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CHILD SAFETY FEATURES

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ABSTRACT

A system may include computing devices (e.g., a mobile phone, a tablet computer, a laptop computer, a wearable device, a tracking tag, an Internet of Things (IoT) booster seat, an IoT adaptive headrest, etc.) and vehicles (e.g., an automobile, a motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, train, a plane, a boat, a helicopter, a personal transport vehicle, etc.). Based on a location of a child with respect to the vehicles (which may be determined using, e.g., Bluetooth™, ultra-wideband technology, sensors of the vehicles, etc.), the system may perform actions to improve child safety. For example, based on the location of the child, the vehicles may change vehicle settings to those suitable for a child (e.g., enable child safety locks, disable power window controls in the rear seats, adjust airbag deployment based on the presence and size of the child, etc.). In this way, the techniques may facilitate the implementation of protection measures for children, ensuring their safety in and near vehicles.

DESCRIPTION

Throughout this disclosure, examples are described a where computing device and/or a vehicle analyzes information (e.g., context, locations, speeds, search queries, etc.) associated with a computing device and a user of a computing device, only if the computing device receives permission from the user of the computing device to analyze the information. For example, in situations discussed below, before a computing device or vehicle can collect or may make use of information associated with a user, the user is provided with an opportunity to provide input to control whether programs or features of the computing device and/or vehicle can collect and

make use of user information (e.g., information about a user's current location, current speed, etc.), or to dictate whether and/or how to the device and/or vehicle may receive content that may be relevant to the user. In addition, certain data may be treated in one or more ways before it is stored or used by the computing device and/or vehicle, 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 about 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 will have control over how information is collected about the user and used by the computing device and vehicle.

FIG. 1 below is a conceptual diagram illustrating a system 10 in accordance with techniques disclosed here. As shown in FIG. 1, system 10 includes one or more computing devices, such as computing devices 100A-100N (collectively, "computing devices 100"), and one or more vehicles, such as vehicles 150A-150N (collectively, "vehicles 150"). Examples of computing devices 100 may include a mobile phone, a tablet computer, a laptop computer, a wearable device (e.g., a computerized watch, computerized eyewear, etc.), a gaming system, a media player, an e-book reader, a tracking tag, a smart safety device (e.g., an Internet of Things (IoT) booster seat, an IoT adaptive headrest, etc.) mobile television platform, etc. Examples of vehicles 150 may include an automobile, a motorcycle, a bus, a recreational vehicle (RV), a semi-trailer truck, a tractor or other type of farm equipment, train, a plane, a boat, a helicopter, a personal transport vehicle, etc.

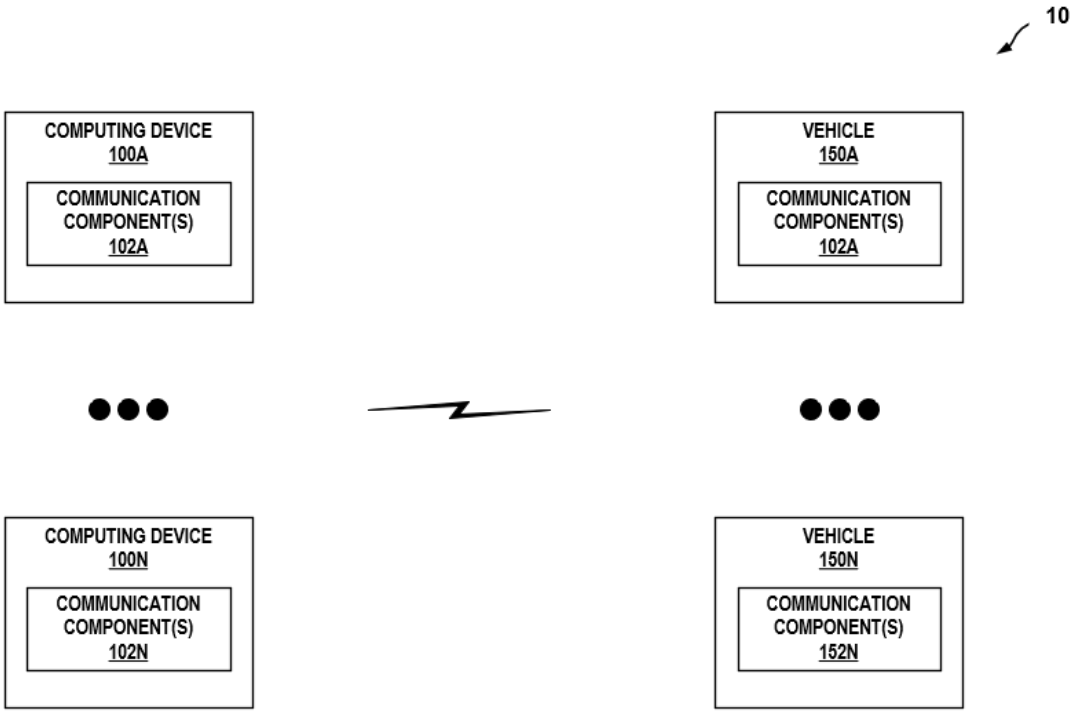

FIG. 1

As shown in FIG. 1, computing devices 100 and vehicles 150 may include communication components 102A-102N ("COMM components 102") and communication components 152A-152N ("COMM components 152"), respectively. COMM components 102, 152 may communicate with one or more external devices via one or more wired and/or wireless networks by transmitting and/or receiving network signals on the one or more networks. Examples of COMM components 102, 152 may include a network interface card (e.g. such as an Ethernet card), an optical transceiver, a radio frequency transceiver, a GPS receiver, a short-wave radio, a cellular data radio, a wireless network radio, etc. COMM components 102, 152 may be configured to support wireless communication using Bluetooth™ (e.g., Bluetooth Low Energy and other versions of Bluetooth™, including future versions of Bluetooth™), Wi-Fi™, Near-Field Communication (NFC), Long Term Evolution, a cellular radio, a third-generation (3G) radio, a fourth-generation (4G) radio, a fifth-generation (5G) radio, ultra-wideband (UWB)

technology, etc. Computing devices 100 and vehicles 150 may use COMM components 102, 152 to both transmit and receive signals.

In accordance with techniques of this disclosure, in instances where users provide explicit consent, system 10 may perform actions to improve child safety based on a location of a child with respect to vehicles 150. For example, system 10 may determine a location of a child by determining a location of a computing device owned by the child and/or using sensors of vehicles near the child. Based on the location of the child, vehicles may change the vehicle settings to those suitable for a child (e.g., enable child safety locks, disable power window controls in the rear seats, adjust airbag deployment based on the presence and size of the child, etc.). In this way, the techniques may facilitate the implementation of protection measures for children, increasing their safety in and near vehicles.

Computing devices 100 and vehicles 150 may communicate (e.g., transmit and receive wireless signals) with each other via COMM components 102, 152. Computing devices 100 and vehicles 150 may broadcast (e.g., periodically) information, such as a unique identifier, so that computing devices 100 and vehicles 150 may search for and find each other. For example, computing devices 100 and vehicles 150 may broadcast a unique bit address (e.g., a Bluetooth Device Address (BD_ADDR)). In some examples, when computing devices 100 and vehicles 150 have found each other, computing devices 100 and vehicles 150 may establish a secure connection and exchange encryption keys to ensure privacy.

Responsive to a computing device (e.g., computing device 100A) and a vehicle (e.g., vehicle 150A) determining that they are proximate to each other, the vehicle may determine whether the computing device is being used by a child. For example, the computing device may, upon receiving explicit user consent, communicate information about the user account associated

with the computing device to the vehicle. If the user so authorizes, the information may include personal information, such as the age of the user. Based on the age of the child (e.g., whether the age of the user is under 16 years), the vehicle may determine whether the computing device is being used by a child.

System 10 may, upon receiving explicit permission from a parent or guardian, determine a location of a computing device owned by a child. In some examples, system 10 may use COMM components 102, 152 to provide location tracking and proximity detection. For example, system 10 may determine the location of computing device 100A with respect to vehicles that have found computing device 100A (e.g., vehicle 150A) based on one or more wireless signals (e.g., Bluetooth™ signals, UWB signals, etc.) exchanged between COMM components 102, 152. In some examples, one or more COMM components 152 may be installed at various locations inside and/or outside of the vehicles (e.g., near the front seats, near the rear seats, etc.).

Based on the wireless signals, system 10 may determine whether computing devices 100 are outside vehicles 150, inside vehicles 150, in a specific seat of vehicles 150, etc. That is, system 10 may use the wireless signals exchanged between COMM components 102, 152 to perform device localization. For example, computing devices 100 and/or vehicles 150 may use a time-of-flight parameter to determine the distance of COMM components 102 (and in turn computing device 100) between COMM components 152. As used here, time-of-flight may refer to the amount of time from COMM components 152 sending the wireless signals to COMM components 102 receiving the wireless signals, and vice versa. Because time-of-flight is correlated to distance, system 10 may process time-of-flight values to determine the distance between computing devices 100 and vehicles 150. In some examples, system 10 may perform triangulation to determine distance and direction of computing devices 100 from vehicles 150.

Vehicles 150 may be equipped with components other than COMM components to determine a location of a child. For example, vehicles 150 may be equipped with seat occupancy sensors, seatbelt sensors, infrared or ultrasonic sensors, child seat detection sensors, etc. Seat occupancy sensors may be integrated into seat cushions and detect the presence of a passenger by measuring the weight or pressure applied to the seat. Seatbelt sensors may detect whether a seatbelt has been fastened or not. Infrared or ultrasonic sensors may determine the number of occupants and their positions within vehicles 150. Child seat detection sensors may recognize the presence of a child booster seat.

In instances where users provide explicit consent, system 10 may perform an action based on the location of a child with respect to vehicles 150. For example, if the child is within vehicle 150A, vehicle 150A may enable child safety locks and disable power window controls in the rear seats, adjust airbag deployment based on the presence and size of the child, etc. In some examples, if the child is within vehicle 150A, vehicle 150A may restrict (e.g., with the explicit consent of the operator) a top speed.

For example, if computing device 100A (e.g., which may be owned by a child) is within vehicle 150B (e.g., which may not be owned and operated by the parents and/or caregivers of the child), computing device 100A may communicate to vehicle 150B that the parents and/or caregivers of the child prefer that a vehicle transporting the child does not travel at a speed exceeding a speed limit. If the operator of vehicle 150B explicitly consents (e.g., by providing an appropriate user input to vehicle 150B), vehicle 150B may not accelerate further when vehicle 150B reaches the speed limit. Additionally or alternatively, computing device 100A may send a notification to computing devices owned by the parents and/or caregivers (e.g., computing devices 100B-100C) whenever vehicle 150B travels at a speed exceeding the speed limit.

In some examples, infotainment systems of vehicles 150 may restrict content that vehicles 150 output depending on the presence of a child in vehicles 150. For example, if computing device 100A (e.g., which may be owned by a child) is within vehicle 150B (e.g., which may not be owned and operated by the parents and/or caregivers of the child), computing device 100A may communicate to vehicle 150B that the parents and/or caregivers of the child prefer that a vehicle transporting the child does not output content that is not family-friendly. If the operator of vehicle 150B explicitly consents (e.g., by providing an appropriate user input to vehicle 150B), vehicle 150B may only output content that is age-appropriate, safe, and engaging for children.

In some examples, system 10 may generate notifications based on a location of a child with respect to vehicles 150. For example, if computing device 100A (e.g., which may be owned by the child) is near (e.g., entering) a vehicle not owned by the parents and/or caregivers of the child (e.g., vehicle 150C), computing device 100A may send a notification to computing devices 100B-100C (e.g., which may be owned by the parents and/or caregivers of the child) that the child is near or has entered a vehicle as well as a location of computing device 100A (and in turn the child). In some examples, the notification may indicate whether the vehicle the child is near or has entered is a familiar or unfamiliar vehicle (e.g., based on a unique identifier provided by vehicle 150C).

In some examples, system 10 may generate notifications based on a location of an unfamiliar person with respect to vehicles 150. For example, if vehicle 150A (e.g., which may be owned by the parents and/or caregivers of a child) determines that a computing device with an unfamiliar unique identifier (e.g., computing device 100D) is within vehicle 150A, vehicle 150A

may send a notification to computing devices 100B-100C (e.g., which may be owned by the parents and/or caregivers of the child).

In some examples, system 10 may perform an action if a child is left unattended in a vehicle. For example, if computing device 100E (e.g., an IoT child booster seat) is within vehicle 150A and being occupied by a child while computing devices 100B-100C (e.g., which may be owned by the parents and/or caregivers of the child) are outside vehicle 150A for a predetermined period of time (and optionally when vehicle 150A is locked), vehicle 150A and/or computing device 100E may send a notification to computing devices 100B-100C. Additionally or alternatively, vehicle 150A may not lock if computing device 100E is within vehicle 150A and being occupied by the child while computing devices 100B-100C are outside vehicle 150A. Vehicle 150A may send computing devices 100B-100C a notification if vehicle 150A does not lock because a child is still within vehicle 150A.

It is noted that the techniques of this disclosure may be combined with any other suitable technique or combination of techniques. As one example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2013/0049955A1. In another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2022/0118941A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2022/0262169A1. In yet another example, the techniques of this disclosure may be combined with the techniques described in U.S. Patent Application Publication No. 2019/0135229A1.