Contextual Suggestions Based on Driving Stage and Context

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ABSTRACT

A framework for providing suggestions based on drive context is described. Described techniques can be implemented in virtual assistant or other software accessed via a device directly installed in a vehicle or available via a user mobile device paired with a vehicle infotainment system. With user permission, a drive context and a drive stage (e.g., pre-drive, active drive, end of drive) is determined based on one or more user-permitted factors, and is utilized along with other permitted contextual information to generate a ranked list of suggestions for activities such as media playback, communication actions (calls, messages, etc.), etc. and of informational content. The top ranking suggestions are provided to the user via a user interface. User selection of the suggestions can trigger user-requested actions such as starting media playback, placing a call, etc.

KEYWORDS

- Virtual assistant
- In-car assistant
- Navigation system
- Infotainment system
- Contextual suggestion
- Drive context
- Drive stage
- User context

BACKGROUND

Many vehicles include integrated in-vehicle audio and navigation systems (infotainment systems) that include a virtual assistant for use by vehicle occupants when driving. Some vehicles enable a user to pair in-car infotainment systems to their mobile phones or other devices, e.g., via an automotive mode, and can also enable access to a mobile device virtual assistant when the mobile device is in a driving mode.
The virtual assistant (in-car assistant) can be utilized for a variety of tasks, e.g., to play music, to listen to an audiobook, to place or receive calls, to send or receive messages, etc. Suggestions are provided to the user to aid user selection. However, depending on the driving context, a user has a varying ability to interact with such a system to carry out tasks. For example, while driving it can be difficult for the user to access digital maps and set their destination address, or to open a phone dialer to place a call, since such actions can be distracting and/or may require precise touch input via a touchscreen.

DESCRIPTION

A system that automatically provides actionable or informational suggestions (e.g., via the infotainment system user interface) tailored to the user driving state can minimize user distraction and enhance the user experience. This disclosure describes the automatic generation of actionable suggestions and/or informational messages for user selection via a user interface for use when the context of use is driving. The suggestions are generated based on user-permitted information accessed in the context of a drive. The described techniques can be implemented in virtual assistant software accessed via a device directly installed in a vehicle, e.g. integrated into a head unit or dashboard of a car and/or in virtual assistant software accessed via a user mobile device configured in a driving mode (e.g., paired to an in-car system).

<table>
<thead>
<tr>
<th>Drive stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-drive</td>
<td>Time before a user has embarked on a drive</td>
</tr>
<tr>
<td>Start of drive</td>
<td>The user is inside the vehicle but the vehicle is not in motion</td>
</tr>
<tr>
<td>Active drive</td>
<td>The user is in an active driving state</td>
</tr>
<tr>
<td>End of drive</td>
<td>The user has completed their drive but is still inside their vehicle</td>
</tr>
</tbody>
</table>

Table 1: A typical drive can involve multiple drive stages
Table 1 lists example drive stages that occur during a typical drive. For example, a pre-drive stage can include a period when the user has not yet entered a vehicle. A start of drive stage can include a time when the user is inside the vehicle, but the vehicle is not yet in motion. An active drive stage can represent the time when the user is driving, and where their focus is on the road and the surrounding environment. An end of drive stage can include a time when the trip is completed but the user is still in the vehicle.

Per techniques of this disclosure, a drive context is determined based on the drive stages and is utilized to provide contextual suggestions to the user. The drive stage is determined based on information obtained, with user permission, from a user device, e.g. a mobile phone or other device. In some implementations, the drive stage is determined based on contextual information obtained directly from an interface to the vehicle itself, e.g. via a communication interface established between an in-vehicle audio/navigation system and a vehicle information system. Some examples of contextual information include a navigation state (e.g., time-to-destination, destination, current location, whether the destination is a home location or a work location), recipients and/or originators of recent calls and/or messages with the user, locally stored messages that were previously received and/or sent, etc. Information is accessed locally for the specific purpose of determining drive context.
Fig. 1: Drive context based suggestions provided via in-vehicle integrated system

Fig. 1 depicts example drive context based suggestions provided to a user, per techniques of this disclosure. The suggestions can be provided as a displayed user interface utilizing a suitable user interface such as a display device of an in-vehicle audio/navigation system.

In a first illustrative example, a user is determined to be in a pre-drive stage. The user enters a destination, and based on navigation data, it is determined that the user is embarking on a drive that is expected to take 5 hours and 10 minutes to reach the destination. Based on a
determined drive context indicative of a long drive, the user is prompted with a suggestion via a user interface whether they would like to listen to an audiobook from their collection.

In another illustrative example, a user is determined to be in a pre-drive stage. Based on user provided destination information and user activity history that is obtained with user permission, it is determined that the user is on their way to customarily drop their child off at day-care. The user is prompted via the user-interface whether they would like to play suitable media, e.g. nursery rhymes, identified based on user preferences. The user is provided with easy selection options to provide their response. This illustrative example also depicts informational content being provided to the user. For example, the user is provided with a reminder about upcoming appointments (“Your next meeting is at 11am”) via the user interface.

In another illustrative example, it is determined that the user is in an active drive stage. Based on received navigation and other contextual information, it is determined that the user is driving home, and that due to traffic delays, the user is expected to arrive later than an initially scheduled time. Based on the determination, the user is prompted whether they would like to place a call or send a text message to their spouse to provide an updated arrival time. Easy touch-based response options are provided that enable the user to select an option with minimal distraction. The responses can also be selected by voice input. Additional examples include navigation suggestions, e.g., to add a stop to refuel/ charge a vehicle battery, directions to a predicted destination, etc.
Fig. 2: Suggestions are based on multiple inputs, including a drive context

Fig. 2 depicts an example framework for contextual generation of suggestions, per techniques of this disclosure. As depicted, a variety of inputs can be utilized to generate relevant suggestions.

The user’s privacy settings are accessed to determine the factors that the user has permitted for use to determine drive context and provide suggestions. If the user does not provide permission or if the user has turned off the suggestions feature, user information is not accessed. If the privacy settings indicate that the user has provided permission, one or more input factors are accessed. Some examples of input factors include:

- Vehicle location
- Connectivity status and signal strength information of paired devices, e.g., mobile phones
- User context - Number and characteristics of vehicle occupants
- Drive/vehicle context
- Recent user activity - e.g., recent searches (e.g., weather at a location), recent commands to the virtual assistant, etc.
Display context - Information related to the user interface of the vehicle infotainment system and/or user device

A suggestion generation module receives a request for suggestions, for example, from a module associated with an integrated audio/navigation system. The user-permitted inputs are analyzed to determine contextual information, including a drive stage and/or a drive context. Based on a determined user context, relevant suggestions and/or informational content are generated, which are then filtered and ranked.

A ranked list of suggestions and/or informational content that can be presented to the user is provided to a module associated with a user interface, e.g., of an infotainment system, virtual assistant, etc. The list of suggestions can include metadata that can be utilized to implement user-requested actions based on user selection, e.g., via a tap, voice command, etc. received via the user interface.

Further to the descriptions above, a user may be provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable collection of user information (e.g., information about a user’s driving context, vehicle, social network, social actions or activities, profession, a user’s preferences, or a user’s current location), and if the user is sent content or communications from a server. In addition, certain data may be treated in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a user’s identity may be treated so that no personally identifiable information can be determined for the user, or a user’s geographic location may be generalized where location information is obtained (such as to a city, ZIP code, or state level), so that a particular location of a user cannot be determined. Thus, the user may have control over
what information is collected about the user, how that information is used, and what information is provided to the user.

CONCLUSION

A framework for providing suggestions based on drive context is described. Described techniques can be implemented in virtual assistant or other software accessed via a device directly installed in a vehicle or available via a user mobile device paired with a vehicle infotainment system. With user permission, a drive context and a drive stage (e.g., pre-drive, active drive, end of drive) is determined based on one or more user-permitted factors, and is utilized along with other permitted contextual information to generate a ranked list of suggestions for activities such as media playback, communication actions (calls, messages, etc.), etc. and of informational content. The top ranking suggestions are provided to the user via a user interface. User selection of the suggestions can trigger user-requested actions such as starting media playback, placing a call, etc.

REFERENCES