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Automatically Detecting and Assisting a Drowsy Driver

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ABSTRACT

This disclosure describes a virtual assistant that provides suitable interventions and/or suggestions to drivers to mitigate risks from drowsy driving. With user permission and express consent, the virtual assistant receives inputs from multiple sensors, devices, and systems that provide driving context information. For example, the virtual assistant can be provided via a wearable device, a mobile device, vehicle infotainment system etc. Inputs are received from various user-permitted sensors on one or more of these devices and are utilized to calculate a drowsiness score for the driver. Based on the drowsiness score, suitable interventions and suggestions are provided via audio, visual, or another interface. With user permission, tools to enhance driver alertness such as live conversation, jokes, games, etc. are provided.

KEYWORDS

- Drowsy driving
- Distracted driving
- Traffic safety
- Driving assistant
- Virtual Assistant
- In-car assistant
- Drowsiness detection
- Contextual suggestion
- Infotainment system

BACKGROUND

Driving while drowsy can lead to traffic safety incidents, including automobile crashes. Virtual assistant applications are made available via a mobile device, or a mobile device paired with the infotainment system. In some vehicles, such applications are natively built into automobile infotainment systems. Virtual assistant applications provide many types of in-vehicle

assistance, e.g., mapping a route; locating restaurants, rest stops, and coffee shops, playing media, games, communications, etc.

DESCRIPTION

This disclosure describes a virtual assistant that, with specific user permission, detects or receives information about potential drowsy driving and provides interventions and tools to the driver to mitigate risks from drowsy driving. Per techniques of this disclosure, the virtual assistant ("drowsy driver assistant") determines a likelihood of the driver being drowsy while driving through a drowsiness risk score for the driver and performs appropriate interventions.

With user permission and express consent, the virtual assistant is integrated with and receives inputs from various sensors, devices, and systems that provide driving context information. For example, the virtual assistant can be integrated with a wearable device worn by the driver, in-home smart devices, navigation applications, camera(s) in the automobile or on a mobile device of the driver, mobile device accelerometers, automobile sensors, etc. The received inputs are analyzed to calculate a drowsiness risk score for the driver. Alternatively, a separate device (e.g., mounted in the vehicle and operating with the user's permission) can detect the drowsiness risk score.

The virtual assistant is also integrated with and provides its outputs via multiple user interfaces. For example, the virtual assistant may provide interventions and/or suggestions via a speaker of the mobile device or in-car infotainment system, via a display of the mobile device or in-car infotainment system, etc.

The drowsy driver assistant feature can be activated at any time. For example, a user can initiate a query to trigger the drowsy intervention experience by using a hotword that is

recognized by the virtual assistant. The drowsy driver assistant feature is also offered to the user for activation or can be automatically activated during a drive based on a drowsiness risk.

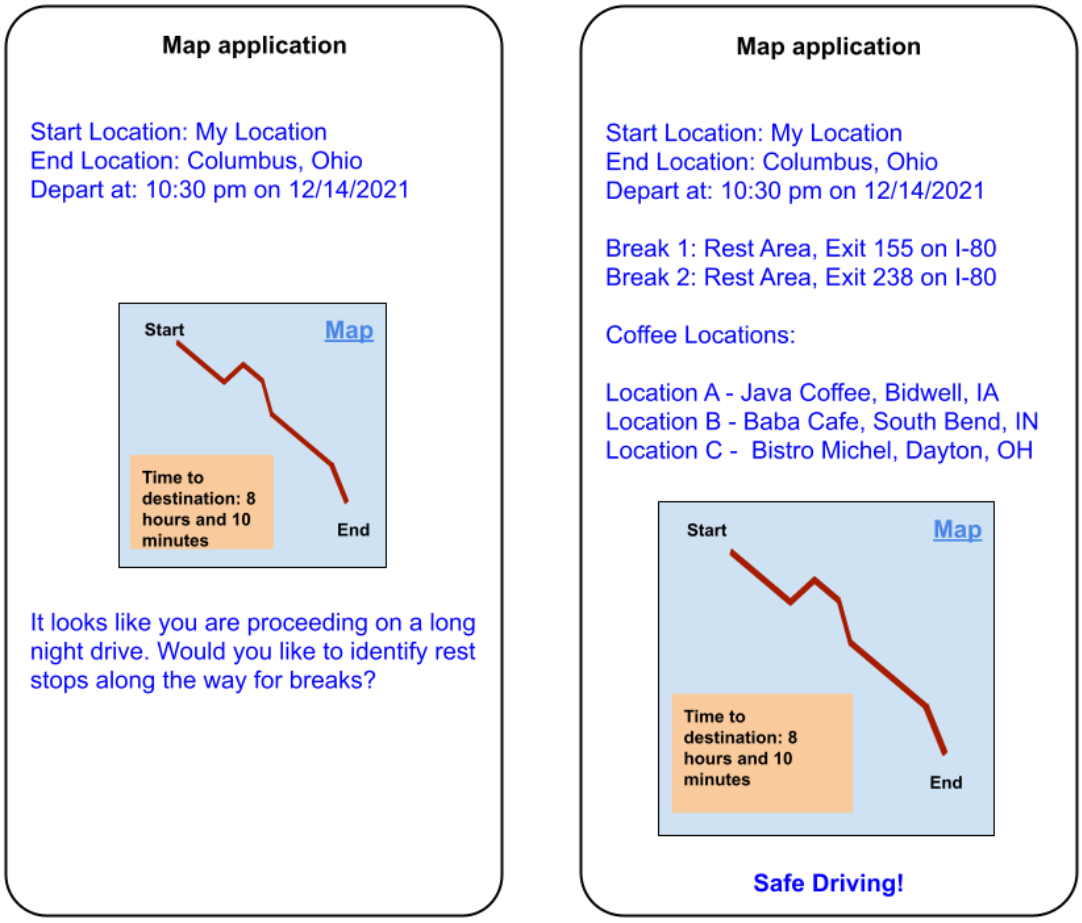

Fig. 1: Suitable rest stops suggested to a driver by a virtual assistant

Fig. 1 depicts a virtual assistant with support for drowsy driver assistance, per techniques of this disclosure. As depicted in Fig. 1, a user seeks navigational assistance (route and map information) by providing information about their start location, end location, and an expected time of departure. Based on the user-provided information, it is determined that the user is proceeding on a long drive that includes periods of night driving. The virtual assistant queries the user whether they would like to identify rest stops along the route to enable the driver to take breaks at suitable intervals. Based on user response, rest stops and coffee shops along the route

are identified and displayed to the user. The user is provided with an option to add stops of their choice to the route map for navigation. Detection of likelihood of the driver being drowsy while on the drive is based on time of the drive, duration of the drive, type of route being driven, etc.

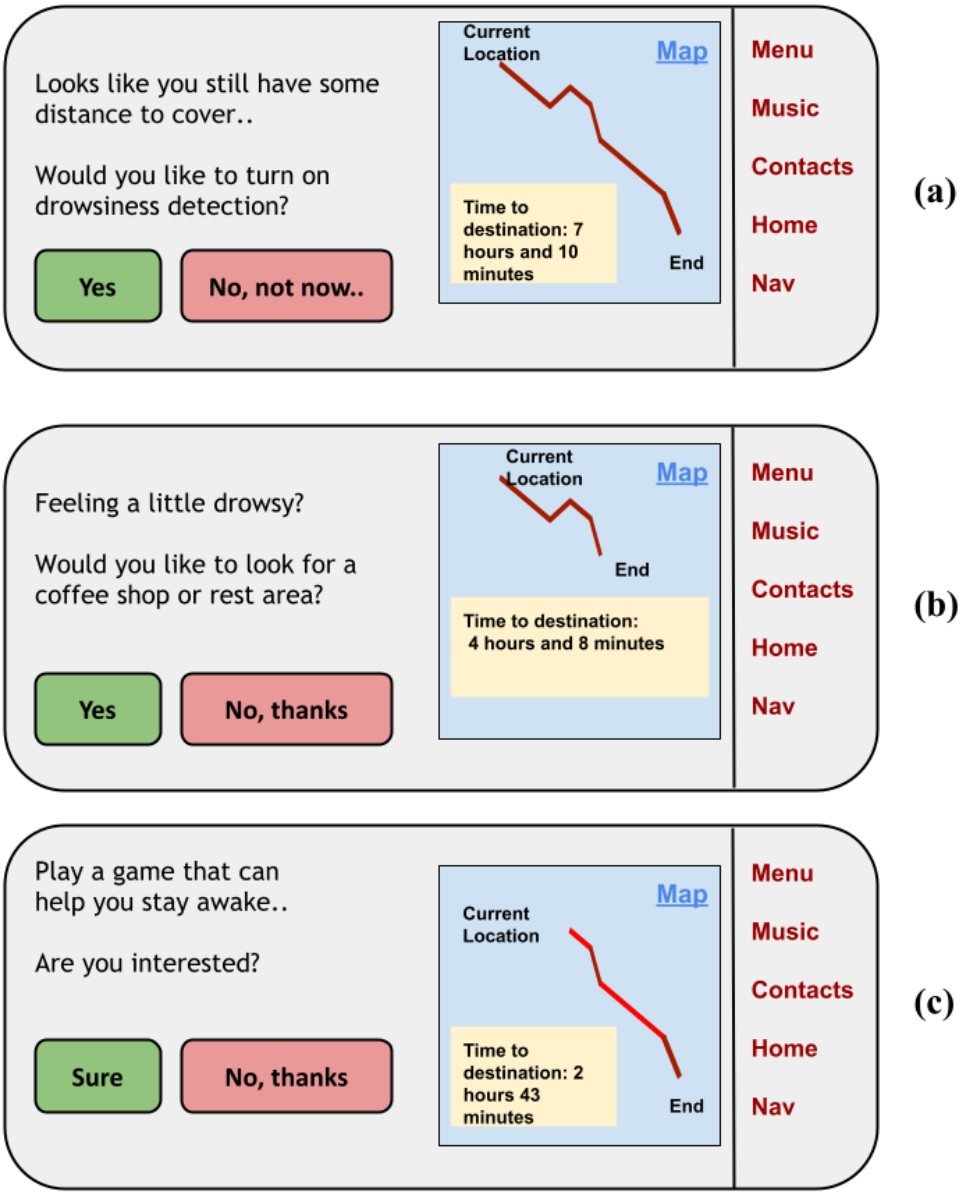

Fig. 2: Interventions are suggested by a virtual assistant based on drowsiness score

Fig. 2 depicts interventions provided by a virtual assistant based on driver drowsiness, per techniques of this disclosure. The user is provided with an option to activate a drowsy driver

assistant feature of the virtual assistant at a time of setup and/or onboarding. As depicted in Fig. 2(a), the user is also provided with a suggestion to activate the drowsy driver assistant feature at different times during a drive, based on detection of a potential for the user becoming drowsy while driving. Such detection can be based on user-permitted factors such as a time of the drive, a duration of the drive, etc.

If it is determined that the drowsiness score meets a predetermined threshold, various interventions and/or suggestions are automatically provided to the driver. Navigation information to a nearby rest area or coffee shop can be provided. Fig. 2(b) depicts a user being queried by the virtual assistant on whether they would like to locate a coffee shop or rest area along the route. As depicted in Fig. 2(c), the virtual assistant can also provide tools to enhance driver alertness by providing live conversation, jokes, playing games, etc.

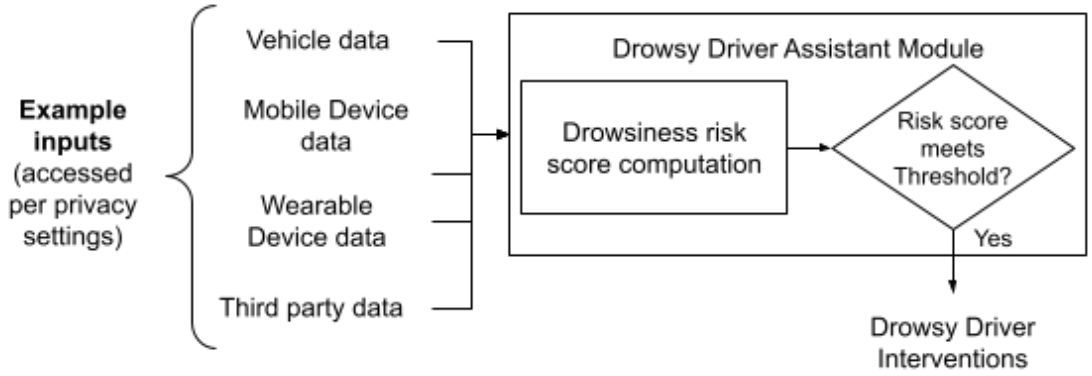

Fig. 3: Drowsy driver assistant module is integrated with multiple input devices

Fig. 3 is a block diagram that depicts integration of a drowsy driver assistant module of the virtual assistant with multiple devices and/or systems. With user permission and express consent, the drowsy driver assistant module receives vehicle data (e.g., speed, acceleration, drift, steering information), mobile device data (e.g., accelerometer data, camera data), wearable device data (e.g., sleep data), other third-party data that assists in drowsiness detection, etc. The

received data is utilized to determine a driver drowsiness score. Alternatively, the drowsiness risk score may be received directly from a separate device. Based on the driver drowsiness score meeting a predetermined threshold, suitable interventions are provided/suggested to the driver. Techniques of this disclosure can be utilized to help drivers stay alert or get off the road and promote driver safety.

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 the collection of user information (e.g., information from a user's mobile device, a user's automobile infotainment system, 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 that provides suitable interventions and/or suggestions to drivers to mitigate risks from drowsy driving. With user permission and express consent, the virtual assistant receives inputs from multiple sensors, devices, and systems that provide driving context information. For example, the virtual assistant can be provided via a wearable device, a mobile device, vehicle infotainment system etc. Inputs are received from

various user-permitted sensors on one or more of these devices and are utilized to calculate a drowsiness score for the driver. Based on the drowsiness score, suitable interventions and suggestions are provided via audio, visual, or another interface. With user permission, tools to enhance driver alertness such as live conversation, jokes, games, etc. are provided.

REFERENCES

1. "Drowsy Driving | NHTSA" available online at https://www.nhtsa.gov/risky-driving/drowsy-driving#issue-crash-factors, accessed 16 December 2021.