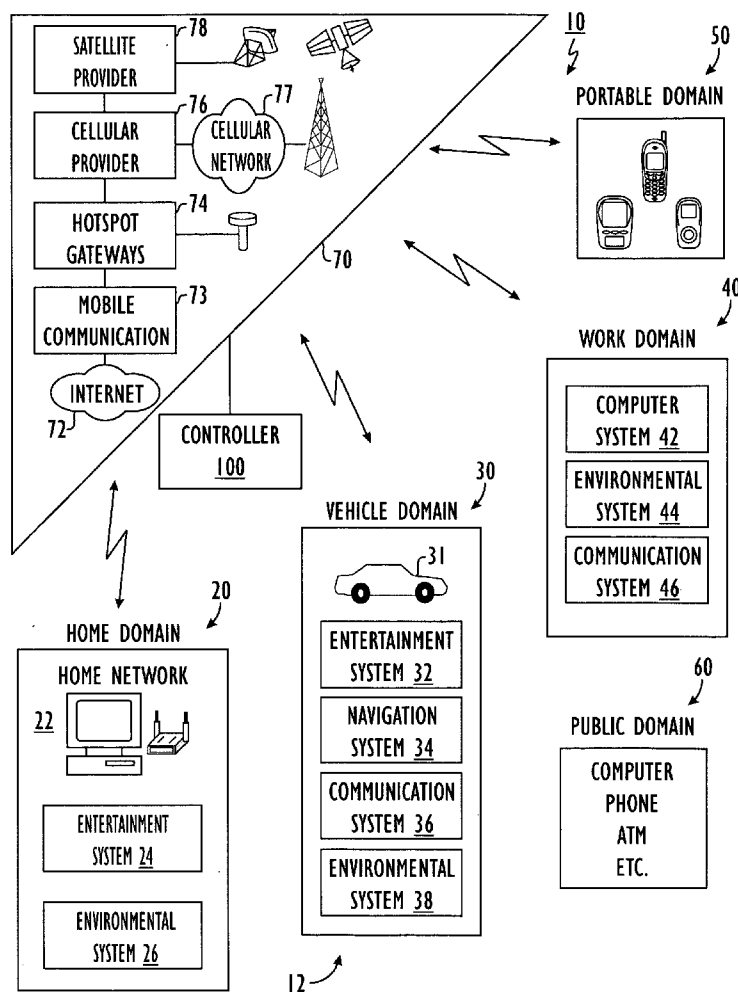




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Zancho(10) **Pub. No.: US 2007/0143482 A1**(43) **Pub. Date: Jun. 21, 2007**(54) **SYSTEM AND METHOD FOR HANDLING
MULTIPLE USER PREFERENCES IN A
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SCHAUMBURG, IL 60196(21) Appl. No.: **11/312,022**(22) Filed: **Dec. 20, 2005****Publication Classification**(51) **Int. Cl.**
G06F 15/16 (2006.01)(52) **U.S. Cl.** **709/227**(57) **ABSTRACT**

A preference-handling system includes one or more communication interfaces, user interfaces, memory, and a controller. The controller can be used in a vehicle to handle preferences. The communication interfaces communicatively connect with devices in a domain, and the memory stores preferences for users. The controller is operably coupled to the communication interfaces, the memory, and a domain system. The controller is configured to monitor for devices active in the domain of the unit and determine a preference for each of at least two users associated with active devices. Each of the preferences is related to controlling behavioral operation of or content presented by the domain system, which can be an entertainment, user interface, navigation, communication, or environmental system in the vehicle. The controller arbitrates the preferences based on an arbitration scheme of the controller and controls operation of the system based on the arbitration of the preferences.



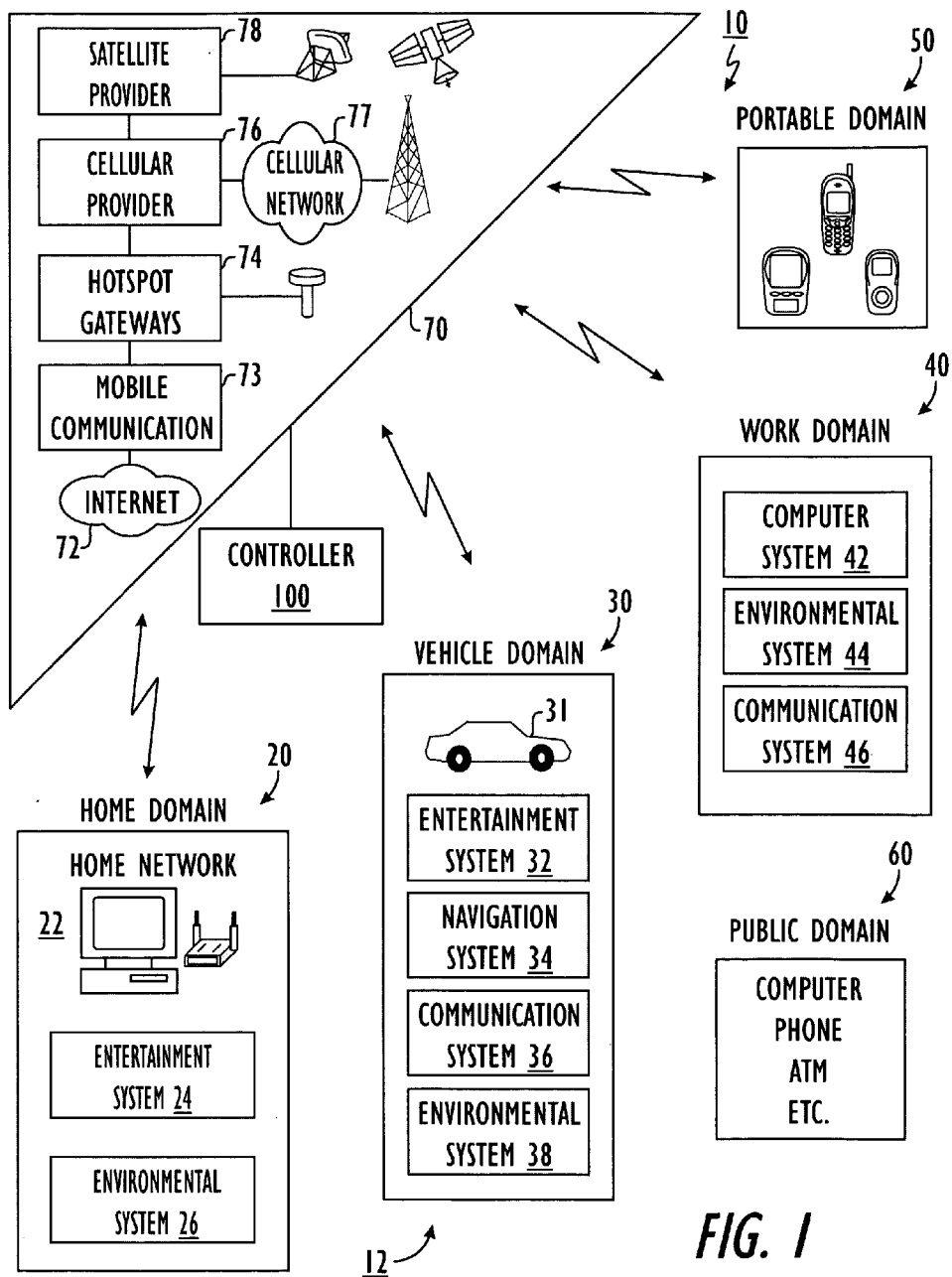


FIG. 1

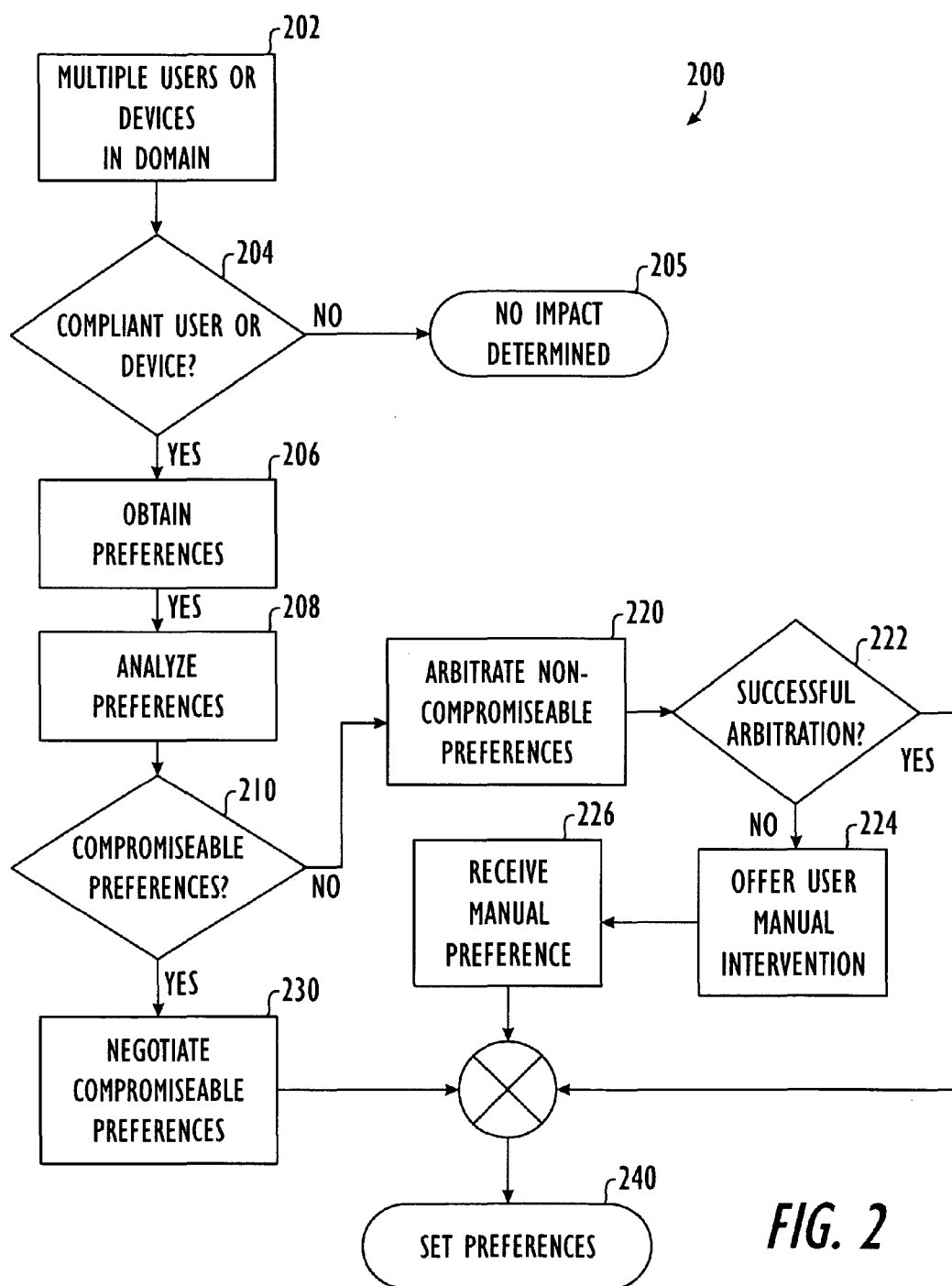
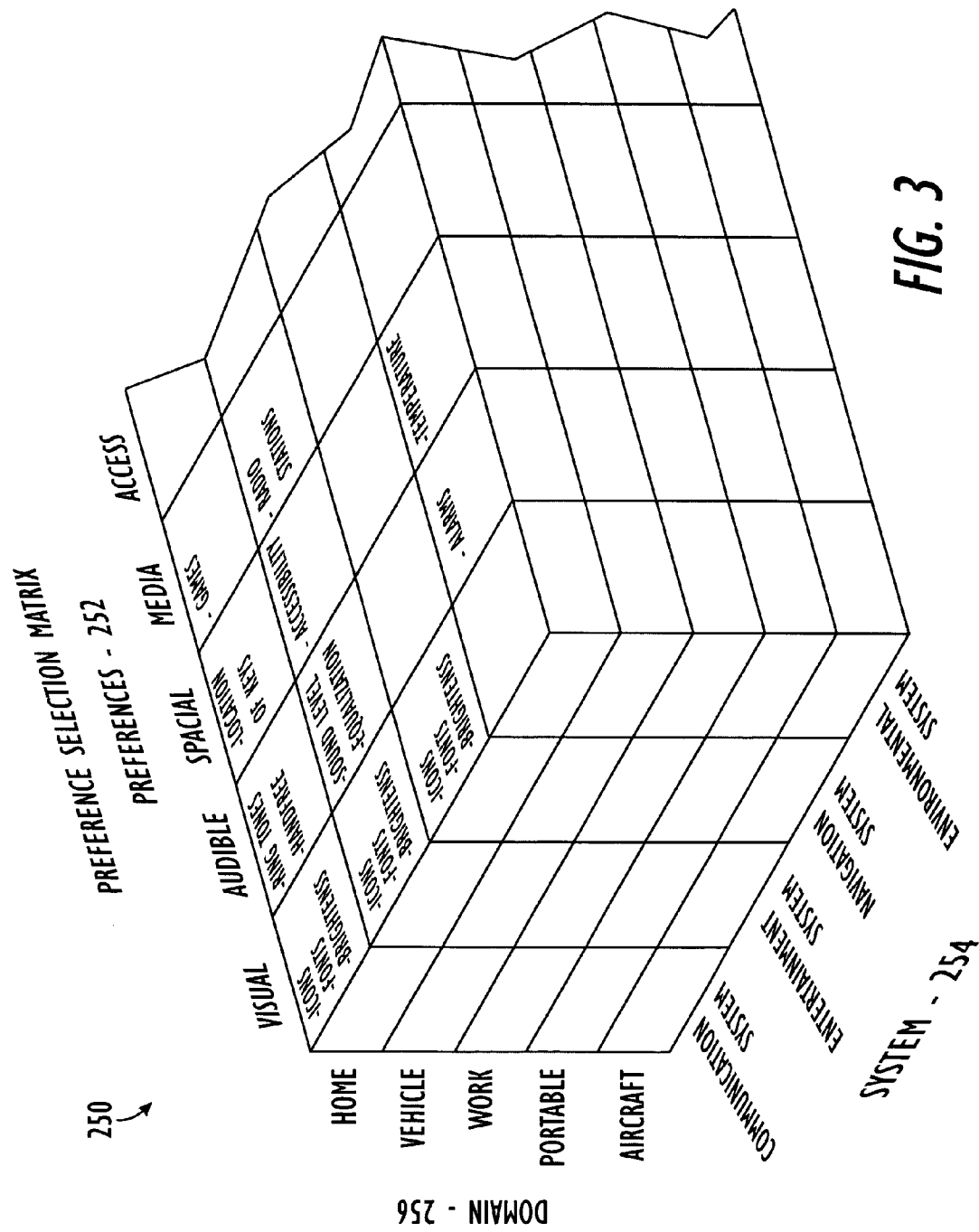


FIG. 2



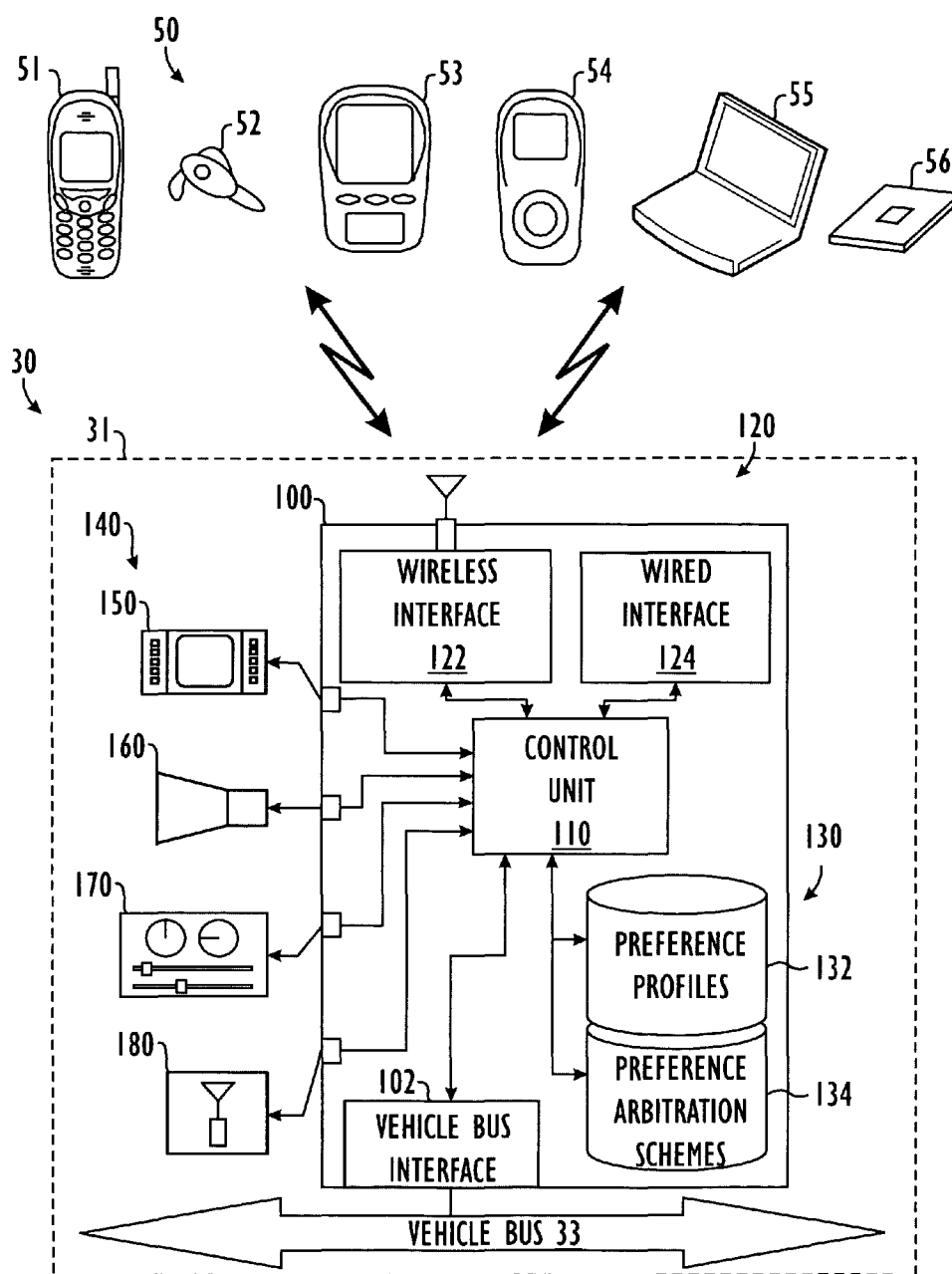


FIG. 4

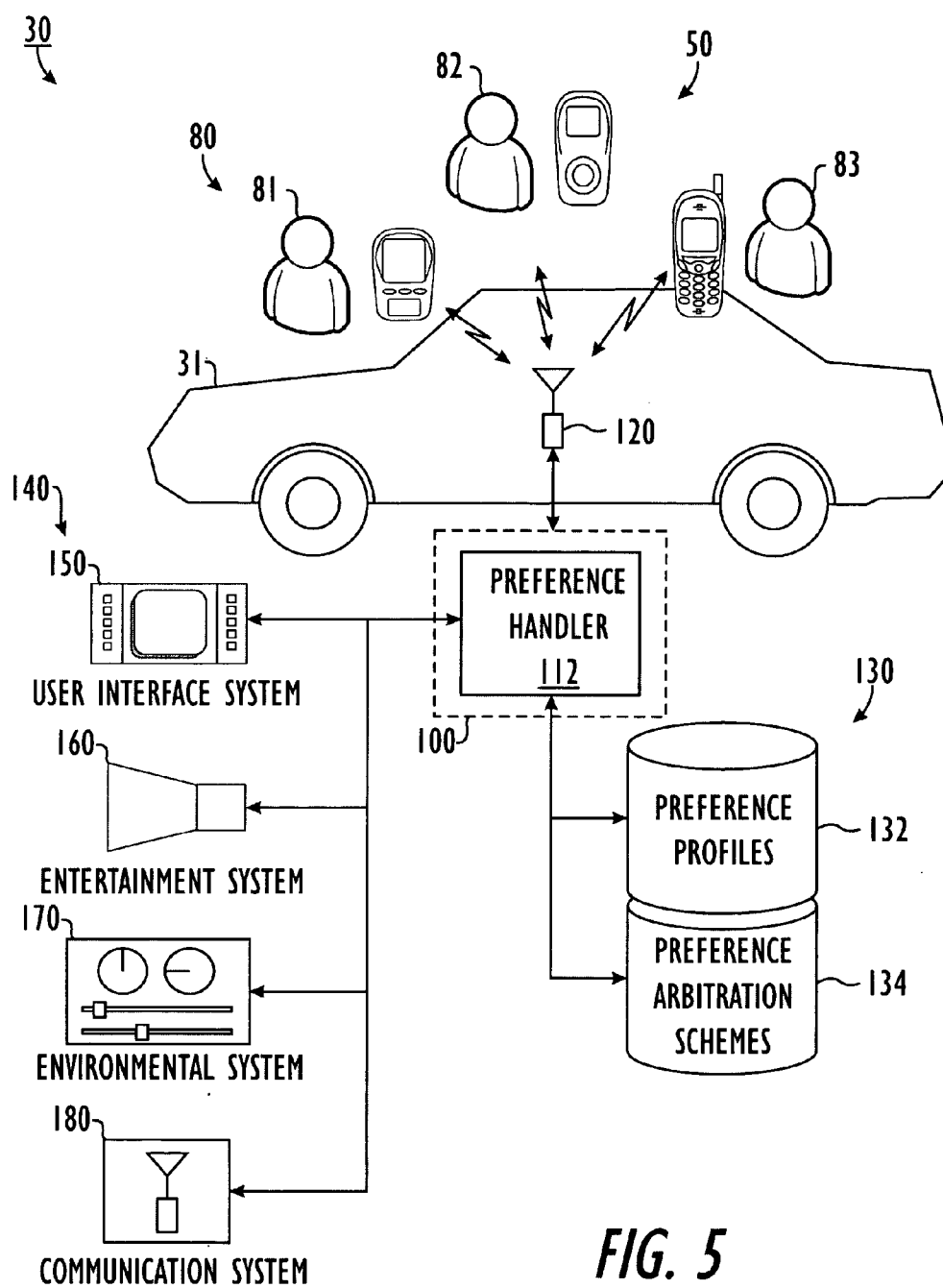


FIG. 5

300

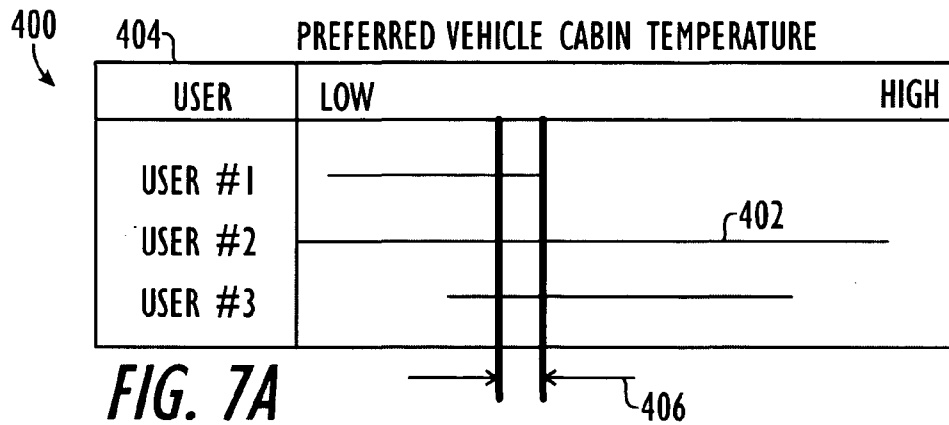
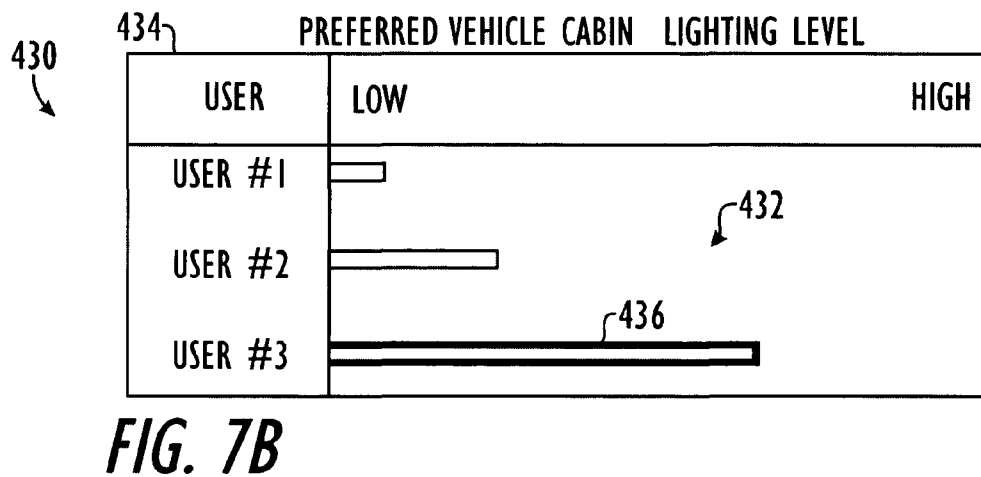
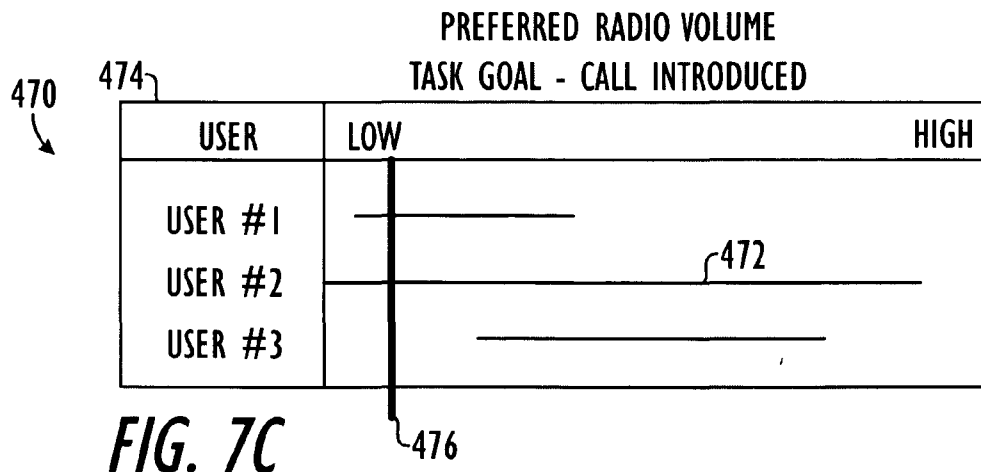
302 DEVICE ID	304 GENRE SELECTION #1 GENRE SELECTION #2 GENRE SELECTION #3			306 SELECTED PROGRAMMING
DRIVER'S DEVICE	NEWS	ROCK	CLASSICAL	ROCK
PASSANGER'S DEVICE #1	COUNTRY	ROCK	RAP	
PASSANGER'S DEVICE #2	ROCK	COUNTRY	NEWS	

FIG. 6A

350

352 DEVICE ID	354 VIDEO SELECTION #1 VIDEO SELECTION #2 VIDEO SELECTION #3			356 SELECTED PROGRAMMING
REAR PASSENGER'S DEVICE #1	TITANIC	RAIN MAN	OKLAHOMA	OKLAHOMA
REAR PASSENGER'S DEVICE #1	STAR GATE	STAR WARS	OKLAHOMA	
REAR PASSENGER'S DEVICE #1	STAR WARS	GREASE	OKLAHOMA	

FIG. 6B



SYSTEM AND METHOD FOR HANDLING MULTIPLE USER PREFERENCES IN A DOMAIN

FIELD OF THE DISCLOSURE

[0001] The subject matter of the present disclosure generally relates to a system and method for handling multiple preferences of users and more particularly relates to a system and method for handling preferences of multiple users in a domain of a network.

BACKGROUND OF THE DISCLOSURE

[0002] A particular user may have preferences that they prefer when using and interacting with various devices or systems. For examples, users may prefer various forms of information and may prefer a certain way that information is delivered to them on a particular type of device or in a given situation. Preferences for a particular user can generally include visual attributes (e.g., fonts, contrast, brightness, background pattern, color, icon type, icon location, choice of digital or analog gauges), environmental attributes (e.g., temperature, humidity levels, car seat position, vehicle mirror orientation), audio attributes (e.g., sound levels, equalization levels), and a host of other preferences.

[0003] Typically, users must program a device with their preferences. Consequently, each time a user encounters a new device, she must program her preferences into the device or simply use the preprogrammed forms of user interaction established in the device by default. As a solution to this problem, U.S. Pat. Nos. 5,633,484 and 5,814,798, which are incorporated herein by reference in their entireties, disclose techniques for establishing and managing preferences for a user. Using the disclosed techniques, a user can readily transport her preferences to various devices, such as telephones, automobiles, and computers, which she uses and encounters.

[0004] In a network, various devices and users can interact with one another in an environment. One type of network is a seamless mobility network that allows devices of various users to interact seamlessly in a plurality of environments or domains, such as a vehicle, a home, an office, etc. Typically, the users in the seamless mobility network have different preferences. When a group of users interacts together in a domain, conflicts may arise when there are conflicting preferences applicable to current circumstances in the domain. For example, two users in a vehicle may have different preferences for what volume and equalization levels should be used to deliver music in a vehicle. Thus, determining what volume and equalization levels to use in the vehicle presents a problem if both users attempt to apply their particular preferences to devices in the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 illustrates an embodiment of a platform or seamless mobility network according to certain teachings of the present disclosure.

[0006] FIG. 2 illustrates an embodiment of a process for handling preferences in a domain.

[0007] FIG. 3 illustrates an embodiment of a preference selection matrix.

[0008] FIG. 4 illustrates an embodiment of a controller in a vehicle domain according to certain teachings of the present disclosure.

[0009] FIG. 5 illustrates an embodiment of the controller handling preferences for multiple users in a vehicle domain.

[0010] FIGS. 6A-6B illustrate embodiments of arbitration schemes in tabular form for arbitrating preferences for multiple users in a vehicle domain.

[0011] FIGS. 7A-7C illustrate embodiments of arbitration schemes in graphical form for arbitrating preferences for multiple users in a vehicle domain.

DETAILED DESCRIPTION

[0012] Systems and methods for handling multiple preferences in a domain are disclosed. In one embodiment, a preference-handling method involves storing user preference accessible to a controller. For example, these preferences can be stored remotely on a network accessible to the controller, stored on individual portable devices, or stored locally at the controller. Preferences are determined for at least two users in the domain of the controller. For example, the controller can monitor for wireless devices active in a wireless personal area network of the controller and obtain the preferences of those users associated with the active devices from the device itself, from local memory of the controller, or from elsewhere. The determined preferences are related to controlling operation of a domain system in the domain of the controller. The domain system can be a networked computer system, a user interface, an entertainment system, an environmental system, or a communication system. The determined preferences are arbitrated based on an arbitration scheme of the controller, and operational behavior of the device or system is controlled based on the arbitration of the preferences.

[0013] In another embodiment, a preference-handling system includes one or more communication interfaces, memory, and a controller. The one or more communication interfaces can be used to connect communicatively with devices in a domain of the preference-handling system or with memory. The memory stores preferences for users. The memory can be stored on a portable device active in the domain, can be stored remotely at a network accessible storage system, or can be stored locally at the controller. The controller is operably coupled to the communication interfaces, the memory, and a domain system, such as previously described. The controller is configured to determine preferences for at least two users active in the domain. For example, the controller can monitor for wireless devices active in a wireless personal area network of the controller and can upload preferences from the devices or can access preferences already stored in the controller's memory. The determined preferences are related to controlling operation of the domain system operably coupled to the controller. The controller arbitrates the preferences based on an arbitration scheme and controls operation of the domain system based on the arbitration of the preferences.

[0014] The arbitration scheme can involve selecting a type in all or most of a list of preferences, selecting a preference having a highest priority, selecting a value within ranges of each of the preferences, selecting a preference having a greatest weighting, or selecting a preference based on a task controlling the domain. In addition, the arbitration scheme can involve assigning preferences to one of a plurality of categories. The categories can include non-compromiseable preferences, compromiseable preferences, and yielding preferences.

[0015] The foregoing is not intended to summarize each potential embodiment or every aspect of the present disclosure. Let us now refer to the figures to describe the subject matter of the present disclosure in more detail.

[0016] Referring to FIG. 1, an embodiment of a platform 10 according to certain teachings of the present disclosure is schematically illustrated. The present embodiment of the platform 10 illustrates a variety of possibilities available for the systems and methods of the present disclosure. In one embodiment, the platform 10 can be a seamless mobility network. However, the platform 10 in a broader sense allows disparate devices and users to interact with one another across various networks. In this broader sense, the platform 10 provides users with consistent behavior, user interaction, and preferences across disparate devices, applications, environments, and domains of networks. In this way, a user's experience can be substantially consistent with her mental model of interaction between various domains or environments, and her experience can be substantially the same, if her preferences so dictate, regardless of the various devices with which she interacts.

[0017] In the illustrated example, the platform 10 has a plurality of domains or environments 12, such as a home domain 20, a vehicle domain 30, a work domain 40, a portable domain 50, and a public domain 60. It will be appreciated that the platform 10 can have more or less domains 12. In addition, it will be appreciated that the platform 10 does not necessarily apply only to an individual user or device or a particular set of users or devices. Rather, the platform 10 can apply to any user or device that is compatible with the architectural framework, data structures, communication protocols, applications, etc. of the platform 10.

[0018] The domains 12 are defined by a set of circumstances, a set of users, a specific environment (e.g., vehicle, home, office, etc.), and a set of devices and systems capable of operating and interacting in the domains. For example, the home domain 20 can include a home networked computer system 22, an entertainment system 24, and an environmental system 26. The vehicle domain 30 for a vehicle 31 can include an entertainment system 32, a user interface or navigation system 34, a communication system 36, and an environmental system 38. The work domain 40 can include a networked computer system 42, a communication system 44, and an environmental system 46. The portable domain 50 can include various portable electronic devices, such as a Personal Digital Assistant (PDA), a portable music player, a portable video player, a portable navigation device, a cellular phone, a wireless headset, and a laptop. Finally, the public domain 60 can include computers, telephones, Automated Teller Machines, and other public devices and systems that a user may encounter and use in public.

[0019] The various devices and systems in these domains 12 are capable of interacting or communicating with other devices and systems in the same domain or in different domains using communication techniques known in the art. In one example, the devices and systems in the domains 12 are capable of wired or wireless communication with various communication sources 70, which can include the Internet 72, mobile communication 73 (e.g., Dedicated Short Range Communication (DSRC) and vehicle-to-roadside/vehicle-to-vehicle communication), hotspot gateways 74,

cellular service providers 76 and networks 77, and satellite providers 78. Some examples of wireless communication include cellular communication, Bluetooth®, Wi-Fi, Ultra Wide Band (UWB), and other wireless communication techniques known in the art.

[0020] The platform 10 also includes a controller 100 capable of wired and wireless communication with the various devices and systems in the domains 12 and with the sources 70. In one embodiment, the controller 100 is a central server or a host computer system for arbitrating preferences between users in one or more of the various domains 12. In a distributed embodiment, one or more of the domains 12 can include a controller 100. For example, the networked computer system 22 in the home domain 20 can embody features of the controller 100 and can handle preferences in the home domain 20. In another example, the vehicle domain 30 can include such a controller 100 for arbitrating preferences between portable devices of the portable domain 50 interacting with the vehicle systems 32, 34, 36, and 38. In a further distributed embodiment, one or more of the devices or systems of the platform 10 can include features of the controller 100.

[0021] Now that the platform 10 has been described, the present discussion turns to an embodiment of a process 200 shown in FIG. 2 for handling preferences in a domain. In the preference handling process 200, two or more users and/or their devices enter or are currently active in a domain (Block 202). As disclosed herein, the controller can identify users by monitoring for active devices associated with users or by receiving manual input. Regardless of how this is done, a determination is made whether the user has preferences that are compliant with the preference handling process of the platform (Block 204). For example, a particular device associated with a user may be detected in the domain, but the device may not have the necessary information or preferences associated with it. If the user or her device is not compliant, then they will have no impact on any preference handling to be performed in the domain (Block 205).

[0022] For those compliant users or devices, the preferences associated with them are obtained (Block 208). Obtaining the preferences can involve one of a variety of methods. In one example, a compliant device active in the domain may store preferences for the user, and these preferences can be accessed or uploaded to the controller. In another example, a compliant device active in the domain may have an identification associated with it, such as a network or Internet Protocol (IP) address. This identification can then be used by the controller to obtain preferences associated with the user from a storage system or elsewhere using techniques known in the art. In a third example, the user can have a donor device with a memory for storing preferences, and the user can connect the donor device with an appropriate interface of the controller in the domain. Examples of a donor device used in a vehicle domain and elsewhere are disclosed in incorporated U.S. Pat. Nos. 5,633,484 and 5,814,798. In a fourth example, the user can access a user interface to manually input that they are present in the domain, and the preferences associated with the user can be obtained from a local memory in the domain or from a memory stored elsewhere on a network.

[0023] Once the relevant preferences have been obtained, an analysis of those preferences is made to determine how

to handle the preferences from multiple users (Block 208). In this step, a determination is made as to who “owns” or controls the domain or a system in the domain. For example, a particular user may be designated as owner of the domain. The preferences associated with this user may always be applied, or this user’s preferences are given more weight in determining how to handle conflicts between preferences. In addition, a determination is made as to what rank the various users have in the domain. For example, one user may be directly associated with a domain, such as a family member in a home domain. However, another user may have compliant preferences for this home domain, but they may be a friend or the like and may have a lower rank in the home domain compared to the family member’s rank.

[0024] Furthermore, this step 208 involves determining which of the preferences associated with the users are applicable to the current circumstances in the domain. For example, the preferences associated with a user can encompass an entire variety of preferred user interactions, such as audio levels, visual effects, preferred media, and others detailed herein. Preferences associated with audio levels and settings would be applicable in the domain if the domain has an entertainment system. Therefore, in this situation, a determination would be made that audio-related preferences are applicable to current operation of the entertainment system in the domain.

[0025] Continuing with the process 200, step 210 determines what type or category the applicable preferences have. The preferences are classified according to a rigid or non-compromiseable category, a flexible or compromiseable category, or a yielding category. A preference in the non-compromiseable category does not allow for compromise and acts as a veto to other preferences or alternatives with which it comes in conflict. A preference in the compromiseable category does allow for compromise and has a range, weight, or priority that can be used to negotiate or compromise with other preferences or alternatives with which it comes in conflict. A preference in the yielding category automatically yields to any other preference with which it comes in conflict.

[0026] Although preferences can be defined as rigid or non-compromiseable, a policy or rule relevant to the domain can be associated with a non-compromiseable preference. The policy or rule can account for situations, such as those dealing with emergencies, safety, or health, where other preferences or the default operation of a system or device needs to take precedence over any non-compromiseable preferences that a user may have. For example, a driver may have a non-compromiseable preference indicating that communication devices of passengers cannot use handsfree or other communication capabilities of the vehicle. In an emergency (i.e., after air bag deployment), however, such a non-compromiseable preference may be overridden by a policy or rule so that a passenger can take advantage of the communication capabilities of the vehicle. In addition to selecting a preference based on policies and rules, a preference can be selected based on a restriction, such as a health restriction, relevant to a domain, a user, or a system in the domain.

[0027] Preferences that are non-compromiseable are arbitrated or negotiated according to one or more of the arbitration schemes disclosed herein (Block 220). In general,

these arbitration schemes are guided by the weightings or rankings associated with the preferences. In particular, preferences associated with the owner of the domain are first selected if the owner of the domain is present (e.g., a device associated with the owner is active or detected in the domain). Next, common preferences associated with all users in the domain are selected. Otherwise, those remaining preferences associated with the user having the highest ranking are selected.

[0028] After arbitration of the non-compromiseable preferences, a determination is made whether the arbitration scheme was successful in arbitrating a result (Block 222). If the arbitration was successful, the process 200 continues and sets those arbitrated preferences at step 240. Depending on the circumstances, however, there may be situations where a successful result does not occur during arbitration. For example, a particular arbitration scheme may not be capable of resolving a particular conflict between non-compromising preferences of two or more users, or historical arbitration information stored in memory may have not offered a solution to the conflicts. Therefore, an offer is made to the owner of the domain, a high ranked user, or other user to intervene manually in the arbitration process (Block 224). In this situation, the user is allowed to input a selection of a preference manually (Block 226). The manual selection can then be stored for arbitrating preferences in the future in similar circumstances. After the manual selection is received, the process 200 continues and sets the preference at step 240.

[0029] Preferences that are compromiseable are also arbitrated or negotiated according to one or more of the arbitration schemes disclosed herein (Block 230). In general, these arbitration schemes involve algorithms that average, weight, or prioritize the preferences. In addition, these schemes can use the order in which the users or devices entered the domain as criteria for selecting preferences. Furthermore, the arbitration schemes can use a history of selected preferences for a given set of users to determine how to handle preferences for the same users in the same situation. For example, results of arbitrating or negotiating preferences between a particular group of users can be accessed and can be used to set shared preferences in a similar situation.

[0030] Once selections have been made in steps 220 and 230, the shared or selected preferences are set so that operation of systems in the domain can use these set preferences (Block 240). Moreover, it is beneficial to store these selections so that they can be accessed later to provide a history for arbitrating or negotiating preferences again for this group of users in this domain.

[0031] As alluded to previously, various types of preferences can be handled according to the techniques of the present disclosure. Referring to FIG. 3, an embodiment of a preference selection matrix 250 is shown. This matrix 250 is similar to that disclosed in incorporated U.S. Pat. No. 5,814,798 and can be used to provide the benefits of intelligent user interface to users. This matrix 250 graphically represents how a user’s preferences can be stored in one or more devices, memory, or elsewhere on a network.

[0032] As graphically shown, the user’s preference can be viewed as a multi-dimensional matrix 250 having a preference category axis 252, a system or device axis 254, and an

environment or domain axis **256**. The preference category axis **252** is classified by various types or categories of preferences and user interaction modalities, such as visual, audible, spatial, media, haptic, etc. The system or device axis **254** defines particular categories of systems and devices, such as communication systems (e.g., cellular telephones, headsets, handsfree units), entertainment systems (e.g., radios, video players, TVs), navigation systems (e.g., vehicle navigation unit), and environmental systems (e.g., heater, air conditioner). It is understood that these categories can be further defined and particularized to specific types of devices and system or even particularly identified devices and systems. The environment or domain axis **256** defines categories of various domains or environments where the user's preferences are applicable in a seamless mobility network or more general network platform. For example, the domains **256** include home, vehicle, work, portable, and aircraft, but the matrix can include more or less categories and can include specific locations.

[0033] Particular user preferences are stored in attribute cells located at the intersection of the matrix's different axes **252**, **254**, and **256**. Using the matrix **250**, the controller, devices, and systems of the present disclosure can use techniques disclosed in the incorporated U.S. Pat. No. 5,814,798 to predict a users preferences based on a "context" of a particular situation. The "context" is determined by the intersection of axes **252**, **254**, and **256** as they relate to which domain the user is in (axis **256**), what devices or systems are operating in the domain (axis **254**), and what actions or types of user interaction are being used in the domain (axis **252**). Although not shown in FIG. 3, the matrix **250** also includes information on whether preferences are compromiseable, non-compromiseable, or yielding, as discussed previously.

[0034] For the sake of illustration, several preferences in the attribute cells of the matrix **250** are discussed. In general, preferences associated with the visual category of axis **252** can include font types, font sizes, menu order preferences, menu size preferences, window size preferences, locations of icons, patterns, colors, font sizes, and preference for analog or digital gauges or display graphs. Preferences for the audible category of axis **252** can include types of prompts such as key feedback prompts, e-mail audible feedback prompts, bad move error prompts or change done prompts, negative indication preferences, speech and language recognition preferences, ringing such as urgent ringing, normal ringing, data ringing, volume preferences, tone type preferences, or commercial broadcast station selection preferences, base and treble control as well as fade and balance preferences. Preferences associated with the spatial category of axis **252** can include temperature preferences, humidity preferences, percentage of outside (fresh) air preferences, air conditioning balance preferences, car seat position preferences, automobile mirror position preferences, and seat heater temperature preferences.

[0035] For example, various categories (axis **252**) for systems (axis **254**) in the home domain (axis **256**) can include preferences related to room-to-room distribution of access to networks, network media access (e.g., ability of family members and/or guests to access subscription based media services in the home domain), sources of entertainment, room-to-room distribution of entertainment, color settings, preferences to skip TV commercials, audio prefer-

ences, preset radio stations, ambiance settings, volume levels, air-conditioning, heating, humidity, and lighting.

[0036] For example, various categories (axis **252**) for systems (axis **254**) in the vehicle domain (axis **256**) can include preferences related to audio preferences (e.g., equalization levels, volume levels), preferred media (e.g., genre, songs, preset radio stations, etc.), navigation routes, hands-free cellular phone capabilities (e.g., ability of passengers to have calls routed through vehicle's audio system), access network media (e.g., ability of passengers to access subscription based media services in the vehicle), seat and mirror positions, and air-conditioning settings.

[0037] For example, various categories (axis **252**) for systems (axis **254**) in the work domain (axis **256**) can include preferences related to teams or shifts of employers, shared office equipment (e.g., copiers and computer work stations), and office space or conference rooms (e.g., lighting, air conditioning, heating, projector control, video-conferencing operation, and ring control). For the portable domain (axis **256**), preferences can be related to preferences for handling calls, volume settings, preferred types of media (e.g., music or video), etc.

[0038] With an understanding of the process for handling various preferences discussed above with reference to FIG. 2 and the examples of preferences discussed above with reference to FIG. 3, we now turn to FIGS. 4 and 5 to discuss some detailed examples of handling preferences in a vehicle domain **30**. Although the discussion that follows focuses on the vehicle domain **30** and those preferences, devices, and systems associated with a vehicle **31**, it will be appreciated with the benefit of the present disclosure that the same teachings disclosed herein can be applied to other domains in the platform **10** of FIG. 1.

[0039] In FIG. 4, the controller **100** is shown in more detail in the vehicle domain **30** of a vehicle **31**. In general, the vehicle domain **30** can be part of a platform discussed previously, and the controller **100** can be part of a server or other computer system located somewhere else in the platform. In the present example, however, the controller **100** is integrated into the vehicle **31**. The controller **100** has a control unit **110**, interfaces **120**, and memory **130**. A vehicle bus interface **102** connects the controller **100** to an existing vehicle bus **33** using techniques known in the art, such as an On-Board-Diagnostic II (OBD-II) connection or other bus interface. The vehicle bus interface **102** provides the controller **100** with access to features and components of the vehicle **31**, such as power, ground, ignition, mute, mileage, speed, controls, parameters, and other vehicle information.

[0040] The controller **100** is communicatively connected to one or more vehicle systems **140**, such as a user interface or navigation system **150**, an entertainment system **160**, an environmental system **170**, and a communication system **180** in the vehicle **31**. In general, the controller **100** is communicatively connected to the systems **140** using input/output interfaces known in the art or using the vehicle bus interface **102** and vehicle bus **33**.

[0041] The user interface system **150** can include various controls for other components of the vehicle **31** and can include a navigation system. The entertainment system **160** can include a radio, a video display, a DVD player, etc. The environmental system **170** can include an air conditioning

system, a heater system, power seat controls, seat warmers, etc. The communication system **180** can include a cellular interface, a Global Positioning System interface, an in-vehicle microphone, an in-vehicle speaker, a Telematics system, and a Bluetooth®-enabled unit capable of Hands-free.

[0042] In the present example, the interfaces **120** of the controller **100** establish a personal area network (PAN) that defines the extent of the domain **30** in the vehicle **31**. Within the personal area network, multiple personal devices **50** can interact simultaneously with the controller **100**. In the present example, the devices **50** include, but are not limited to, a cellular phone **51**, a wireless headset **52**, a PDA **53**, a portable music player **54**, a laptop computer **55**, a dedicated donor device **56**, portable navigation device (not shown), and a portable video player (not shown). The dedicated donor device **56** can be similar to the donor device disclosed in the incorporated U.S. Pat. Nos. 5,633,484 and 5,814,798 and can be a portable memory card or a widely accessible central database that stores preferences for users.

[0043] The devices **50** and the controller **100** are associated with the same platform, such as previously discussed, so that all of the devices **50** and controller **100** are compliant with techniques disclosed herein for arbitrating conflicting preferences. To be compliant, the various devices **50**, controller **100**, interfaces **120**, memory **130**, and other necessary components must support the common platform's memory storage, architectural framework, data structures, communication protocols, software, etc., as will be apparent to one skilled in the art.

[0044] The devices **50** can interact with the controller **100** using wired or wireless interfaces **122** and **124** known in the art. One or more of the devices **50** can contain a dedicated memory for storing preferences associated with the users of the device **50**. Preferably, the preferences stored in the device **50** are comprehensive and encompass the various forms of interaction detailed herein. Alternatively, one or more of the devices **50** may not contain a dedicated memory for storing preferences. Instead, such devices **50** may be associated with a particular user by an identification number, such as a network or IP address. The preferences associated with the user of such a device **50** may be stored elsewhere outside the vehicle domain **30** or stored locally in memory **130** of the controller **100**. When the particular device **50** and associated user are identified, the controller **100** can access those preferences.

[0045] The controller **100** has preference profiles **132** for storing user preferences and preference arbitration schemes **134** for handling preferences of multiple users. The preference profiles **132** and preferences arbitration schemes **134** can be entered and stored in memory **130** using direct entry with the user interface **150**, uploads from the devices **50**, or other techniques known in the art.

[0046] With an understanding of the controller **100** in the vehicle domain **30** of FIG. 4, we now turn to FIG. 5 to discuss examples of multiple users interacting with the controller **100** in the vehicle domain **30**. In FIG. 5, the controller **100** is illustrated relative to some users **80** having portable devices **50** brought into a vehicle **31**. The controller **100** includes a preference handler **112** for determining how to arbitrate or negotiate between various preferences of the

users **80**. The preference handler **112** is schematically shown as a component of the controller **100** but is preferably embodied in software.

[0047] During operation, the preference handler **112** determines the "context" of the domain **30**. The context is defined by what users **80** are active, what systems **140** are operating, what operations are requested, and what preferences are associated with the users **80** in the domain **30**. Based on the context, the preference handler **112** uses a preference arbitration scheme **134** to decide how to handle preferences when they conflict.

[0048] As noted previously, determining which users **80** are in the domain **30** can involve monitoring for devices **50** of the users **80** active in the domain **30** and obtaining the preferences associated with those users **80** from the device **50**, from local memory **130**, or from elsewhere in a network. In addition, a user **80** may manually identify herself in the domain **30** using the user interface **150**, for example, and the controller **100** can then obtain her preferences from local memory **130** or from elsewhere. Furthermore, the controller **110** can identify a user **80** based on identification of an active device **50** and can access the user's preferences from local memory **130** or from elsewhere.

[0049] When two or more users **80** are active in the domain **30**, the preference handler **112** determines whether the preferences of these users **80** are relevant to the current context of the domain **30** and uses one or more preference arbitration schemes **134** to handle any conflicts in the preferences. The preference arbitration schemes **134** can use various algorithms for negotiating or arbitrating conflicting preference. As provided in more detail below, the schemes **134** can use ownership, rankings, averaging, weighting, priorities, order of entering the domain, and history of preferred selection for a set of devices. Some example scenarios are discussed below to show how the device handler **112** uses the preference arbitration schemes **134** for a set of circumstances.

[0050] In a first example scenario, a first user **81** has a non-compromiseable preference for operating one of the systems **140** in the vehicle **31**, while other users **82** and **83** have either compromiseable or yielding preferences. In this situation, the non-compromiseable preference of the first user **81** essentially vetoes the preferences of the other users **82** and **83**. This may be the case where the first user **81** is the driver, the vehicle owner, or is a user that otherwise owns the domain **30**. In a second example scenario, the first user **81** has a compromiseable preference for operating one of the systems **140**, and the other users **82** and **83** have preferences in the yielding category. In this situation, the compromiseable preference for the first user **81** is used during operation of the system **140**. This may be the case where the other users **82** and **83** are guests in the domain **30**, and any preferences associated with them are automatically set to the yielding category.

[0051] In a third example scenario, at least two of the users **81**, **82**, and **83** have compromiseable preferences. In this situation, the compromiseable preferences are negotiated according to a preference arbitration scheme **134**. In general, the preference arbitration scheme **134** negotiates the preferences by determining a level, attribute, or selection of a preference to operate the system **140** based on ranges, weightings, or rankings associated with preferences of the users **80**.

[0052] In a fourth example scenario, at least two of the users **80** each have non-compromisable preferences for operating one of the systems **140**. In this situation, the non-compromisable preferences are negotiated according to a preference arbitration scheme **134**. In general, the preference arbitration scheme **134** selects the preference of the owner of the domain **30** if available. If no owner is present, the preference arbitration scheme **134** determines a level, attribute, or selection of a preference that is common to all of the users **80**. If no common selection can be made, the preference arbitration scheme **134** selects the preference for the highest ranked user **80** currently in the domain **30** or the preference associated with the first of the users **80** to enter the domain **30**.

[0053] With this general understanding of the operation of the preferences handler **112**, several examples of arbitrating preferences for multiple users **80** interacting with the controller **100** is discussed. In a first example of arbitrating preferences, the users **80** have preferences associated with them for controlling audio in the vehicle domain **30**. The first user **81** may be the driver, and the second and third users **82** and **83** may be passengers. Accordingly, these users **80** may have different and potentially conflicting preferences with respect to audio settings, and the preferences can affect how audio should be delivered or controlled in the vehicle **30** with the entertainment system **160**.

[0054] For example, the satellite radio of the entertainment system **160** can have predefined radio stations pertaining to certain types or genres of music available from a satellite radio provider. One of the users **80** makes a request to operate the satellite radio of the entertainment system **160**, but the users **80** have preferences for different genres of music. The device handler **112** uses an arbitration scheme **134** to determine from the preferences stored in the profiles **132** what genre to use for a station of the satellite radio so that the selected station satisfies the preferred genres of the users **80** in the vehicle domain **30**.

[0055] One way of arbitrating preferences is to establish a ranking, weighting, or priority of preferences so that the preference handler **112** can resolve conflicts between preferences. In FIG. 6A, for example, preferences for users are ranked in an order within a preference arbitration scheme **300**, which is shown in tabular form. The scheme **300** includes device IDs **302** and ranked genre selections **304** for active devices in the domain. These genre selections **304** can be relevant to the operation of a satellite radio of an entertainment system in a vehicle and can be used to set which station to operate the radio. The device IDs **302** in this example correspond to users having detected devices of in the domain and are listed as "Driver's Device," "Front Passenger's Device," etc. for illustrative purposes. Each user has a plurality of genre selections **304** that are ranked in order.

[0056] Based on a comparison of the genre selections **304** and their rankings, the preference handler determines which genre satisfies the preferences of all the users **302**. In this case, the arbitration scheme **300** shows that "Rock" is the preferred genre **306**. Based on the determination from the preference arbitration scheme **300**, the preference handler **112** of FIG. 5 sets or suggests that the satellite radio of the entertainment system **160** be operated with a station having the "Rock" genre. Thus, the preference handler **112** can initially set the satellite radio to a station having the "Rock" genre but may allow the station to be changed.

[0057] In a second example of arbitrating preferences, the users **80** of FIG. 5 have different and potentially conflicting

preferences with respect to video, and the preferences can influence how video should be delivered or controlled in the vehicle **31** with a video display of the entertainment system **160**. During operation, one of the users **80** makes a request to play a movie on the video display of the entertainment system **160**. Each of the users **80** has different preferred video selections associated with them. The preference handler **112** determines from those preferences **132** which video content to deliver with the video display of the entertainment system **160** according to a preference arbitration scheme **134**.

[0058] For example, FIG. 6B shows an example of an arbitration scheme **350** where video selections **354** are ranked for each user **352** identified in the domain or having an active device in the domain. These ranked video selections **354** are relevant to the operation of the video display of the entertainment system in the vehicle and can be used to determine which video to deliver with the video display. Based on a comparison of the preferred video selections **354** and their rankings, the arbitration scheme **350** shows that "Oklahoma" is the preferred video selection for all three users **352**.

[0059] After determining the preferred video selection, the preference handler **112** of FIG. 5 plays or suggests playing the selected video on the video display of the entertainment system **160**. For example, in response to a request in the vehicle **31** to play a video, the preference handler **112** sets the selected video as an initial option to be selected by the users **80** for playing on the video display of the entertainment system **160**.

[0060] In a third example of arbitrating preferences, the users **80** have different preferences for the temperature of the vehicle cabin. In this situation, the device handler **112** has a plurality of preferred cabin temperatures or ranges to arbitrate when a request to operate the vehicle's environmental system **170** is made. Using a preference arbitration scheme **134**, the device handler **112** determines a cabin temperature or range that suits the preferences of each user **80** in the vehicle domain **30**.

[0061] One way of arbitrating preferred ranges or values involves mathematically averaging them. In FIG. 7A, for example, an arbitration scheme **400** is shown in graphical form for arbitrating a preferred cabin temperature or range for a vehicle. The preferred temperature ranges **402** of three users **404** associated with the active devices in the vehicle are shown. A comparison of the preferred temperature ranges is made to determine a suitable range or value **406** for the vehicle cabin that accommodates the preferences of each user **404**. In this example, the suitable range **406** is an interval in the temperature ranges that overlap in all three preferred ranges **402**. Based on the determination from the preference arbitration scheme, the preference handler **112** of FIG. 5 then controls operation of the vehicle's environmental system **170** according to that determined range **406** of FIG. 7A.

[0062] In a fourth example of arbitrating preferences, the users **80** of FIG. 5 have different preferences for the cabin lighting level in the vehicle **31**. In FIG. 7B, a preference arbitration scheme **430** is shown in graphical form for arbitrating a preferred cabin lighting level for a vehicle. The preferred lighting levels **432** of three users **434** associated with the active devices in the vehicle are shown. Rather than negotiating between the preferred lighting levels **432**, the characteristic of each user **434** associated with the preferred lighting levels **432** is determined. For example, the device

associated with the owner of the vehicle may be detected, or one of the users may be defined as the owner of the vehicle domain. Based on this determination, a preferred lighting level 436 of this owner (i.e., User #3) is selected over the other preferred lighting levels 432. As a result, the preference handler 112 of FIG. 5 can then control operation of the lighting levels of the environmental system 170 in vehicle 31 according to that preferred level.

[0063] In a fifth example of arbitrating preferences, the users 80 of FIG. 5 have different preferences for audio levels in the vehicle 31. In contrast to previous examples, these preferred audio levels have a controlling task or other criteria that controls or restricts them. In FIG. 7C, for example, an arbitration scheme 470 is shown in graphical form for arbitrating preferences based on a task goal. In this example, each user 474 has a preferred range 472 for audio volume to operate the entertainment system in the vehicle. The arbitration scheme 470, however, is restricted by a task goal, which in this example pertains to a call being introduced in the vehicle. Thus, an arbitrated or predefined level 476 is automatically selected when a call is introduced in the vehicle. As a result, the preference handler 112 of FIG. 5 can then control operation of the audio levels of the entertainment system 160 in vehicle 31 according to that preferred level. Another possible controlling task includes automatically switching between visual and audio navigation directions when the vehicle is in drive or when a call is introduced in the vehicle.

[0064] The foregoing description of preferred and other embodiments is not intended to limit or restrict the scope or applicability of the inventive concepts conceived of by the Applicants. In exchange for disclosing the inventive concepts contained herein, the Applicants desire all patent rights afforded by the appended claims. Therefore, it is intended that the appended claims include all modifications and alterations to the full extent that they come within the scope of the following claims or the equivalents thereof.

What is claimed is:

1. A preference-handling method, comprising:
 - storing preferences accessible to a controller;
 - determining preferences associated with at least two users active in a domain of the controller, each of the preferences being related to operation of a domain system operably coupleable to the controller;
 - arbitrating determined preferences based on an arbitration scheme of the controller; and
 - controlling operation of the domain system based on the arbitration of the preferences.
2. The method of claim 1, wherein storing preferences comprises one or more of:
 - storing preferences on a device communicatively coupleable to the controller;
 - storing preferences at a remote storage accessible to the controller via a network; and
 - storing preferences at the controller.
3. The method of claim 1, wherein the domain of the controller comprises a home domain, a vehicle domain, a work domain, a portable domain, or a public domain.
4. The method of claim 1, where the domain system operably coupleable to the controller comprises a networked

computer system, a user interface system, an entertainment system, a navigation system, a communication system, or an environmental system.

5. The method of claim 1, wherein determining preferences comprises:

- monitoring for devices active in the domain of the controller; and

- obtaining preferences associated with users of the active devices.

6. The method of claim 1, wherein the preferences comprise a list of types, a range of values, a weighting, a priority, a ranking, a controlling task, a rule, or a restriction, and wherein arbitrating the preferences comprises one or more of:

- selecting a type in all or most of the lists;

- selecting a preference having a highest priority;

- selecting a value within ranges of each of the preferences;

- selecting a preference having a greatest weighting;

- selecting a preference based on a task controlling the domain;

- selecting a preference based on a safety rule relevant to a domain, a user, or a system; and

- selecting a preference based on a health restriction relevant to a domain, a user, or a system.

7. The method of claim 1, wherein the preferences are defined as non-compromisable, and wherein arbitrating determined preferences comprises selecting a preference associated with the user having a highest rank.

8. The method of claim 1, wherein the preferences are defined as non-compromisable, and wherein arbitrating determined preferences comprises:

- determining whether an automatic selection of a preference has resulted from the arbitration scheme; and

- receiving a manual selection of a preference if the automatic selection has not resulted.

9. The method of claim 1, wherein the preferences are defined as compromiseable or yielding, and wherein arbitrating determined preferences comprises negotiating a preference satisfying each of the compromiseable preferences.

10. The method of claim 1, wherein one of the preferences associated with one of the users is defined as non-compromiseable, wherein the other preferences are defined as compromiseable or yielding, and wherein arbitrating the preferences comprises selecting the non-compromiseable preference.

11. The method of claim 1, wherein controlling operation of the system comprises one or more of:

- operating an entertainment system with a selected attribute for a user interface of the system;

- delivering a selected type of entertainment with an entertainment system;

- delivering a selected entertainment file with an entertainment system;

- delivering entertainment with an entertainment system according to a selected audible or visual preference;

operating an environmental system with a selected temperature level or range, with a selected lighting level, or with selected attribute for a user interface of the system;

operating a communication system with a selected audible or visual preference;

enabling a communication system to use an entertainment system to deliver communications in the domain; and

operating a user interface with a selected attribute for user interaction.

12. A preference-handling system, comprising:

one or more interfaces for communicatively connecting with devices;

memory for storing preferences for users; and

a controller operably coupleable to the one or more interfaces and the memory, the controller configured to:

determine preferences associated with at least two users active in a domain of the preference-handling system, each of the preferences being related to operation of a domain system operably coupleable to the controller;

arbitrate determined preferences based on an arbitration scheme of the controller; and

control operation of the domain system based on the arbitration of the preferences.

13. The system of claim 12, wherein the memory for storing preferences for users comprises one or more of:

memory on a portable device communicatively coupleable to the controller;

memory remotely accessible to the controller via a network; and

memory stored locally at the controller.

14. The system of claim 12, wherein the domain comprises a home domain, a vehicle domain, a work domain, a portable domain, or a public domain.

15. The system of claim 12, where the domain system comprises a networked computer system, a user interface system, an entertainment system, a navigation system, a communication system, or an environmental system.

16. The system of claim 12, wherein to determine preferences, the controller is configured to:

monitor for devices active in domain of the controller; and

obtain preferences associated with users of the active devices.

17. The system of claim 12, wherein the preferences comprise a list of types, a range of values, a weighting, a priority, a ranking, a controlling task, a rule, or restriction, and wherein to arbitrate determined preferences, the controller is configured to select one or more of: a type in all or most of the lists; a preference having a highest priority; a value within ranges of each of the preferences; a preference having a greatest weighting; a preference based on a task controlling the domain; and a preference based on a safety rule relevant to a domain, a user, or a system; and a preference based on a health restriction relevant to a domain, a user, or a system.

18. The system of claim 12, wherein the preferences are defined as non-compromisable, and wherein to arbitrate determined preferences, the controller is configured to select a preference associated with the user having a highest rank.

19. The system of claim 12, wherein the preferences are defined as non-compromisable, and wherein to arbitrate determined preferences, the controller is configured to:

determine whether an automatic selection of a preference has resulted from the arbitration scheme; and

receive a manual selection of a preference if the automatic selection has not resulted.

20. The system of claim 12, wherein to control operation of the system, the controller is configured to perform one or more of:

operate an entertainment system with a selected attribute for a user interface of the system;

deliver a selected type of entertainment with an entertainment system;

deliver a selected entertainment file with an entertainment system;

deliver entertainment with an entertainment system according to a selected audible or visual preference;

operate an environmental system with a selected temperature level or range, with a selected lighting level, or with selected attribute for a user interface of the system;

operate a communication system with a selected audible or visual preference;

enable a communication system to use an entertainment system to deliver communications in the domain; and

operate a user interface with a selected attribute for user interaction.

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