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PREPARING AN ASSISTANT-ENABLED VEHICLE

ABSTRACT

An interactive assistant computing system, referred to herein as “an interactive assistant,” “a virtual assistant,” “a computational assistant,” or simply “assistant,” is described that stores information related to settings of a vehicle (e.g., seat locations, cabin temperature, mirror location, music preferences, directions to a destination, etc.) such that the assistant can automatically adjust one or more parameters of the vehicle in response to receiving an indication of an identity of an operator or passenger of the vehicle. The assistant in the vehicle may store settings for various users and prepare the vehicle once a second computing device sends the assistant an indication of a user’s identity. This way, the assistant can prepare the vehicle with settings preferred by the user, reducing the time between the user entering the vehicle and beginning to operate the vehicle by eliminating the need for the user to manually adjust each of the settings to the user’s preferred state.

DESCRIPTION

Assistants execute on counter-top devices, mobile phones, automobiles, and many other type of computing devices. Assistants output useful information, responds to users’ needs, or otherwise performs certain operations to help users complete real-world and/or virtual tasks. Some such tasks include altering the settings of computing devices that executes the assistant or using one computing device executing the assistant to alter the settings of a second computing device, such as an automobile or other assistant-enabled computing device. While altering the settings of such devices may be beneficial to the user, devices that include the option for preset
or default settings may experience difficulty when catering to the preferences of multiple users, especially in instances where the multiple users have widely varying preferences.

In many cases, a user may wish to utilize the assistant to access previously used settings and adjust the current settings of the device executing the assistant. In a simple case, the user may initiate a search (e.g., via an audible or a manual query) for the user’s personal settings. The assistant may perform a search in a database or log of historical interaction information, locally and/or via a remote server, to provide the user (e.g., audibly, visually) with search results that correspond to the search. The user may then proceed to adjust one or more settings of the device based on the retrieved historical settings, as desired. However, this search is typically unable to execute until the user is already interacting with the device being altered. For instance, if the user is wishing to adjust settings in a vehicle, the user must typically be in a position to interact with the various systems within the vehicle with the vehicle turned on. With the additional time required to connect with the device, perform this search, and implement the retrieved settings, it may be more efficient to manually adjust the settings in need of adjustment, causing the assistant to be a net-neutral feature in many devices.

The computing system shown in Figure 1 below provides users with an ability to, while the user is approaching the vehicle, use a secondary computing device to communicate with the assistant of the vehicle to adjust various settings of the vehicle automatically prior to the user turning the vehicle on or even being inside the vehicle. In a simple case, the secondary computing device sends an electronic indication of a user’s identity to the user’s assistant-enabled vehicle. Upon receiving the electronic indication of the user’s identity, the assistant-enabled vehicle may automatically retrieve the user’s preferred settings from memory and automatically adjust one or more settings within the vehicle according to the user’s preferred
settings in order to facilitate quick and easy preparation of various personalized settings in a vehicle. In other examples, rather than the vehicle being assistant-enabled, the vehicle may simply be configured to store and execute a non-assistant application. An assistant on the secondary computing device may be configured to control the application on the vehicle and may adjust the one or more settings of the vehicle through the non-assistant application.

In this way, the assistant automatically prepares various operational settings of the vehicle without requiring the user to manually adjust each setting upon entering the vehicle. By storing these settings for retrieval upon receiving an indication of a user’s identity, the assistant reduces the time between the user entering (or approaching) the vehicle and the vehicle being ready for operation i.e., having the user’s preferred settings, especially in instances where the vehicle is used by multiple different users who have varying preferred settings. The techniques described herein have many applications and use cases. Although an assistant in a vehicle is described throughout the disclosure, an assistant executing in any computing environment could benefit from use of the techniques described herein.

Throughout the disclosure, examples are described where devices and systems analyze information (e.g., locations, movements, calendars, communications, settings, etc.) associated with users of the devices and systems only if the devices and systems receive explicit permission from the users to analyze the information. For example, in situations discussed below in which an automobile and/or information server system collects and aggregates contextual information regarding various settings and/or destinations associated with a user, the user may be provided with an opportunity to control whether the devices and/or systems can collect and make use of the information, and to dictate how the devices and systems present information to the user. Additionally, certain data may be treated in one or more ways before the devices and systems
store or use the information so that any personally-identifiable information is removed before storage or use. As such, the individual users maintain control over how information is collected about the user and how the information is used by the device and/or system.

Consider the example system shown in Figure 1 which is configured to provide an assistant in accordance with the techniques described herein. The system includes two computing devices communicating across a network.

![Diagram](image)

**Figure 1**

The network represents a combination of any one or more public or private communication networks, for instance, television broadcast networks, short-wavelength wireless networks, cable or satellite networks, cellular networks, Wi-Fi networks, broadband networks,
and/or other type of network for transmitting data (e.g., telecommunications and/or media data) between various computing devices, systems, and other communications and media equipment.

The first computing device with the assistant module and the user information data store may represent any type of computing device, server, or other system that is configured to execute an assistant and communicate on a network. For example, the first computing device may be an assistant-enabled automobile.

Similarly, the second computing device (shown only with the user identity information data store) may represent any type of computing device, server, or other system that is configured to execute communicate on a network with an assistant-enabled device. The second computing device may not be assistant-enabled itself; although, in some instances, the second computing device may also execute an assistant. In some examples, the second computing device may be shared assets of multiple users. Examples of the second computing device include cloud computing environments, mobile phones, tablet computers, wearable devices, laptop computers, stereos, computerized keys, computerized keychains, and any and all other type of mobile and computing device that is configured to communicate over the network with an assistant-enabled device. For example, the computing device may be a radio-enabled computerized keychain. The second computing device may store an indication of the user’s identity in the user identity information data store. The second computing device may be configured to send the indication of the user’s identity to the assistant-enabled computing device when the second computing device is within a particular distance from the assistant-enabled computing device.

The assistant module (also referred to as “the assistant) may execute at the assistant-enabled computing device to provide assistant services to users of the assistant-enabled
computing device. Examples of assistant services include altering various settings of an automobile based on a received indication of a user identity. These settings, when the assistant-enabled computing device is an automobile, include a seat position, a cabin temperature and other climate control settings (e.g., seat warmers, defrost, air conditioning power and location, etc.), a mirror location, music or radio preferences, directions to a predicted destination, or any other alterable setting within the assistant-enabled computing device (e.g., the assistant-enabled automobile). The user may adjust such settings by, e.g., providing manual, audible, tactile, or other form of user input.

As a user interacts with the assistant and settings within the automobile, the assistant may obtain personal information about the user. Examples of personal information include: habits, preferences for settings within the automobile, location histories, contacts, communications, interests, and other types of user information. After receiving explicit permission from the user, the assistant may store the personal information and an indication of the user’s identity at the user information data store and, in the course of providing assistant services, make use of the personal information stored at the user information data store.

In these and other examples, while interacting with the user, the assistant may collect, cluster and/or index data for storage in one or more data stores that store interaction history information (e.g., the user information data store). In some cases, the assistant may store the interaction history locally on the assistant-enabled computing device, while in other cases, the assistant may store at least part of the history on one or more external computing systems which are coupled to the interactive assistant via one or more networks (e.g., one or more wired and/or wireless networks).
The assistant-enabled computing device and the assistant treat the information stored at the user information data store such that the information is protected, encrypted, or otherwise not susceptible to hacking or unauthorized use. The information stored at the user information data store may be stored locally at the assistant-enabled computing device and/or remotely (e.g., in a cloud computing environment accessible via the network). The user information data store may also store information for multiple different users such that the assistant-enabled computing device may be shared amongst multiple users.

For example, a user may set a seat position setting and a temperature setting prior to using a particular assistant-enabled automobile to drive to work. The assistant may save these preferred settings to a user database, along with an indication of the user’s identity. A second device, such as the user’s mobile telephone, may provide the indication of the user’s identity to the automobile. Later that day, the user’s spouse may use the same automobile to go to the grocery store. Prior to the user’s spouse using the automobile, the user’s spouse may adjust the seat position setting and the temperature setting such that the settings correspond to the user’s spouse’s preferences. The assistant may also save these preferred settings to the user database, along with an indication of the user’s spouse’s identity. Here, the identity may be as simple as “user A” versus “user B”. Anything involving more personal data will have associated with it additional and specific privacy and permission protections for each user. A third device, such as a computerized key, may provide the indication of the user’s spouse’s identity to the automobile. The next day, when the user is again about to enter the automobile to go to work, the user’s mobile telephone may send an indication of the user’s identity to the automobile. Using the indication of the user’s identity, the assistant may retrieve the preferred settings of the user that
matches the received indication of user identity and automatically adjust the seat position setting and the temperature setting to the preferred settings of that user.

When a user is interacting with the assistant, the assistant may further define a context of the user. The context is indicative the state of the previously determined user, the user’s environment, and/or the operating environment of the assistant-enabled computing device at which that particular assistant is executing, at a particular time. The context might indicate a location of the user, a time of day, weather conditions, traffic conditions, an activity performed by the user, other people in the presence of the user, or any other information that could alter particular settings within the vehicle.

For instance, if a particular user is entering the driver’s seat of the automobile (as detected via proximity of the phone to the automobile), the assistant may determine a time, a day, and a location of the automobile. If it is during the morning on a weekday and the automobile is at the user’s home, then the assistant may predict that the user is driving to work and provide directions to the user’s place of business based on preferred routes and traffic conditions. If it is during the evening on a weekday and the automobile is at the user’s place of business, then the assistant may predict that the user is driving home and provide directions to the user’s home based on preferred routes and traffic conditions. In another instance, if it is during the morning on a weekend and the automobile is at the user’s home, then the assistant may predict that the user is driving to a regular workout class that the user attends on weekends and provide directions to the user’s gym of preference based on preferred routes and traffic conditions.

In another instance, if the user is entering the vehicle by themselves, then the assistant may set the climate control settings to be in accordance with the user’s preferred settings.
However, if the user is entering the vehicle with an additional user, or multiple additional users, then the assistant may set the climate control settings to be more moderate than if the user was by themselves, or the assistant may set various zones within the automobile to be in accordance with each of the additional user’s preferred settings to create a multi-zone environment. Similarly, if additional users are in the vehicle, the assistant may alter seat positions for each of the additional users based on the preferred settings of the additional users. The automobile may determine the presence of additional users either through the detection of multiple devices configured to communicate with the automobile, through weight sensors in the seats, through the detection of multiple doors opening before the vehicle’s ignition is started, or through any other means that may detect the presence of additional users.

In yet another instance, if the user is entering the vehicle by themselves, then the assistant may set the radio to be in accordance with the user’s preferred settings. If the user’s spouse is entering the vehicle alone, then the assistant may set the radio to be in accordance with the user’s spouse’s preferred settings. However, if the user and the user’s spouse are both entering the vehicle together, then the assistant may set the radio to a third set of preferences that are stored in the user information data store based on the context of both user’s being in the vehicle together.

The assistant may further alter settings when multiple users are in the vehicle based on which user is driving and which user is the passenger. The assistant may determine which user is driving based on proximity sensors within the vehicle, weight sensors, or motion sensors, driving patterns, or any other indication of where the user is positioned within the vehicle.

In another example, the second computing device may include additional information in the indication of the user’s identity that the second computing device sends to the assistant-enabled computing device. For instance, the second computing device may store a copy of the
user’s preferred settings that are stored in the assistant-enabled computing device. As such, if the user of the second computing device enters a different vehicle other than the automobile of the assistant-enabled computing device (e.g., a rental car, a taxi, a friend’s vehicle, a newly purchased vehicle, a self-driving car, etc.), the second computing device may send the copy of the user’s preferred settings to the different vehicle such that the different vehicle may prepare the vehicle for the user’s operation.

In other instances, the second computing device may store an indication of the user’s current environment. For example, the second computing device may be a mobile phone in the user’s home that controls various household appliances, such as a heat control device or an entertainment device. The second computing device may set the temperature in the user’s home to be at a particular temperature and may set the entertainment device to be playing a particular radio station. When the user leaves the user’s home to enter the assistant-enabled automobile, the second computing device may send an indication of the user’s identity to the assistant-enabled automobile along with the particular temperature within the user’s home and the particular radio station playing on the entertainment device. In doing so, the assistant-enabled automobile may provide a continuous environment, having the environment of the assistant-enabled automobile mimicking the environment of the user’s home. This may be to the extent that the assistant notes at which point a particular song or podcast was playing when the user exited the house, and starts back up at that point when the user enters the vehicle.

In this way, the assistant may automatically prepare the environment of a vehicle to be a user’s preferred environment, regardless of whether the preferred environment is an overall environment, an environment based on a current context, a shared environment with other users, or a continuous environment based on current settings of where the user previously was located.
prior to entering the vehicle. By automatically altering the settings of the automobile in this way, the assistant may greatly reduce the time it would typically take a user to manually adjust each of the numerous settings within the vehicle, especially in instances where the vehicle is a shared vehicle or a vehicle the user has not previously operated.