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Reporting road hazards using in-vehicle camera

ABSTRACT

Mobile phones, tablets, wearables, and cars themselves are increasingly aiding drivers. For example, mobile applications can alert drivers of hazardous road conditions, congestion, or accidents along the driver's route. Additionally, mobile applications permit the reporting of such situations to other users. Occasionally, drivers may want to report nearby vehicles that exhibit unsafe or hazardous driving, or observed road hazards. This disclosure describes techniques to utilize devices (e.g., cameras) within a vehicle to automatically detect information about other vehicles that exhibit hazardous driving and road incidents nearby, such as vehicles driven by intoxicated persons. Further, these techniques also enable a driver to send the information to other users nearby and the relevant authorities with minimal interaction.

KEYWORDS

- Road Conditions
- Road hazard
- Dashboard Camera
- Incident reporting

BACKGROUND

Drivers are increasingly turning to smartphone applications as driving aids. For example, smartphone navigation applications can provide a driver with information about destinations, nearby attractions, distances between places of interest, and turn-by-turn directions with estimated times of arrival taking the local traffic into account. These applications can also alert drivers to hazardous road conditions, construction, road closures, and other events that may

impact the estimated arrival time. The applications aid drivers in getting to their destinations faster and more efficiently.

Some applications also enable drivers to self-report road hazards so that other users of these applications can be aware of hazards along a route. For example, a driver may notice a stopped vehicle along their route. The drive can input this information into a smartphone application which can then alert other users of the hazard.

Some hazards are too complex to report without consuming a considerable amount of a driver's time and attention. For example, consider a late night on a holiday often associated with drivers consuming alcohol, e.g., New Year's Eve. A driver may observe a car that is moving erratically, e.g., not staying within the lines on the road, indicating a possibly intoxicated person at the wheel. While the driver can try to dial an emergency number and report the erratic vehicle, such reporting is cumbersome and prone to delays. By the time specifics such as basis of the report, location, closest highway exit, car model and make, etc. are reviewed, it may be too late for remedial action, e.g., for authorities to intercept the intoxicated driver.

Further, current mobile applications are ill-equipped to report complex roadside hazards such as erratic or intoxicated drivers or road debris. Drivers may not be able to safely capture information about potential roadside hazards. Further, drivers may be prohibited by local laws from operating a vehicle while using a smartphone or similar device. One consequence is that drivers may choose not to self-report hazards due to the time and complexity involved with reporting as well as difficulty in capturing relevant information while operating a vehicle themselves.

DESCRIPTION

This disclosure describes techniques to use device location information along with captured image data to automatically detect information about nearby erratically driven vehicles and other road hazards. The techniques provide a driver with a simplified way to report such information to relevant authorities and to other users.

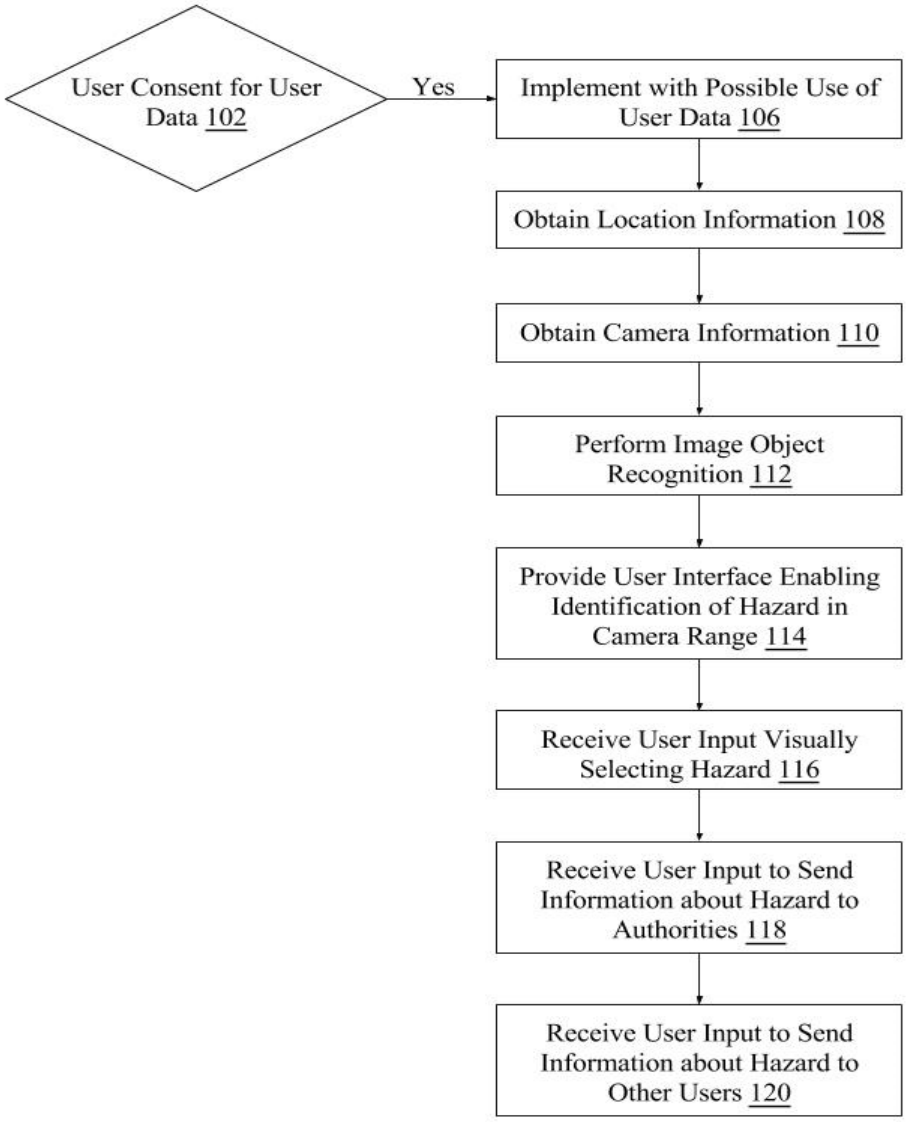

Fig. 1: Reporting road incidents using in-vehicle camera

Fig. 1 illustrates an example method to report road hazards using an in-vehicle camera. It is determined whether a driver has expressly consented to use of user data (102), e.g., location,

camera, connection information, etc. If the driver declines consent, the technique is not implemented. If the driver provides consent, the technique is implemented with possible use of user data (106).

First, when permitted by the driver, a location of the driver's device (e.g., smartphone or dash mounted capture device that includes a camera) is determined (108). In the determination of the location, information is only used as permitted. For example, if the driver permits access to data from one or more location sensors, such as global position system data (GPS) and cellular networks of the device, data from such sensors is used to determine the location. If the driver permits, location can be determined using triangulation techniques, near field communication, Bluetooth beacon data, maps data, ZigBee, Wi-Fi, accelerometer data, gyroscope data, etc. Location determination techniques that require access to data for which the driver has not provided permission are not used.

Next, when permitted by the driver, information, e.g., images captured by the camera of the driver's device is determined (110). Camera information is only used as permitted by the driver. For example, if the driver permits access to the camera, input from the camera is used. A driver may have a separate or additional camera, such as a dashboard camera or a camera built into the automobile, which is not physically connected to the driver's device. Such a camera may be paired to the driver's device, using commercially available techniques, e.g., Wi-Fi, Bluetooth, near-field communications, etc. Information from such cameras is only used as permitted by the driver. If the driver has multiple cameras, information is used from the multiple cameras, as permitted by the driver. Cameras from nearby users may also be used if nearby users consent to the use of data from their cameras.

In an example scenario, the camera in the driver's device continuously captures images of the environment around the vehicle (e.g., other vehicles, road, roadside, etc.). Images may be any type of image, e.g., a photograph, video, etc. Object recognition is performed by analyzing the obtained images if the driver has permitted such analysis (112). Object recognition identifies vehicles present within the field-of-view of the camera. If possible, additional characteristics of the vehicles identified are obtained. For example, such additional characteristics can include make, model, year, color, license plate, etc. Image recognition is used to identify one or more objects present within captured images, e.g., debris, furniture, potholes, construction equipment, stalled vehicles, etc.

Once hazards present within the camera's field of view are recognized, a user interface is provided (114) as an overlay to the camera's user interface (e.g., atop the viewfinder). The user interface can be displayed on a smartphone screen, a viewfinder, a screen attached to the camera itself, or another apparatus suitable for view-finding and receiving user input. The user interface enables the driver to tap (or provide other input) on the hazard to select the hazard (116). The overlay interface enables the driver to easily select a hazard on the road visible in the camera's view with few commands and minimizes distraction. While the foregoing description recites a driver, a passenger in the car can also provide such input.

In an example scenario, the technique is implemented as a software application on a device suitable to receive input from a connected camera and location sensors. As the vehicle moves, the software application collects information to identify objects presented within the camera viewfinder. If a nearby vehicle is driving erratically, the driver can select the erratic vehicle in the user interface. Further, the software application can communicate with nearby

users to obtain additional details about the selected hazard such as images or videos captured from different angles.

After relevant information about the selected hazard is determined, the user interface provides the driver with the option of sending the information gathered to the authorities and to other users of the software application. A prompt is presented to enable the driver to send information to authorities (118). Such information can include video clips and photographs. Additional information about a hazardous vehicle can also be shared as available, e.g., make, model, year, license plate number, color, condition, estimated location of the hazardous vehicle, estimated speed, etc. The information may be streamed to a particular client device or server if supported and if the driver grants user data permissions.

Further, the driver can also choose to send information about potential road hazards to other users of the software application (120). Some applications that enable reporting of driving conditions from multiple users (i.e., crowdsourced reporting) require lengthy, typed descriptions of potential hazards, which can distract a driver. The present technique enables information to be gathered automatically, reducing effort for the driver to provide such details.

The camera or cameras can record a vehicle's surroundings, e.g., periodically or continuously, both before and after the user provides user input selecting a potentially hazardous vehicle. In some implementations, the capture of images begins only after the user provides input selecting a vehicle or hazard. No images are captured if the user does not grant permission.

Additional object recognition is performed as the vehicle travels through different conditions, enabling different views and potentially the recognition of additional characteristics of the hazard. Other vehicles nearby are contacted with user consent of the other vehicles to capture additional details about the hazard recorded by the cameras of the other vehicles. If

nearby drivers do not grant permissions, no such information is used. Cameras in vehicles that are nearby may also capture additional details about the hazard, such as footage of vehicles or road debris from alternative angles or over certain distances, in different lighting, or from an adjacent roadway. Such additional information about a hazard is also provided, subject to user consent.

In situations in which certain implementations discussed herein may collect or use personal information about users (e.g., user data, information about a user's social network, user's location and time at the location, user's biometric information, user's activities and demographic information), users are provided with one or more opportunities to control whether information is collected, whether the personal information is stored, whether the personal information is used, and how the information is collected about the user, stored and used. That is, the systems and methods discussed herein collect, store and/or use user personal information specifically upon receiving explicit authorization from the relevant users to do so. For example, a user is provided with control over whether programs or features collect user information about that particular user or other users relevant to the program or feature. Each user for which personal information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more such control options over a communication network. 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. As one example, a user's identity may be treated so that no personally identifiable information can be determined.

As another example, a user's geographic location may be generalized to a larger region so that the user's particular location cannot be determined.

CONCLUSION

This disclosure describes techniques to report road incidents and hazards using in-vehicle cameras. Upon the granting of user data permissions, location, camera data, and image object recognition are used to provide a visual user interface to a driver. The user interface enables the driver to select road hazards such as vehicles with intoxicated drivers. The techniques enable sharing of information gathered about the road hazards with authorities and with other users.