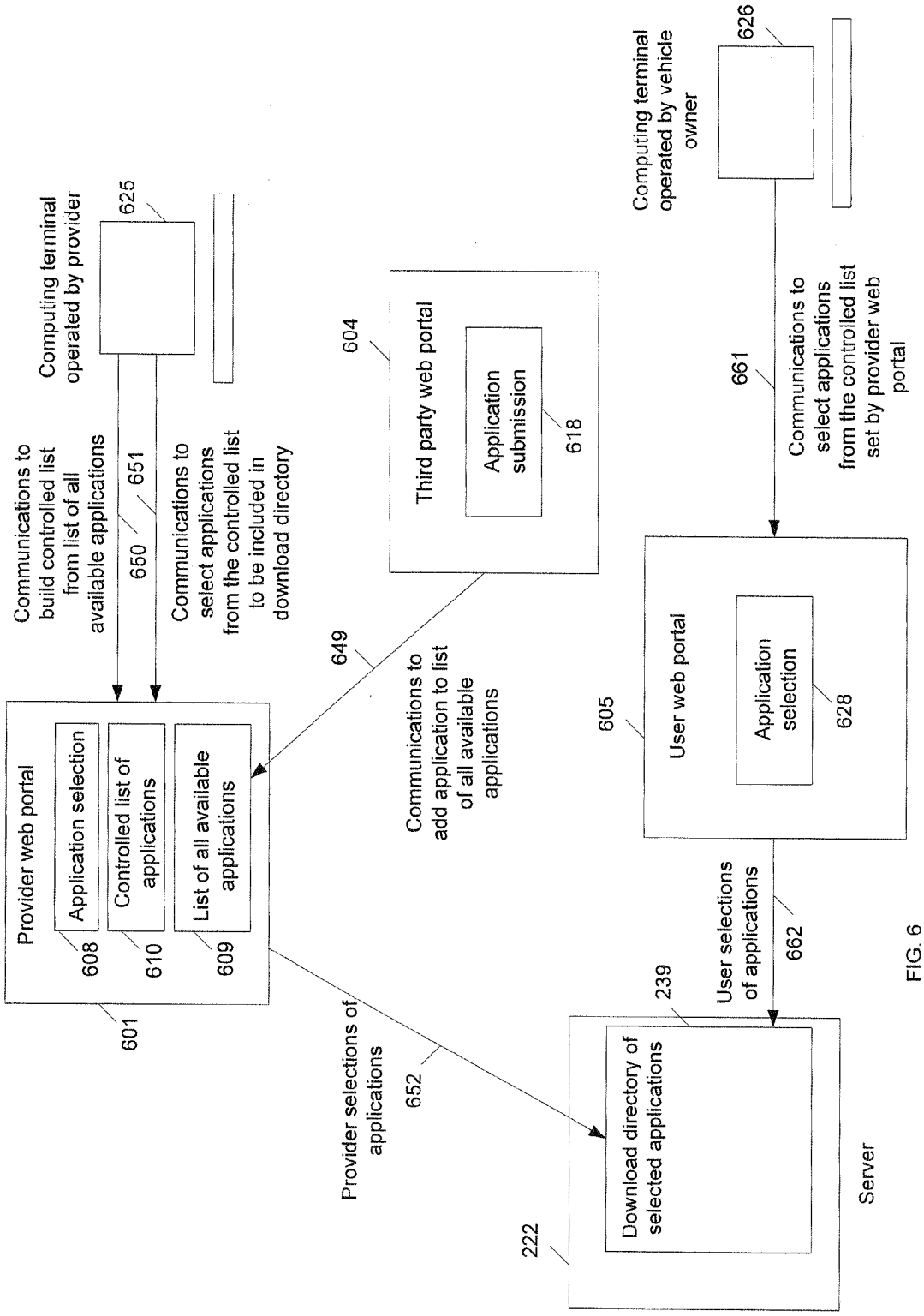

Computing terminal operated by provider
625
Communications to build controlled list from list of all available applications
650
651
Communications to select applications from the controlled list to be included in download directory
Provider web portal
Application selection
Controlled list of applications
List of all available applications
608
610
609
601
649
Communications to add application to list of all available applications
604
Third party web portal
Application submission
618
Provider selections of applications
652
Computing terminal operated by vehicle owner
626
661
Communications to select applications from the controlled list set by provider web portal
605
User web portal
Application selection
628
User selections of applications
662
239
Download directory of selected applications
222
Server

FIG. 6

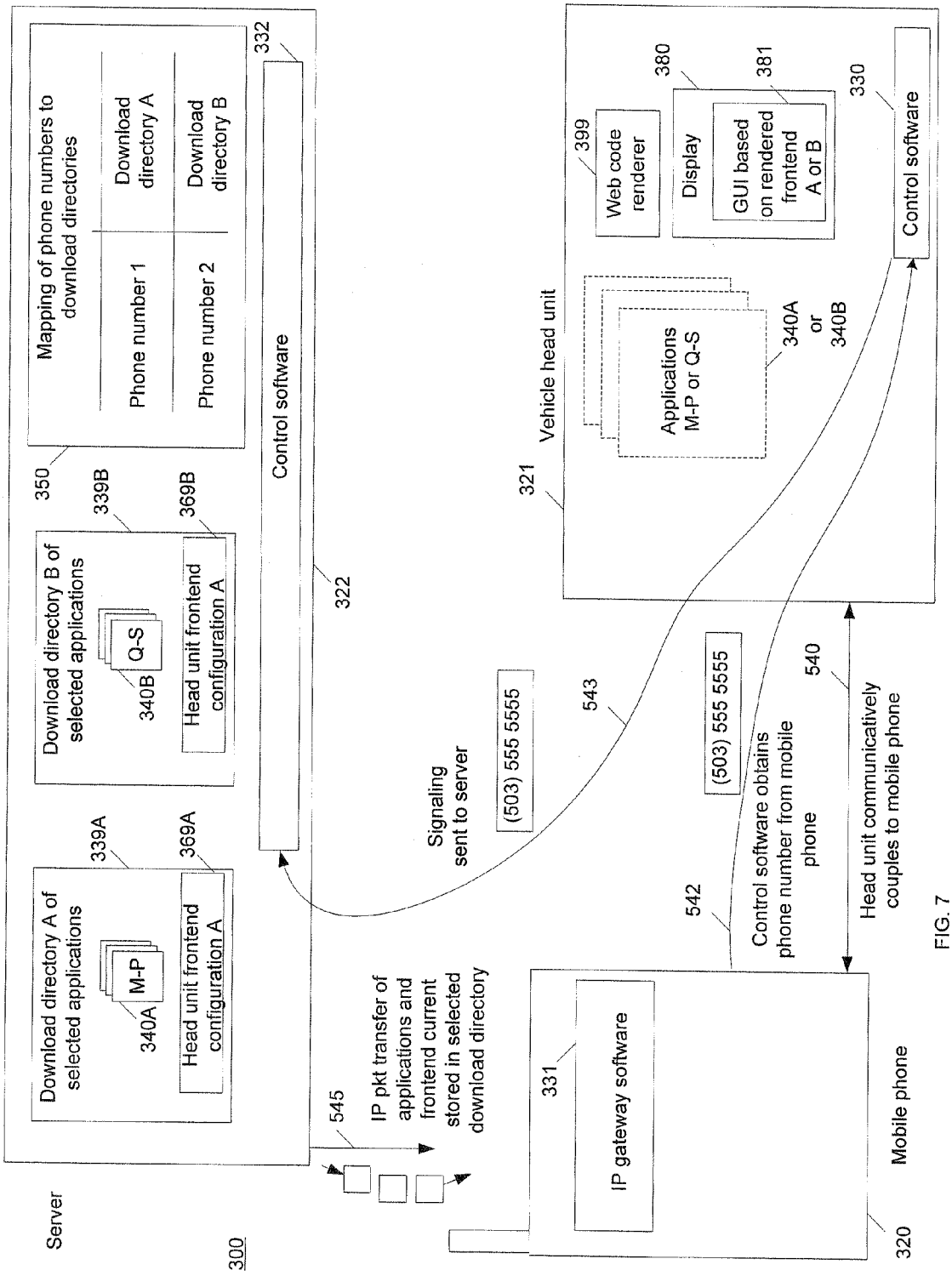

Server
300
Mapping of phone numbers to download directories
Phone number 1
Download directory A
Phone number 2
Download directory B
350
332
Control software
322
Download directory B of selected applications
Q-S
340B
339B
Head unit frontend configuration A
369B
Download directory A of selected applications
M-P
340A
339A
Head unit frontend configuration A
369A
545
IP pkt transfer of applications and frontend current stored in selected download directory
Signaling sent to server
(503) 555 5555
543
Vehicle head unit
321
Applications M-P or Q-S
340A or 340B
Web code renderer
399
Display
380
GUI based on rendered frontend A or B
381
Control software
330
(503) 555 5555
542
Control software obtains phone number from mobile phone
540
Head unit communicatively couples to mobile phone
IP gateway software
331
Mobile phone
320

FIG. 7

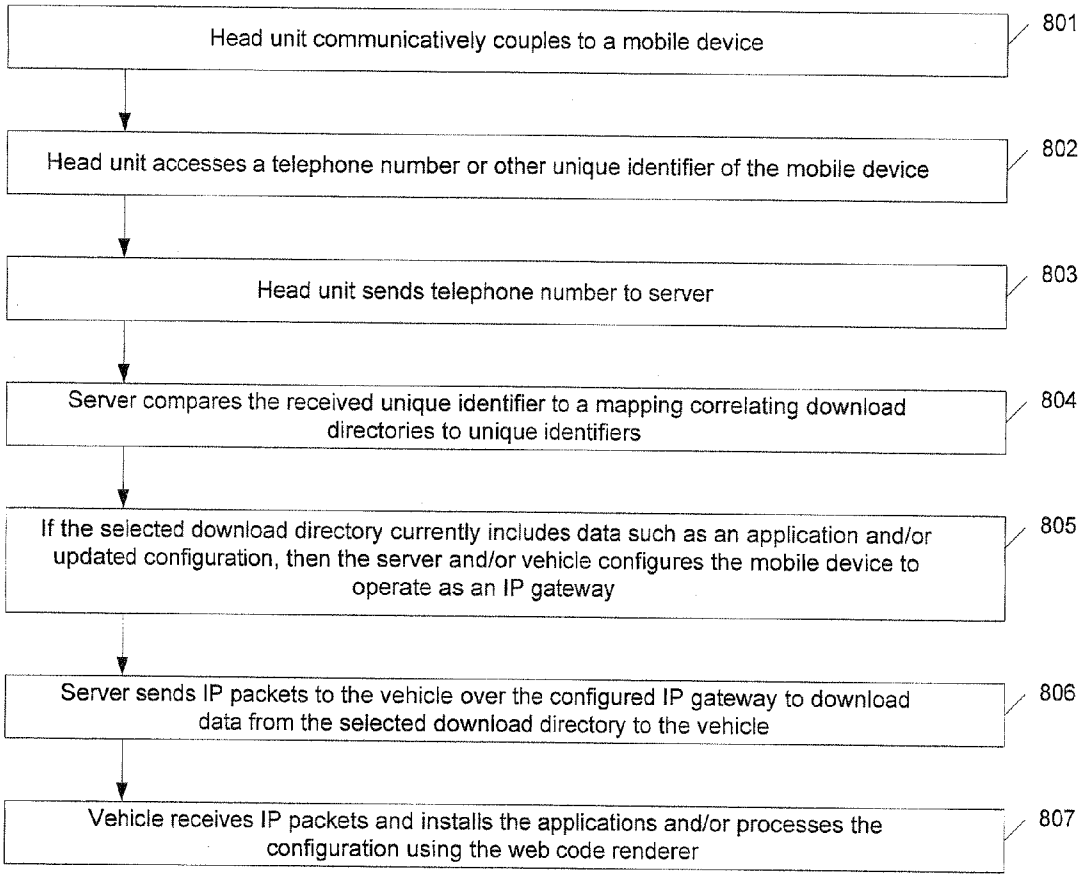

Head unit communicatively couples to a mobile device
801
Head unit accesses a telephone number or other unique identifier of the mobile device
802
Head unit sends telephone number to server
803
Server compares the received unique identifier to a mapping correlating download directories to unique identifiers
804
If the selected download directory currently includes data such as an application and/or updated configuration, then the server and/or vehicle configures the mobile device to operate as an IP gateway
805
Server sends IP packets to the vehicle over the configured IP gateway to download data from the selected download directory to the vehicle
806
Vehicle receives IP packets and installs the applications and/or processes the configuration using the web code renderer
807

FIG. 8

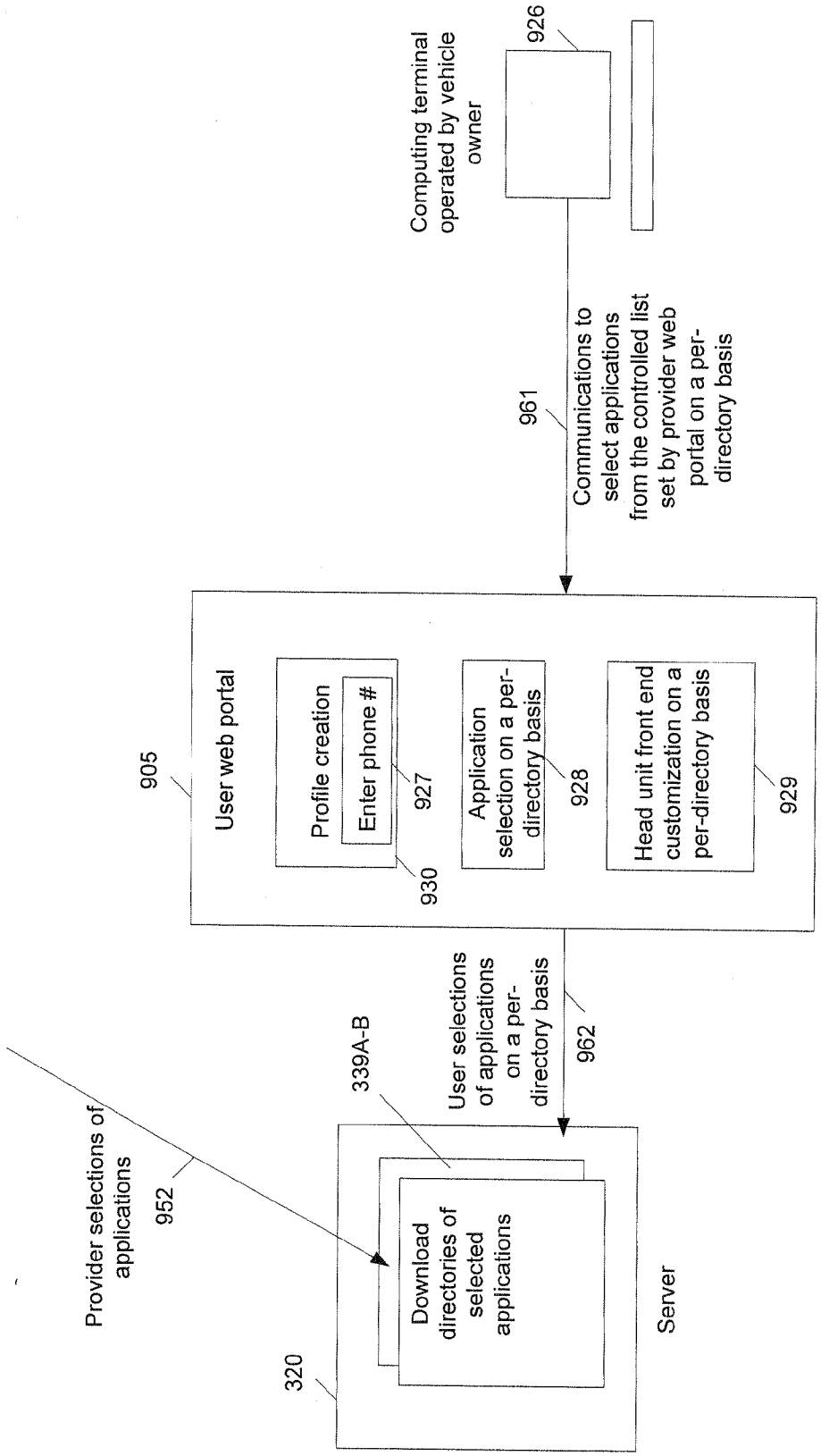

Computing terminal operated by vehicle owner
926
961
Communications to select applications from the controlled list set by provider web portal on a per-directory basis
905
User web portal
Profile creation
Enter phone #
927
930
Application selection on a per-directory basis
928
Head unit front end customization on a per-directory basis
929
User selections of applications on a per-directory basis
962
339A-B
Provider selections of applications
952
Download directories of selected applications
320
Server

FIG. 9

CENTRALIZED MANAGEMENT OF MOTOR VEHICLE SOFTWARE APPLICATIONS AND SERVICES

RELATED APPLICATIONS

[0001] This application is a non-provisional of U.S. Provisional Application No. 61/252,530 filed on Oct. 15, 2009, entitled: CENTRALIZED MANAGEMENT OF MOTOR VEHICLE SOFTWARE APPLICATIONS AND SERVICES, which is herein incorporated by reference in its entirety, and U.S. Provisional Application No. 61/260,781 filed on Nov. 16, 2009, entitled: CENTRALIZED MANAGEMENT OF MOTOR VEHICLE SOFTWARE APPLICATIONS AND SERVICES, which is herein incorporated by reference in its entirety.

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BACKGROUND OF THE INVENTION

[0003] A motor vehicle can be equipped with a "head unit" having a user interface. The user interface can include various resource components such as a screen, speakers, a microphone, a touch screen and/or keypad, etc.

[0004] Smart phones or other mobile phones can download various applications that operate on the phone. A user can utilize a user interface of the phone to control the application and/or utilize the application in some way (such as watching the visual display or listening to the audio output).

[0005] Extending applications from the mobile phone to the head unit has become a popular feature offered by various service providers and vehicle manufacturers. As a result, the user can take advantage of better user interface components offered by the head unit (e.g. a larger screen and higher quality audio output). It is desirable to provide a mechanism to control, manage, and arbitrate the extension of mobile phone applications operating on the head unit utilizing the service control logic available in a remote server.

[0006] Vehicles can also be manufactured with components that allow the applications to be installed on the vehicle itself (as opposed to being installed on a mobile device). It is desirable to control, manage, and arbitrate the use of the vehicle interface by these applications as well.

SUMMARY OF THE INVENTION

[0007] The following is a summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not intended to identify key/critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

[0008] In one example, a network device stores a mapping of application operation modes to vehicle conditions such as a first condition of the vehicle powered but not moving and a second condition of the vehicle moving. The network device receives a wirelessly transmitted request (sent by either a wireless transmitter of the vehicle or of a mobile device coupled to the vehicle) for a particular application to utilize an interface powered by the vehicle. The network device compares an application identifier specified by the received request to the mapping. The network device then identifies a portion of the vehicle interface according to the comparison and signals control software on the vehicle to grant the particular application access to only the identified portion of the vehicle interface. The application can reside on the mobile device and utilize the vehicle interface as an extended interface, or the application can reside on the vehicle itself. Additional aspects and advantages of this invention will be apparent from the following detailed description of preferred embodiments, which proceeds with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** illustrates a system to control the use of a head unit as an extended interface for a phone application in a safe and intelligent manner.

[0010] FIG. **2**A illustrates a flow chart showing operation of the software **32** of FIG. **1**.

[0011] FIG. **2**B illustrates a flow chart showing a contention scheme that can be used by the software **32** of FIG. **1**.

[0012] FIG. **3** illustrates a flow chart showing operation of the software **30**A-B of FIG. **1**.

[0013] FIG. **4** illustrates a system to select and distribute applications to a vehicle in a safe and intelligent manner.

[0014] FIG. **5** illustrates a flow chart showing operation of the software of FIG. **4**.

[0015] FIG. **6** illustrates more detail of the system shown in FIGS. **4**-**5**.

[0016] FIG. **7** illustrates a system to select and distribute applications to a vehicle in a safe and intelligent manner according to user preferences.

[0017] FIG. **8** illustrates a flow chart showing operation of the software of FIG. **7**.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0018] In one example, a user couples a phone to a motor vehicle head unit using a wired or wireless connection for the purpose of using the head unit as an extended interface for the phone. The user may be permitted to control an application on the phone using the interface of the head unit, depending on a determination via a remote server as described in the next paragraph. Similarly, the user may be permitted to watch or listen to an output of the application over the interface of the head unit, depending on a determination via a remote server as described in the next paragraph.

[0019] Novel client control software on the phone and the head unit interfaces with novel server control software on a remote server over a wireless connection extending from the phone. The client control software identifies a phone application to utilize the head unit as an extended interface. The server control software compares the identified phone application to one or more databases accessible by the remote server. Based on the comparison, the server control software determines whether the identified application will be permitted to utilize the head unit as an extended interface, and if so, which components of the head unit interface will be permitted to be used by the application. The server control software signals the client control software to control the phone and

head unit according to the determination. Accordingly, any utilization of the head unit as an extended interface can be controlled in a safe and intelligent manner.

[0020] FIG. **1** illustrates a system to control the use of a head unit as an extended interface for a phone application in a safe and intelligent manner.

[0021] The system **100** includes software **30**A and **30**B configured on, respectively, a mobile phone **20** (or other mobile device) and head unit **21** (or other interface powered by a motor vehicle such as a user interface integrated with a steering wheel or a user interface integrated with a seat back). The software **30**A and **30**B interfaces with the software **32** configured on a remote server **22** to regulate and control when and how applications **40** operating on the phone **20** access I/O resources **1**-**4** of the head unit **21**.

[0022] FIG. **2**A illustrates a flow chart showing operation of the software **32** of FIG. **1**.

[0023] In block **201**, the software **32** receives a request for a particular application **40** on the phone **20** to utilize the interface (including input **24** resources **1**-**2** and output **25** resources **3**-**4**) of the head unit **21**. The request includes a user identifier corresponding to the user of the motor vehicle and/or head unit **21**, an application identifier corresponding to the particular application **40**, and vehicle status information. The user identifier could be an identifier provided by the user when the control software **30**A was first activated in the mobile phone **100**, user's phone number, etc.

[0024] In block **202**, the software **32** authenticates the user. This can include determining whether the user identified by the user identifier matches a database **11** of subscribers for the service of extending the interface of the phone **20** using the head unit **21**. If the user is not authenticated in diamond **203**, then in block **204**A the software **32** signals the software **30**A/B to block access by the application **40** to the head unit **21**. It should be understood that the system **100** can be configured so that block **202** is optional.

[0025] Otherwise, if the user is authenticated, then in block **204**B the software **32** authenticates the application **40** by comparing the application identifier to a list **12** of applications (also referred to as a whitelist). This list **12** can be compared by version number such that one particular version of an application **40** can be identified on the list while a different version is excluded. If the particular application **40** (or particular version) is not on the list **12** in diamond **205**, then in block **204**A the software **32** signals the software **30**A-B to block access by the application **40** to the head unit **21**.

[0026] Otherwise, if the application **40** is authenticated, then in block **206** the software **32** compares the application identifier and the current vehicle status information to a mapping **15** of application operation modes. As shown, the mapping **15** can have an entry **17** for each application **40** of the list **12**. Each entry **17** includes a mapping that is particularized for the corresponding application **40**. For example, an entry **17** for application A maps the vehicle status "vehicle moving ≦than X" to resources **1**, **2**, and **4** (namely application A will be permitted to access the only the screen **1**, the speaker **2**, and microphone **4** under this vehicle condition) whereas the entry **17** for application C maps the vehicle status "vehicle moving ≦than X" to only resources **2** and **4** (namely application C will be permitted to access the speaker **2** and microphone **4**). One real world example might be a navigation application A and a video game application C, where even when a passenger is present the system **100** will not allow the video game application C to be displayed on the head unit **21** screen **1** as this is deemed to be too much of a distraction for a driver whereas the navigation application A can be displayed on the head unit **21** screen **1**. Another real world application can be a vehicle with a plurality of interfaces, such as a head unit and a display attached to the back of a seat. An application can be granted access to the back seat display under conditions where the same application would not be granted access to the head unit.

[0027] It should be understood that, in other examples, the mapping **15** can be stored on the mobile phone **20**. In this case, the comparison described in the previous paragraph can be performed by the control software **30**A. In such a case, the control software **30**A checks the current vehicle status by communicating with the head unit **21**.

[0028] In block **207**, the software **32** identifies a set of some or all of the I/O resources of the head unit **21** according to the comparison. In block **208**, the software **32** signals the remote software to provide the particular application **40** access to only those ones of the I/O resources **1**-**4** of the identified set. In one example, such signaling can include controlling the software **30**A on the mobile phone **20** so that all access requests sent from the mobile phone **20** conform to the identified set of the I/O resources. In another example, such signaling can include controlling the software **30**B on the head unit **21** to block access requests sent from the mobile phone **20** in any manner such as by simply disabling I/O resources on the head unit **21**. In yet other examples, such signaling can include controlling both the software **30**A and the software **30**B.

[0029] FIG. **2**B illustrates a flow chart showing a contention scheme that can be used by the software **30**B of FIG. **1**. A contention scheme can be utilized in addition to the scheme shown in FIG. **2**A.

[0030] In block **209**, the software **30**B determines whether any of the I/O resources of the identified set are currently in use. If none are in use in diamond **210**, then in block **211**A the software **30**B provides the particular application access to only those I/O resources of the identified set.

[0031] Otherwise, if at least one of the resources of the set is in use, then in block **211**B the software **30**B identifies a by-resource ranking **13** of the applications for each of the in-use resources of the identified set. This is shown in FIG. **1** where there is a ranking **13** for each resource **1**-**4**. In block **212**, the software **30**B compares the application identifier to the by-resource ranking(s) **13** to determine whether the application **40** has priority for any of the in-use resources of the identified subset (the may be performed via signaling since the ranking **13** is shown on the remote server or the ranking may have been sent to the vehicle interface in an earlier process). This comparison will indicate whether the application currently using a particular in-use resource is deemed higher or lower priority than the requesting application for that in-use resource. In block **213**, the software **30**B provides the particular application **40** access to only those ones of the I/O resources **1**-**4** of the identified set that are also not currently in use or are in use by a lower priority application.

[0032] FIG. **3** illustrates a flow chart showing operation of the software **30**A-B of FIG. **1**.

[0033] In block **301**, the software **30**A-B sends a request for a particular application **40** on the phone **20** to utilize the interface of the head unit **21**. In block **302**, the software **30**A-B receives back a signal indicating whether or not the application **40** is authorized to access the head unit **21** at this

time, and if so, an identification of which resources **1-4** can be utilized. If the application **40** is not authorized in diamond **303**, then in block **304**A the software **30**A-B outputs a notification that the application **40** is not authorized to access the head unit. This notification could be output by the mobile phone **20** or the head unit **21**, or both.

[0034] Otherwise, if the application **40** is authorized in diamond **303**, then in block **304**B the software **30**A-B controls the mobile phone **20** and the head unit **21** to cause the application **40** to be extended to the identified resources. If only a subset of possible resources for the application **40** (from the respective mapping **17**) are utilized due to a conflict, then the software **30**A-B may generate a notification to alert the driver about the lower priority application being suspended before activating the higher priority application. In another example, if the resources are currently used by a lower priority application, software **30**A-B can automatically suspend/end the lower priority application and allow the higher priority application to be activated using the required resources.

[0035] If it is determined that application **40** can be extended to the head-unit **21**, the server **22** can download corresponding "control panel" software to the head unit to control the application **40**. By having downloading this software to the head unit **21** based on the application being requested, a service provider can customize and update the "control panel" accordingly when new applications or update to existing applications are available. The head-unit can have a web-code renderer to display the "control panel" software.

[0036] Referring again to FIG. **1**, the software **30**A-B interfaces with the software **32** over a wireless connection extending from the phone **20**. This wireless connection can utilize a packet data connection (including but not limited to GPRS, EDGE, EVDO, UTMS, WiMAX, WiFi, etc.), Short Message Service (SMS), or In-Band-Signaling modems on the mobile phone **20** and the remote server **22** as described in U.S. Pat. Nos. 6,144,336; 6,690,681; and 6,493,338.

[0037] Still referring to FIG. **1**, it is noted that the mobile phone **20** can couple to the head unit **21** by using a connection such as a USB, Bluetooth, or WiFi connection. These are just examples, however, and in other cases a different connection and/or protocol may be suitable for utilizing the interface of the head unit **21** for the application **40** of the phone **20**.

[0038] It should be understood that the mapping **15** can have any vehicle statuses and that the four illustrated examples are merely some examples. For example, another vehicle status could be whether the vehicle is moving more than speed 'X' AND a passenger is present.

[0039] It should be understood the head unit **21** can include less than all the example resources shown, or other resources that are not shown. For example, another possible I/O resource component is a text to speech component.

[0040] In the illustrated example, a first application can be permitted to access a first subset of whichever resources are actually present on the head unit **21** based on an intelligent decision by the system **100**, while a second different application can be permitted to access a second subset of the resources, or even all of the resources.

[0041] It should be understood that the applications **40** can be ranked "by resource" as illustrated or there can be a single ranking including all the applications **40**. The system **100** is implemented with the "by resource" ranking as shown, but the concepts described herein could be implemented in another system that ranks applications independently of resource.

[0042] It should be that certain details can depart from the specific example described above while still being within the principles described herein. For example, any functions described above as being performed by the software of the head unit **21** described above can alternatively be performed by the software of the mobile phone in other examples, and vice versa. Similarly, functions described above as being performed by the software of the mobile phone **20** described above can alternatively be performed by the software of the server **22** in other examples, and vice versa. Similarly, functions described above as being performed by the software of the head unit **21** described above can alternatively be performed by the software of the server **22** in other examples, and vice versa. Furthermore, it should be readily apparent that the functions described above can be distributed in any manner between the mobile phone **20**, the head unit **21**, and the server **22** by changing the configuration of the software distributed over the system **100**.

[0043] FIG. **4** illustrates a system to select and distribute applications to a vehicle in a safe and intelligent manner.

[0044] One difference between the previously discussed system of FIG. **1** and the system of FIG. **4** is the install location for applications. Whereas the applications A-C in the system **100** of FIG. **1** are installed and operating on the mobile phone **20** (using the head unit **21** or other interface powered by the vehicle as an extended interface), the applications J-L in the system **200** of FIG. **4** are installed on the head unit **221** or other component powered by the vehicle. In system **200** of FIG. **4**, the software **230-232** enables a provider to select which applications can be installed on the head unit **221** and control distribution of the selected applications to the vehicle.

[0045] Before discussing the details of system **200** in detail in the following paragraphs, it should be apparent that the structures and functions of system **100** described in FIGS. **1-3** can be combined with the structures and functions of system **200** (FIGS. **4-6**) into a single system. For example, a single system could include some applications installed on a mobile phone using an interface of a vehicle as an extended interface and some applications installed on a component of the vehicle.

[0046] FIG. **5** illustrates a flow chart showing operation of the software of FIG. **4**.

[0047] In block **501**, in response to the vehicle being powered up, the control software **230** sends a signal **244** to the server **222** indicating vehicle power-up. The signal **244** can be sent over a local connection such as a USB or Bluetooth connection to be relayed by the mobile device **220** over a wireless telecommunications network.

[0048] In block **502**, the software **232** checks a download directory **239** (sometimes referred to as a "sandbox") associated with the vehicle to determine if there are any applications to be downloaded to the vehicle. A scheme for intelligently selecting applications that are present in the download directory **239** will be discussed in detail later with reference to FIG. **6**.

[0049] If the check by the software **232** indicates that the download directory **239** includes at least one application, the process continues. For now, let it be assumed for the purposes of illustration that the download directory **239** includes applications **240** (J-L). Accordingly, in block **503** the software **232** generates and sends signaling **245** to cause the IP gateway

software **231** on the mobile phone **220** to operate as an IP gateway for forwarding applications to the head unit **221**. In one example, signaling **245** includes communications to dynamically load the mobile phone **220** with the software **231** in response to the determination in block **502** and cause the software **231** to operate thereon for the download to vehicle. The signaling **245** may not take place if the mobile phone **220** is already loaded with the software **231** and ready for IP gateway operation. In other examples, the signaling **245** could originate from the control software **230** on the head unit **221** in response to detecting vehicle power-up.

[0050] In block **504**, the software **232** generates and sends IP packets **250** to download the applications **240** onto the vehicle. The IP packets **250** are received by the mobile phone **220** and forwarded by operation of the software **231** to the head unit **221**. In block **505**, the software **230** receives the IP packets **230** and installs the applications **240** (J-L) on the vehicle (installation can be on components of the head unit **221** or other vehicle components).

[0051] Thereafter, a user of the vehicle can operate the applications J-L using the head unit **221** as an interface. It should be understood that the software **230** and **232** can operate according to any of the principles described in FIGS. **1-3**. For example, the software **230** and **232** can regulate utilization of the I/O resources of the head unit **221** by the active application(s) according to current vehicle status. As another example, in systems where applications are installed on both the vehicle and a mobile device, the software **230** and **232** can include all applications that utilize the vehicle interface in an application ranking/priority table similar to the table **13** (FIG. **1**).

[0052] In one example, the head unit **221** includes a web code renderer **299**, for example an HTML renderer, controlled via the software **230**. The web code renderer **299** is configured to display HTML code, but unlike a browser, does not allow a user to freely navigate to web locations. Specifically, the web code renderer **299** displays only applications allowed by the provider, e.g. specified by the server **222**.

[0053] It should be understood that the flow chart described above addresses updating applications installed on the vehicle. The vehicle can also be pre-loaded with certain applications so that some of the applications installed on the vehicle are downloaded according to the flowchart while others are installed thereon during manufacturing.

[0054] Thus, based on the principles described above, vehicles can be manufactured with none of the applications installed on the vehicle but instead the applications can downloaded to the vehicles when the drivers are present in the vehicles. The types of applications downloaded to the vehicles are governed by preferences defined in the network server provided by the drivers.

[0055] It should be that certain details can depart from the specific example described above while still being within the principles described herein. For example, any functions described above as being performed by the software of the head unit **221** described above can alternatively be performed by the software of the mobile phone in other examples, and vice versa. Similarly, functions described above as being performed by the software of the mobile phone **220** described above can alternatively be performed by the software of the server **222** in other examples, and vice versa. Similarly, functions described above as being performed by the software of the head unit **221** described above can alternatively be performed by the software of the server **222** in other examples, and vice versa. Furthermore, it should be readily apparent that the functions described above can be distributed in any manner between the mobile phone **220**, the head unit **221**, and the server **222** by changing the configuration of the software distributed over the system **200**.

[0056] FIG. **6** illustrates more detail of the system shown in FIGS. **4-5**.

[0057] It was previously explained that the server **222** includes a download directory **239** of applications waiting to be downloaded on a per-vehicle basis. FIG. **6** illustrates the user web portals **601**, **604**, and **605** that can be involved in selection of the applications in the download directory **239** and describes an example use of these web portals **601**, **604**, and **605**.

[0058] A provider such as an OEM of the vehicle operates the web portal **601**. Using an interface such as a computing terminal **625**, the provider controls an application selection portion **608** of the web portal **601** with communications **650** to assemble the controlled list **610** of applications from the list **609** of all applications that can be installed on the vehicle. Typically building the list **610** from the list **609** involves validation of the applications from a technical standpoint and/or a business standpoint of the provider.

[0059] The provider also sends communications **651** to select applications from the controlled list **610** to be installed on a particular vehicle. These selections may be based on a mapping a vehicle models to applications, for example. These selections **652** fed into the download directory **239**.

[0060] Regarding the list of all available applications **609**, it should be understood that this list can be assembled by applications developed by the provider and/or third parties. In the case of third parties providing applications, the third party uses the application submission **618** portion of the web portal **604** (which is hosted by a web server operated by the provider in one example) to submit an application **649** to be included in the list **609**.

[0061] A vehicle user can also select applications to be included in the download directory **239** using a computing terminal **626**, for example using any interne accessible computing device such as the mobile device or a desktop computer. The computing terminal **626** accesses the application selection portion **628** of the user web portal **605** (which is hosted by a web server operated by the provider in one example) to view the controlled list **610** of applications that can be installed on his vehicle. The user can then send communications **661** to select applications from the controlled list **610** that the user would like installed on his vehicle. These selections **662** are fed into the download directory **239**.

[0062] The user web portal **605** can also be configured to allow a user to remove particular applications from the download directory **239**, e.g. the user may desire to remove one of the provider selected applications **652** added to the download directory **239** via the provider. Removal can be by deletion of an application already sent to the directory **239** or by indicating that a particular application is not desired before such application is ever added to the download directory **239**.

[0063] According to the above, applications can be accumulated into the per-vehicle download directory **239**. At vehicle power-up, such applications can be downloaded and installed onto the vehicle. The download directory **239** can then accumulate new applications until a next vehicle power up.

[0064] It should be understood that an interface similar to that of the web portal **605** can be displayed on the head unit of the vehicle. The user could then make selections from such interface for selecting applications from the controlled list **610**. The selected applications could be downloaded immediately to the vehicle instead of being put in the download directory when the selections are made from the interface.

[0065] FIG. **7** illustrates a system to select and distribute applications to a vehicle in a safe and intelligent manner according to user preferences.

[0066] One difference between the previously discussed system of FIG. **1** and the system of FIG. **7** is the install location for applications. Whereas the applications A-C in the system **100** of FIG. **1** are installed and operating on the mobile phone **20** (using the head unit **21** or other interface powered by the vehicle as an extended interface), the applications M-P/Q-S in the system **300** of FIG. **7** are installed on the head unit **321** or other component powered by the vehicle. In system **300** of FIG. **7**, the software **330-332** enables a provider to select which applications can be installed on the head unit **321** and control distribution of the selected applications to the vehicle.

[0067] Before discussing the details of system **300** in detail in the following paragraphs, it should be apparent that the structures and functions of systems **100** and **200** described in FIGS. **1-6** can be combined with the structures and functions of system **300** (FIGS. **7-8**) into a single system. For example, a single system could include some applications installed on a mobile phone using an interface of a vehicle as an extended interface and some applications installed on a component of the vehicle.

[0068] FIG. **8** illustrates a flow chart showing operation of the software of FIG. **7**.

[0069] In block **801**, the head unit **321** communicatively couples to a mobile device such as mobile phone **320**. In one example, the connection **540** is established via Bluetooth pairing of the head unit **321** and the mobile phone **320**. The Bluetooth pairing can be in response to the vehicle being powered up (causing the head unit to power up and search for a Bluetooth device), although it should be apparent that Bluetooth pairing could result from other circumstances such as the mobile phone **320** powering up, the mobile phone **320** being brought within range of the head unit **321**, re-pairing after another Bluetooth device is disconnected from the head unit **321**, etc. In other examples, the communicative connection can be established by a user connecting the mobile phone **320** to the head unit **321** using a USB connection.

[0070] In block **802**, the control software **330** accesses a telephone number of the mobile phone **320**. It should be understood that mobile phones are activated with a particular phone number in conjunction with subscribing to a call plan, which is the phone number the control software **330** reads from the mobile phone **320**. In one example, the signaling **542** to obtain the phone number is performed using Bluetooth signaling.

[0071] In block **803**, the control software **330** sends signaling **543** to the server **322**. The signaling **543** can be sent over a local connection such as a USB, Bluetooth, or WiFi connection to be relayed by the mobile device **320** over a wireless telecommunications network. The content of the signaling **543** can be similar to the signal **244** described in more detail previously with respect to FIG. **4**, but in addition, can provide the obtained phone number.

[0072] In block **804**, the control software **332** compares the phone number included in the signaling **543** to the mapping **350**. The mapping correlates each of a plurality of download directories A-B accessible via this particular head unit **321** to a particular phone number. For example, in the mapping a first phone number is correlated with the download directory A and a second phone number is correlated with the download directory B. The control software **332** selects one of the download directories A-B based on the comparison of the received telephone number to the mapping **350**.

[0073] The software **332** then checks the selected one of the download directories A-B to determine if there are any applications currently stored in the selected directory. A scheme for intelligently selecting applications that are present in the download directories A-B will be discussed in detail later with reference to FIG. **9**. For now, let it be assumed for the purposes of illustration that the download directories **339**A and **339**B currently include applications **340**A (M-P) and **340**B (Q-S), respectively, in addition to the head unit frontend configurations **369**A and **369**B.

[0074] As noted briefly in the previous paragraph, the download directories A-B include head unit frontend configurations A-B, respectively, in addition to the applications **340**A and **340**B. The configurations A-B can be stored as HTML code or other web code processable by the web code renderer of the **399**. Depending on which one of the head unit frontend configurations A-B is downloaded to the head unit **321**, a display **380** of the head unit **321** will display a different graphical user interface. Each of the different web code files **369**A and **369**B will produce a different graphical user interface when displayed using the display **380** and the renderer **399**. For example, each graphical user interface could have its own user customized settings such as a particular wallpaper selected by a user. A scheme for generating the different head unit frontend configurations A-B will be discussed in detail later with reference to FIG. **9**.

[0075] In block **805**, the software **332** generates and sends signaling to cause the IP gateway software **331** on the mobile phone **320** to operate as an IP gateway for forwarding applications to the head unit **321** similar to the scheme described in FIG. **4**. In one example, similar to FIG. **4**, such signaling includes communications to dynamically load the mobile phone **320** with the software **331** to cause the software **331** to operate thereon for the download to vehicle. This signaling may not take place if the mobile phone **320** is already loaded with the software **331** and ready for IP gateway operation. In other examples, the signaling **345** could originate from the control software **330** on the head unit **321** after the connection **540** is established.

[0076] In block **806**, the software **332** generates and sends IP packets **545** to download the data from the selected one of the directories onto the vehicle, e.g. either applications M-P and configuration A or applications Q-S and configuration B. The IP packets **545** are received by the mobile phone **320** and forwarded by operation of the software **331** to the head unit **321**. It should be understood that in this particular illustration the IP packets **545** include both applications and a configuration for the graphical user interface, but in other scenarios the IP packets **545** might contain either an application or a configuration. Also, it should be apparent that, if there are no applications currently in the selected download directory and there have been no changes to the configurations stored in the download directory since a previous download, then the IP packets **545** may not be sent.

[0077] In block **807**, the software **330** receives the IP packets **545** and installs the applications included therein on the vehicle (installation can be on components of the head unit **321** or other vehicle components). The software **330** also processes the configuration from the IP packets **545** using the web code renderer **399** to generate a particular graphical user interface based on the detected phone number.

[0078] Thereafter, the graphical user interface output via the display **380** will correspond to one of the configurations A-B stored in the selected download directory. A user of the vehicle can operate the installed applications M-P or Q-S using the head unit **321** as an interface.

[0079] It should be understood that the software **330** and **332** can operate according to any of the principles described in FIGS. **1-3**. For example, the software **330** and **332** can regulate utilization of the I/O resources of the head unit **321** by the active application(s) according to current vehicle status. As another example, in systems where applications are installed on both the vehicle and a mobile device, the software **330** and **332** can include all applications that utilize the vehicle interface in an application ranking/priority table similar to the table **13** (FIG. **1**).

[0080] In the example described above, the control software **330** accesses a phone number of the mobile phone **320** to uniquely identify the mobile phone **320** from other mobile phones. In other examples, control software on the head unit **321** can access a different value on a communicatively coupled mobile phone to uniquely identify the mobile phone from other mobile phones. Other examples of values can include, but are not limited to, a physical address of the mobile phone. In such other examples, it should be apparent that such values are used in the mapping, e.g. if the other values are physical addresses then the mapping includes physical addresses correlated to download directories.

[0081] In the example described above, the control software **330** sends the accessed unique identifier (phone number in this example) to the server **322**. In other examples, the mapping **350** can be stored on the vehicle. In such a case, the control software **330** identifies a particular download directory listed in the mapping according to the comparison and sends an identifier specifying the particular download to the server **322**. The server **322** may then respond with IP packets **545** sending data from the identified download directory.

[0082] FIG. **9** illustrates more detail of the system shown in FIGS. **7-8**.

[0083] It was previously explained that the server **322** includes a plurality of download directories **339**A-B of applications waiting to be downloaded. FIG. **9** illustrates the user web portal **905** that can be involved in creating the download directories **339**A-B and selection of the applications on a per-directory basis and describes an example use of this web portal **905**.

[0084] A vehicle user can create a plurality of profiles corresponding to the vehicle using the profile creation portion **930** of the user web portal **905**. A profile can be created for each person that may use the vehicle. A field **927** requests a unique phone number or other unique identifier of a mobile phone respectively corresponding to each person. A name of each person or other information for each person may be gathered with the phone number(s). After or during profile creation, server **322** creates a download directory for each profile and updates the mapping **350** for each number/directory combination. In some examples, the portion **930** can be configured to allow a user to rank the created profiles so that, if the head unit can be coupled to more than one of the mobile devices simultaneously (it can depend on the connection protocol whether this is possible), a higher ranked one of the corresponding profiles will be used.

[0085] During or after profile creation the web portal **905** can be operated to select applications to be included in the download directories **339**A-B using a computing terminal **926**, for example using any interne accessible computing device such as the mobile device or a desktop computer. The computing terminal **926** accesses the application selection portion **928** of the user web portal **905** (which is hosted by a web server operated by the provider in one example) to view the controlled list of applications that can be installed on the vehicle. The user can then send communications **961** to select applications from the controlled list that the user would like installed on his vehicle on a per-directory basis. These selections **962** are respectively fed into the download directories **339**A-B on a per-directory basis.

[0086] The user web portal **905** can also be configured to allow a user to remove particular applications from the download directories **339**A-B, e.g. the user may desire to remove one of the provider selected applications **952** added to the download directory **339**A or **339**B via the provider on a per-directory basis. Removal can be by deletion of an application already sent to the download directory **339**A or **339**B, or by indicating that a particular application is not desired before such application is ever added to the download directory **339**A or **339**B.

[0087] The user web portal **905** can also include a head unit frontend configuration customization portion **928**. This portion **928** allows new configurations **369**A-B to be added to the download directories **339**A-B, with each person's configuration customized according to their requests. For example, a first wallpaper background can be added to the download directory **339**A and a second different wallpaper background can be added to the download directory **339**B. Other customizations can include customized graphical interface buttons, customized graphical user interface layout, custom images, etc.

[0088] According to the above, applications can be accumulated into the per-vehicle download directories **339**A-B on a per-directory basis. Upon the head unit coupling to a particular one of the mobile devices, data from a corresponding one of the download directories **339**A-B can be downloaded and installed onto the vehicle to provide a customized application set and a customized user interface.

[0089] It should be understood that an interface similar to that of the web portal **905** can be displayed on the head unit of the vehicle. The user could then make selections from such interface for selecting applications from the controlled list. The selected applications could be downloaded immediately to the vehicle instead of being put in the download directory when the selections are made from the interface.

[0090] It should be that certain details can depart from the specific example described above while still being within the principles described herein. For example, any functions described above as being performed by the software of the head unit **321** described above can alternatively be performed by the software of the mobile phone in other examples, and vice versa. Similarly, functions described above as being performed by the software of the mobile phone **320** described above can alternatively be performed by the software of the server **322** in other examples, and vice versa. Similarly, functions described above as being performed by the software of the head unit **321** described above can alternatively be performed by the software of the server **322** in other examples, and vice versa. Furthermore, it should be readily apparent that the functions described above can be distributed in any manner between the mobile phone **320**, the head unit **321**, and the server **322** by changing the configuration of the software distributed over the system **300**.

[0091] It will be obvious to those having skill in the art that many changes may be made to the details of the above-described embodiments without departing from the underlying principles of the invention. The scope of the present invention should, therefore, be determined only by the following claims.

[0092] Most of the equipment discussed above comprises hardware and associated software. For example, the typical navigation device is likely to include one or more processors and software executable on those processors to carry out the operations described. We use the term software herein in its

commonly understood sense to refer to programs or routines (subroutines, objects, plug-ins, etc.), as well as data, usable by a machine or processor. As is well known, computer programs generally comprise instructions that are stored in machine-readable or computer-readable storage media. Some embodiments of the present invention may include executable programs or instructions that are stored in machine-readable or computer-readable storage media, such as a digital memory. We do not imply that a "computer" in the conventional sense is required in any particular embodiment. For example, various processors, embedded or otherwise, may be used in equipment such as the components described herein.

[0093] Memory for storing software again is well known. In some embodiments, memory associated with a given processor may be stored in the same physical device as the processor ("on-board" memory); for example, RAM or FLASH memory disposed within an integrated circuit microprocessor or the like. In other examples, the memory comprises an independent device, such as an external disk drive, storage array, or portable FLASH key fob. In such cases, the memory becomes "associated" with the digital processor when the two are operatively coupled together, or in communication with each other, for example by an I/O port, network connection, etc. such that the processor can read a file stored on the memory. Associated memory may be "read only" by design (ROM) or by virtue of permission settings, or not. Other examples include but are not limited to WORM, EPROM, EEPROM, FLASH, etc. Those technologies often are implemented in solid state semiconductor devices. Other memories may comprise moving parts, such as a conventional rotating disk drive. All such memories are "machine readable" or "computer-readable" and may be used to store executable instructions for implementing the functions described herein.

[0094] A "software product" refers to a memory device in which a series of executable instructions are stored in a machine-readable form so that a suitable machine or processor, with appropriate access to the software product, can execute the instructions to carry out a process implemented by the instructions. Software products are sometimes used to distribute software. Any type of machine-readable memory, including without limitation those summarized above, may be used to make a software product. That said, it is also known that software can be distributed via electronic transmission ("download"), in which case there typically will be a corresponding software product at the transmitting end of the transmission, or the receiving end, or both.

[0095] Having described and illustrated the principles of the invention in a preferred embodiment thereof, it should be apparent that the invention may be modified in arrangement and detail without departing from such principles. We claim all modifications and variations coming within the spirit and scope of the following claims.

1. A memory encoded with instructions that, if executed, result in:

storing a mapping of application operation modes to vehicle conditions, wherein the vehicle conditions include at least a first condition of the vehicle powered but not moving and a second condition of the vehicle moving;

receiving a wirelessly transmitted request for a particular application to utilize an interface powered by the vehicle, wherein the received request includes an application identifier;

comparing the received request to the mapping and identifying a portion of the vehicle interface according to the comparison; and

signaling control software on the vehicle to permit the particular application to access only the identified portion of the vehicle interface.

2. The memory of claim **1**, wherein the particular application resides on a portable mobile device coupled to the vehicle, and wherein the signaling permits the portable mobile device application to utilize the vehicle interface as an extended interface to control the portable mobile device application with such utilization being restricted to the identified portion of the vehicle interface.

3. The memory of claim **1**, wherein the particular application resides on a head unit of the vehicle.

4. The memory of claim **1**, wherein the instructions, if executed, result in:

receiving a wirelessly transmitted signal indicating that the vehicle has been powered up;

checking a download directory corresponding to the vehicle for any applications; and

if the download directory contains an application, then generating and sending packets to download the application of the download directory to the vehicle.

5. The memory of claim **1**, wherein the instructions, if executed, result in:

receiving a wirelessly transmitted signal including a telephone number;

selecting one of a plurality of download directories based on a value of the telephone number; and

if the selected download directory contains data, then generating and sending packets to download the data of the selected download directory to the vehicle.

6. The memory of claim **5**, wherein the instructions, if executed, result in:

causing the vehicle interface to display a particular one of a plurality of customized graphical user interfaces for the vehicle based on a value of the telephone number.

7. The memory of claim **4**, wherein the instructions, if executed, result in:

responsive to determining that the download directory contains an application, signaling control software installed on a portable mobile device that is configured to be powered independently of the vehicle to operate according to an IP gateway function; and

transmitting the packets to the portable mobile device to be forwarded to the vehicle.

8. The memory of claim **4**, wherein the instructions, if executed, result in transmitting the packets to a wireless receiver that is powered by the vehicle.

9. The memory of claim **2**, wherein the instructions, if executed, result in:

generating a first list of applications by accumulating applications submitted by third parties for operation with the vehicle;

generating a second list that is a subset of the applications from the first list based on vehicle manufacturer selections from the first list;

configuring an internet accessible user web portal with a web interface to allow a vehicle operator to select applications from the second list to download to the vehicle, wherein the second list is displayed on the internet accessible user web portal; and

including vehicle operator selections from the second list into the download directory.

10. The memory of claim **9**, wherein the instructions, if executed, result in including vehicle manufacturer selections from the second list into the download directory.

11. The memory of claim **1**, wherein the instructions, if executed, result in permitting the particular application to access a visual display portion of the interface and a speaker of the interface if the vehicle is in the first condition and permitting the particular application access to the speaker while denying the application access to the visual display portion if the vehicle is in the second condition.

12. The memory of claim **1**, wherein the vehicle conditions include at least a third condition of a passenger seat being occupied.

13. The memory of claim **1**, wherein the instructions, if executed, result in:

determining whether the identified portion of the vehicle interface is currently in use;

comparing a first priority rating of an application currently using the identified portion of the vehicle interface with a second priority rating of the particular requesting application; and

permitting access based on the priority rating comparison.

14. The memory of claim **1**, wherein the identified portion comprises the entire vehicle interface if a current status of the vehicle corresponds to the first condition.

15. A method, comprising:

storing a mapping of application operation modes to vehicle conditions, wherein the vehicle conditions include at least a first condition of the vehicle powered but not moving and a second condition of the vehicle moving;

receiving a wirelessly transmitted request for a particular application to utilize an interface powered by the vehicle, wherein the received request includes an application identifier;

comparing the received request to the mapping and identifying a portion of the vehicle interface according to the comparison; and

signaling control software on the vehicle to permit the particular application to access only the identified portion of the vehicle interface.

16. The method of claim **15**, wherein the particular application resides on a portable mobile device that is coupled to the vehicle, and wherein the signaling permits the portable mobile device application to utilize the vehicle interface as an extended interface to control the portable mobile device application with such utilization being restricted to the identified portion of the vehicle interface.

17. The method of claim **15**, wherein the particular application resides on a head unit of the vehicle.

18. The method of claim **15**, further comprising:

receiving a wirelessly transmitted signal indicating that the vehicle has been powered up;

checking a download directory corresponding to the vehicle for any applications; and

if the download directory contains an application, then generating and sending packets to download the application of the download directory to the vehicle.

19. The method of claim **15**, further comprising:

in response to the vehicle interface communicatively coupling to a mobile device that is powered independently of the vehicle, sending a phone number of the mobile device to the vehicle interface;

selecting one of a plurality of download directories for the vehicle stored on a server based on a value of the telephone number; and

if the selected download directory contains data, then generating and sending packets to download the data of the selected download directory from the server to the vehicle.

20. The method of claim **19**, further comprising:

configuring an appearance of a graphical user interface displayed using the vehicle interface based on a value of the telephone number.

21. The method of claim **16**, wherein the instructions, if executed, result in:

generating a first list of applications by accumulating applications submitted by third parties for operation with the vehicle;

generating a second list that is a subset of the applications from the first list based on vehicle manufacturer selections from the first list;

configuring an internet accessible user web portal with a web interface to allow a vehicle operator to select applications from the second list to download to the vehicle, wherein the second list is displayed on the internet accessible user web portal; and

including vehicle operator selections from the second list into the download directory.

22. The method of claim **21**, further comprising including vehicle manufacturer selections from the second list into the download directory.

23. The method of claim **15**, further comprising permitting the particular application to access a visual display portion of the interface and a speaker of the interface if the vehicle is in the first condition and permitting the particular application to access the speaker while denying the application access to the visual display portion if the vehicle is in the second condition.

24. The method of claim **15**, wherein the vehicle conditions include at least a third condition of a passenger seat being occupied.

25. The method of claim **15**, further comprising:

determining whether the identified portion of the vehicle interface is currently in use;

comparing a first priority rating of an application currently using the identified portion of the vehicle interface with a second priority rating of the particular requesting application; and

permitting access based on the priority rating comparison.

26. The memory of claim **15**, wherein the identified portion comprises the entire vehicle interface if a current status of the vehicle corresponds to the first condition.

* * * * *