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Proactively Suggesting Context Appropriate Home Automation Actions

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ABSTRACT

Smart home devices can be controlled via user commands to a virtual assistant. However, the need to issue explicit commands to the virtual assistant for tasks performed routinely in specific contexts limits the user experience. This disclosure describes a virtual assistant with the capability of proactively suggesting relevant domestic actions to smart home users. The suggested actions can be chosen from a database of relevant home automation actions. Each action in the database can be associated with relevant information regarding the context in which the action was performed. When a user's context matches that for past actions recorded in a database, a virtual assistant can proactively ask whether the user would like to perform the corresponding action(s) and automate it in the future. Implementation of the techniques can enable a virtual assistant to anticipate home-related user needs and provide a proactively helpful user experience. Having routine domestic tasks suggested proactively in the right contexts along with the option to automate initiation of the actions in the same context in the future can enhance efficiency, convenience, and utility of smart home environments.

KEYWORDS

- Smart home
- Smart device
- Smart appliance
- Internet-of-Things (IoT)
- Home automation
- Virtual assistant

BACKGROUND

Smart devices and appliances are becoming more common in homes and enable smart home features. Smart home devices include everyday household objects or appliances, such as doorbells, thermostats, speakers, lights, fans, weighing scales, beds, mattresses, blankets, faucets, blinds, etc., that are augmented with digital capabilities. Such physical objects augmented with intelligent functions are also referred to as Internet-of-Things (IoT) devices. Users can control their home and perform various actions via smart home devices.

Users can leverage virtual assistants via such devices, including virtual assistants that implement artificial intelligence (AI) technologies, to control smart home devices for performing the actions. For example, a user can ask a virtual assistant to adjust the lights to a dimmer or brighter setting as necessary. Currently, users must initiate such actions manually by issuing the corresponding command to a virtual assistant. Manual invocation is necessary even when the user routinely performs the same action in a given context. For instance, a user who always dims the lights whenever watching television in the evening must provide a command to the virtual assistant to dim the lights each time.

DESCRIPTION

This disclosure describes a virtual assistant with the capability of proactively suggesting relevant domestic actions to smart home users. The suggested actions can be chosen from a database of relevant home automation actions. With appropriate user permission, the database can include the user's historical smart home actions or routines as well as crowdsourced actions/ routines. Each action in the database can be associated with relevant information regarding the context in which the action was performed.

With user permission, the user's current context within the smart home is obtained. When the current context matches that for one or more of the actions in the database, the virtual assistant can proactively ask whether the user would like the corresponding action(s) to be performed. For example, when a user turns on the television in the evening, the virtual assistant can proactively ask whether the user would like to have the lights dimmed when the database indicates that the user routinely dims the lights prior to watching television in the evenings. If the user accepts a proactively suggested action, the virtual assistant can further ask whether the user would prefer to have the action performed automatically in the future whenever the same context is detected. If the user agrees, the action can be performed in matching future contexts without the need for user confirmation.

If a user declines a proactive action suggestion, a counter corresponding to the action in the database can be incremented to record the number of times the user has declined the action in the specific context. Actions for which the corresponding counters exceed a threshold value are excluded from being suggested to the user in the corresponding contexts. The counter can also be adjusted if the user manually provides a command for the action in the corresponding context.
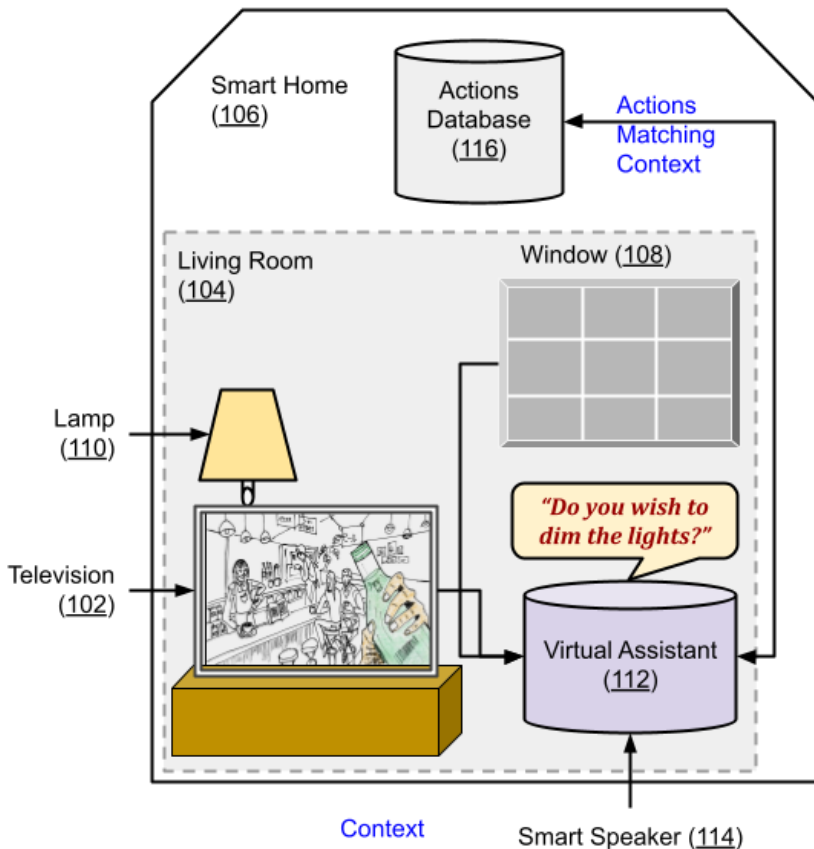
Fig. 1: Suggesting a home automation action based on the current context

Fig. 1 shows an example operational implementation of the techniques described in this disclosure. A user turns on the television (102) in the evening in the living room (104) of the user's home (106) equipped with smart home devices, such as a lamp (110) with a smart light bulb. A virtual assistant (110) provided via a smart speaker (112) is used to look up whether the user's context matches any actions in a database (114) of the user's previous actions within the home. Upon finding a matching action of dimming the lights in a similar context, the virtual assistant proactively generates a suggestion to the user regarding whether the user wishes to dim the lights. While Fig. 1 illustrates a smart speaker providing the query, depending on the user's smart home devices, any suitable device (e.g., the television, the lamp, or other devices) can generate and/or provide the suggestion.

In some cases, an action matching the user's context may require the use of a smart home device that is not already present in the user's home. For example, dimming the lights via a virtual assistant requires a smart light bulb or smart switch. In such cases, virtual assistant interaction can be leveraged to explain the suggested action with recommendations for purchasing the smart home devices needed to automate the action through a virtual assistant.

With user permission, the techniques described in this disclosure can be used with any devices with smart capabilities that can be accessed via a virtual assistant. The virtual assistant functionality can be provided via any suitable device, such as smart speaker, smartphone, smartwatch, smart home hub, etc. The threshold value of any counters needed in an operational implementation of the techniques can be set by the developers and/or determined dynamically at runtime. The database of smart home actions can be stored locally with the smart home environment or hosted with permission at an external location, such as in the user's online account.

Implementation of the described techniques can enable a virtual assistant to anticipate home-related user needs and provide a proactively helpful user experience. Having routine domestic tasks suggested proactively in the right contexts along with the option to automate initiation of the actions in the same context in the future can enhance efficiency, convenience, and utility of smart home environments.

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 smart home devices, a user's context within a smart home, a user's commands to a virtual assistant, 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 a virtual assistant with the capability of proactively suggesting relevant domestic actions to smart home users. The suggested actions can be chosen from a database of relevant home automation actions. Each action in the database can be associated with relevant information regarding the context in which the action was performed. When a user's context matches that for past actions recorded in a database, a virtual assistant can proactively ask whether the user would like to perform the corresponding action(s) and automate it in the future. Implementation of the techniques can enable a virtual assistant to anticipate home-related user needs and provide a proactively helpful user experience. Having routine domestic tasks suggested proactively in the right contexts along with the option to automate initiation of the actions in the same context in the future can enhance efficiency, convenience, and utility of smart home environments.

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