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Contextual Proactive Suggestions for Custom Commands for Vehicle Components

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Contextual Proactive Suggestions for Custom Commands for Vehicle Components

ABSTRACT

Many vehicle components that are sourced from OEMs offer interactive capabilities that enable users to control them using mechanisms such as a voice-based virtual assistant via a spoken command. However, users typically lack awareness of the existence of the commands, thus failing to use them despite their availability. Mechanisms for facilitating proactive and contextually opportune discovery of interactive control options are typically limited to first party components. This disclosure describes techniques that enable OEMs to facilitate user discovery of their custom interactive capabilities by registering the commands and associated metadata with the vehicle platform. With user permission, local contextual information is analyzed to provide suggestions for OEM commands at opportune times based on triggering rules. OEMs can contribute to defining the triggering rules. The user can issue the command in any convenient manner, such as tapping or speaking which is then executed on the OEM component. The proactive and contextually relevant assistance can make the driving experience safer and more comfortable while enhancing the knowledge of vehicle capabilities and how they can be controlled through a virtual assistant.

KEYWORDS

- Original Equipment Manufacturer (OEM)
- Contextual suggestion
- Proactive suggestion
- Custom voice command
- Vehicle platform
- Driving context
- Vehicle console
- Virtual assistant
- Command metadata
- Triggering condition

BACKGROUND

Vehicles include parts and equipment sourced by the vehicle manufacturer from third parties commonly known as original equipment manufacturers (OEMs). For example, OEMs may supply vehicle components such as heat ventilation and air conditioning (HVAC) units, navigation, transmission, stereo, etc. Increasingly, many of the OEM components within vehicles offer interactive capabilities that enable users to control them using mechanisms such as a voice-based virtual assistant. For example, a user can control the HVAC unit of their car by saying "Turn on the heat and set temperature to 72 degrees."

OEMs can specify the interactive capabilities, such as voice commands, supported by their equipment using a standard mechanism such as application programming interfaces (APIs), explicit specification within a platform for integrating the equipment with the vehicle functions, etc. Such mechanisms make the interactive capabilities available to users. However, users often lack awareness of the existence of the commands, thus failing to use them despite their availability. While there are mechanisms for facilitating proactive and contextually opportune discovery of interactive options such as voice commands for a virtual assistant, these mechanisms are often limited to the interactive capabilities of first party manufacturers of devices, applications, and operating systems (OS), thus excluding those offered by OEM components.

DESCRIPTION

This disclosure describes techniques that enable OEMs of vehicle components to facilitate user discovery of their custom interactive capabilities, such as supported custom voice commands, by suggesting them to the user at contextually appropriate times, determined based on factors accessed with user permission. The proactive suggestions can include voice

commands that are relevant and selectable at the current moment during the drive. Users can then choose whether to invoke the suggested commands to perform the corresponding operation on the OEM component.

OEMs can provide each available custom command for interacting with their components along with relevant related metadata such as required parameters, type of suggestion presented to the user, text to display (or provide as audio) for suggesting the command, conditions under which the suggestion is to be triggered, model IDs for the components that support the command, operation to perform for fulfilling the command, text to display (or provide as audio) upon command fulfillment, priority associated with the command, etc. The available custom commands can be registered with the higher-level platform via any suitable mechanism such as specifying the custom actions and their metadata via a template in the onboarding process for integrating an OEM component within a vehicle.

The custom command information from the various OEMs is aggregated and stored at a server. The aggregation process includes mechanisms for deduplicating custom OEM commands and generating a set of suggestions by applying various constraints such as limits on the number of suggestions in a set for each OEM based on usage frequency and recency. With appropriate user permission, usage history can be used to determine the user cohort type for a custom OEM suggestion.

Based on contextual information about the drive obtained with user permission, users can be proactively offered one or more suggestions from the set of custom OEM commands obtained from the server for which the contextual triggering conditions are satisfied. The platform allows OEMs to define a wide range of triggering conditions, such as vehicle status information (such as speed, temperature, etc.), time since last shown, suggestion importance, etc. With user

permission, contextual information about the vehicle and its various components is processed locally at the client to determine whether the context meets the triggering rules for one or more of the server-provided custom OEM commands. For instance, if the temperature drops while passing through a mountainous area, the user can be offered a suggestion for controlling the OEM HVAC: “Try saying turn the heat up to 72 degrees.”

The proactive suggestion for the contextually relevant custom OEM command can be surfaced to the user in any suitable manner, such as displaying it on the user interface (UI) of the vehicle console. When displayed within the UI, the text of the command is shown along with an icon associated with the OEM and the model ID of the OEM component connected to the command. The user can invoke the command in any convenient manner, such as tapping the suggested command text on the touchscreen console, speaking the suggested text to issue a voice command, etc. The command can then be executed on the user’s behalf via a virtual assistant to carry out the operation associated with the command as provided by the OEM. If the execution is connected to a specific app, such as a smartphone app, the app is automatically opened, and the command is fulfilled. Alternatively, if the user permits, the command is executed by calling the appropriate OEM or cloud API to control the corresponding OEM component.

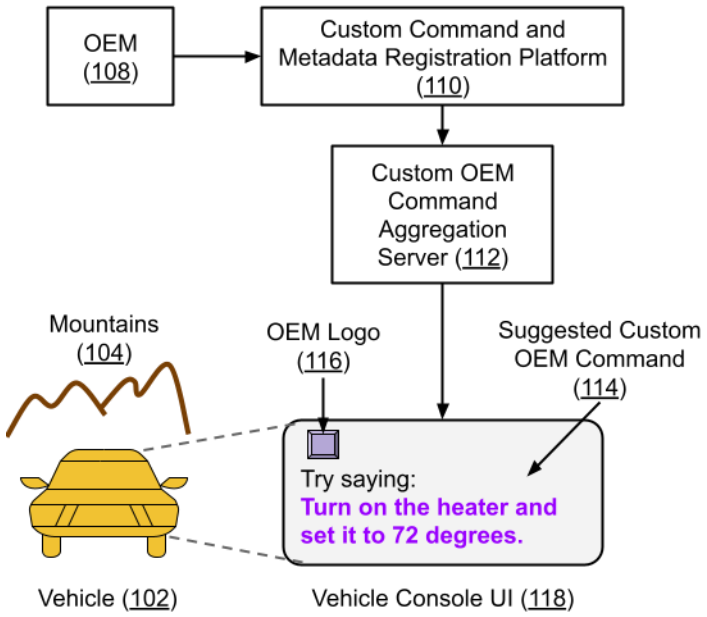

Fig. 1: Suggesting a contextually relevant custom command to control an OEM component

Fig. 1 shows an example of operational implementation of the techniques described in this disclosure. A user enters a region with mountains (104) while in a vehicle (102). The drop in the temperature in the mountain region is detected and a contextually relevant suggestion for a custom command (114) to operate the OEM HVAC is generated, providing the user an option for turning on the heat and setting a comfortable temperature. The command in the suggestion is from a set of custom OEM commands obtained from a server (112) that aggregates the commands and associated metadata registered by OEMs (108) with the vehicle platform (110). The suggested command is displayed in the UI of the vehicle console (118) along with the OEM logo (116). If the user invokes the command, it is fulfilled, e.g., via a virtual assistant, by performing the corresponding operation on the OEM component.

By specifying contextual conditions for triggering a proactive suggestion for a custom OEM command when registering it with the vehicle platform, OEMs can facilitate user discovery and awareness of the command at times when the action is likely to be of high

relevance for the user. For instance, a user driving on a freeway without much variation in speed can be offered a suggestion for turning on the cruise mode at a particular speed.

In case multiple of the suggestions in the set of proactive custom OEM suggestions are contextually relevant, the client can rank them based on ranking rules provided by the server. For instance, the ranking can be based on usage information, such as interaction rate, relevance according to the template provided by the OEM, etc. Only the top N of the ranked suggestions can then be presented to the user where N is a number between 1 and the total number of ranked suggestions that fit the current context.

The techniques described herein can be implemented to support any vehicle and interactive OEM component and can be integrated with any virtual assistant. Implementation of the techniques can enable OEMs to leverage the capabilities of the underlying vehicle platform to help users discover the interactive capabilities of their components, thus facilitating more use and promoting greater brand awareness for their services.

The proactive and contextually relevant assistance for controlling the OEM components in their vehicles can make the driving experience safer and more comfortable. In addition, the suggested custom OEM commands can enhance the knowledge of the vehicle capabilities accessible via a virtual assistant and spoken commands and instill confidence in using voice commands to invoke such functions.

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 car model, a user’s current context, 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

This disclosure describes techniques that enable OEMs to facilitate user discovery of their custom interactive capabilities by registering the commands and associated metadata with the vehicle platform. With user permission, local contextual information is analyzed to provide suggestions for OEM commands at opportune times based on triggering rules. OEMs can contribute to defining the triggering rules. The user can issue the command in any convenient manner, such as tapping or speaking which is then executed on the OEM component. The proactive and contextually relevant assistance can make the driving experience safer and more comfortable while enhancing the knowledge of vehicle capabilities.

REFERENCES

1. Krishnan, Vinod, and Vikram Aggarwal. "Automated assistant suggestions for third-party vehicle computing devices with restricted architecture." U.S. Patent 10,996,925, issued May 4, 2021.
2. Natarajan, Sriram and Singh, Dharminder, "Contextual Suggestions Based on Driving Stage and Context", Technical Disclosure Commons, (December 11, 2020) https://www.tdcommons.org/dpubs_series/3876

3. Aggarwal, Ankur; Tillman, Bálint; and Natarajan, Sriram, "On-device Ranking for Displaying Suggestions", Technical Disclosure Commons, (March 18, 2021) https://www.tdcommons.org/dpubs_series/4161
4. Skobeltsyn, Gleb, Olga Kapralova, Konstantin Shagin, Vladimir Vuskovic, Yufei Zhao, Bradley Nelson, Alessio Macrì, and Abraham Lee. “Supplementing voice inputs to an automated assistant according to selected suggestions.” U.S. Patent Application 16/343,683, filed September 9, 2021.