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(54) **METHOD FOR ANALYZING SOUNDS IN A VEHICLE AND ACTIVATING A DISCO MODE IN THE VEHICLE BASED ON THE SOUNDS**

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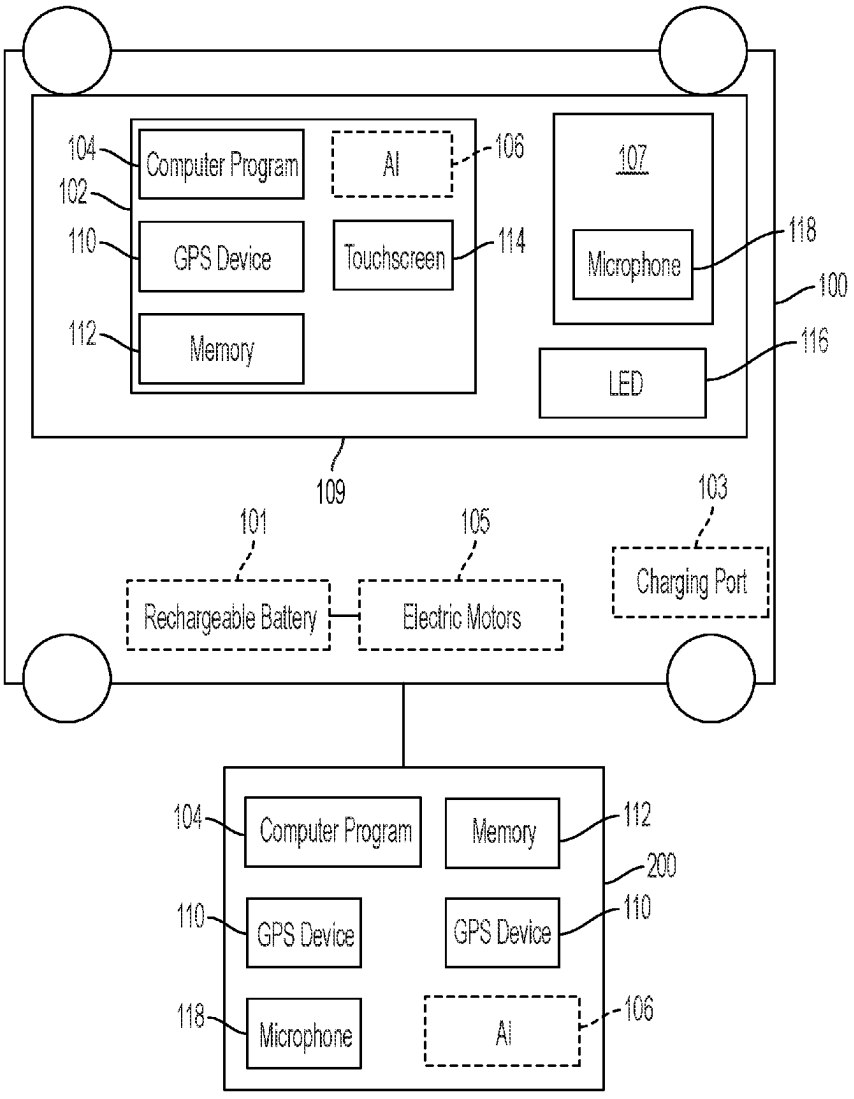
(57) **ABSTRACT**

A computer-implemented method and computer program product for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior. The method includes the steps of: (a) connecting a software application to a vehicle network; (b) capturing, by the software application, at least one sound within the vehicle interior; (c) analyzing, by the software application, the at least one sound captured within the vehicle interior; and (d) changing an appearance of at least one portion of the ambient light system within the vehicle interior based on the captured at least one sound within the vehicle interior. The computer program is configured to perform the aforementioned steps.



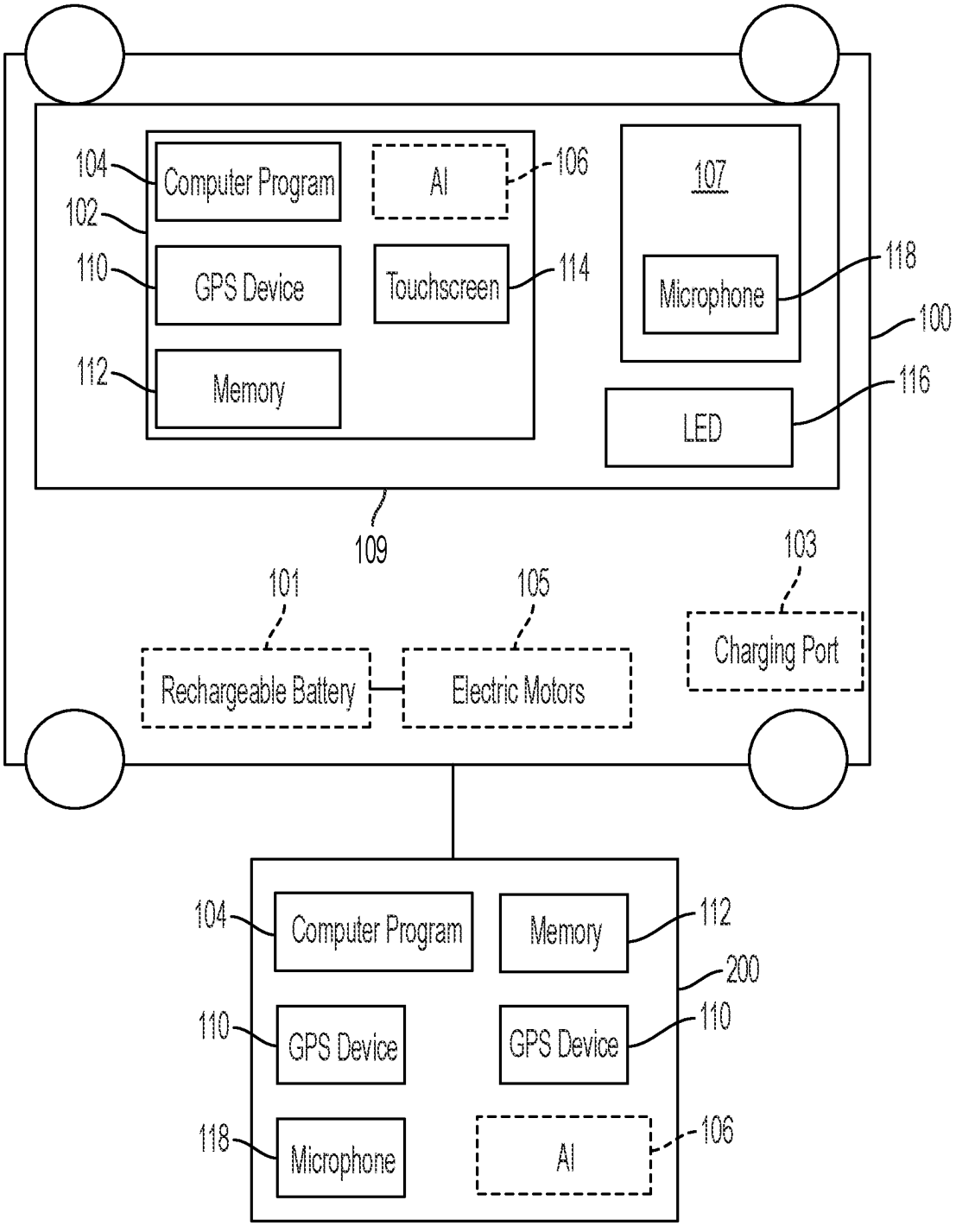

104
Computer Program
AI
106
102
107
110
GPS Device
Touchscreen
114
118
Microphone
100
112
Memory
116
LED
109
103
101
105
Charging Port
Rechargeable Battery
Electric Motors
104
Computer Program
Memory
112
200
110
GPS Device
GPS Device
110
118
Microphone
AI
106

FIG. 1

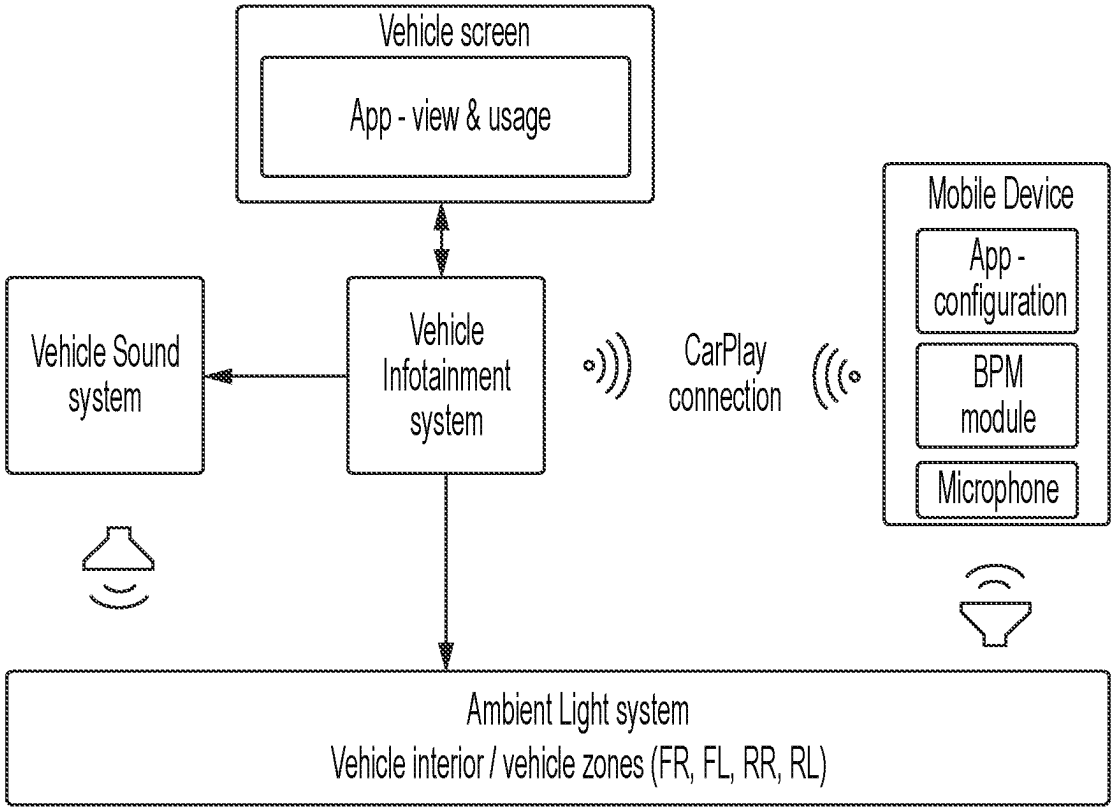

Vehicle screen
App - view & usage
Mobile Device
App - configuration
BPM module
Microphone
Vehicle Sound system
Vehicle Infotainment system
CarPlay connection
Ambient Light system
Vehicle interior / vehicle zones (FR, FL, RR, RL)

FIG. 2

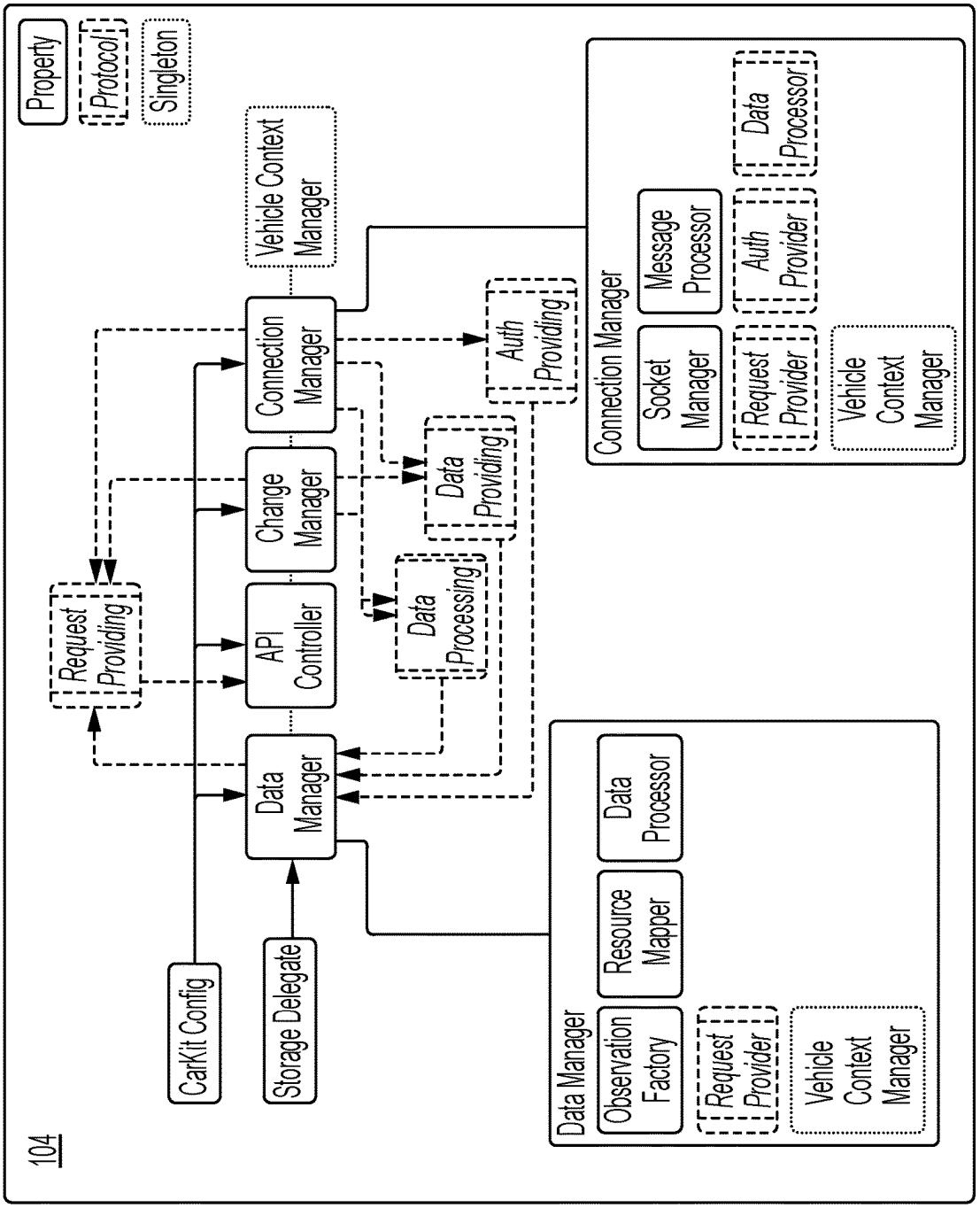

104
Property
Protocol
Singleton
CarKit Config
Storage Delegate
Data Manager
API Controller
Change Manager
Connection Manager
Vehicle Context Manager
Request Providing
Data Processing
Data Providing
Auth Providing
Data Manager
Observation Factory
Resource Mapper
Data Processor
Request Provider
Vehicle Context Manager
Connection Manager
Socket Manager
Message Processor
Request Provider
Auth Provider
Data Processor
Vehicle Context Manager

FIG. 3

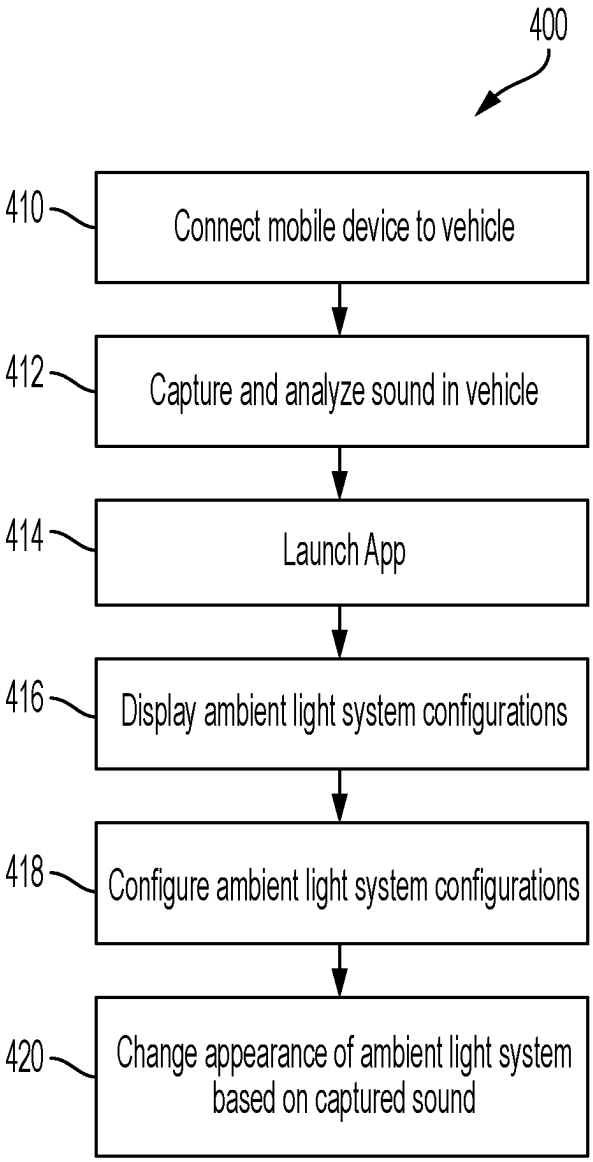

400
410
Connect mobile device to vehicle
412
Capture and analyze sound in vehicle
414
Launch App
416
Display ambient light system configurations
418
Configure ambient light system configurations
420
Change appearance of ambient light system based on captured sound

FIG. 4

METHOD FOR ANALYZING SOUNDS IN A VEHICLE AND ACTIVATING A DISCO MODE IN THE VEHICLE BASED ON THE SOUNDS

TECHNICAL FIELD

[0001] The present subject matter relates to a system and method for analyzing sounds within a vehicle interior and controlling the ambient lights within the vehicle interior in synchronization with the sounds.

BACKGROUND

[0002] The modern automobile in recent years has seen a massive expansion in the number of internal electronic control systems. The use of mobile and wearable electronic devices also continues to increase. Most automobiles are capable of communicating with a smartphone carried by, or a smartwatch worn by, a driver or a passenger in the vehicle. For example, a smartphone is configured to communicate with an Apple CarPlay software system within the vehicle. With the rapid development of mobile technologies, users have higher demands for the convenience of use of in-vehicle software applications (e.g., "apps"). Currently, users can either use an original in-vehicle application provided by the vehicle manufacturer or connect a smartphone to the vehicle onboard computer, and then project an app installed on the smartphone onto the vehicle display screen through Apple CarPlay, Android Auto, CarLife, or other software connectivity protocols. Most users use the vehicle infotainment system or different apps for playing music, particularly during a long drive.

[0003] As is described in U.S. patent application Ser. No. 18/219,933, which is incorporated by reference herein in its entirety, in-vehicle functions (e.g., audio, lighting, video, displays, climate control, etc.) may be integrated within the CarPlay app to create an innovate, personalized experience for the vehicle driver and passengers. Accordingly, the driver and passengers can control various in-vehicle functions via a connected smartphone because the smartphone is connected to the in-vehicle CarPlay app, the CarPlay app is integrated within the vehicle infotainment system, and the vehicle infotainment system is interconnected with the in-vehicle network of controllers, sensors and computers.

[0004] Advancements in the area of internal electronic control systems are continually sought in the interests of user enjoyment, convenience, performance, and safety. Described herein is an electronic control system which controls the ambient lighting system within the vehicle interior based on the kind of music played within the vehicle, thereby reflecting the user's mood and enhancing the in-vehicle user experience, without much effort or distraction from driving.

SUMMARY OF INVENTION

[0005] Described herein are a method and a computer program product for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior, thereby enhancing the in-vehicle experience. The method includes the steps of: (a) connecting a software application to a vehicle network; (b) capturing, by the software application, at least one sound within the vehicle interior; (c) analyzing, by the software application, the at least one sound captured within the vehicle interior; and (d) changing an appearance of at least one portion of the ambient light system within the vehicle interior based on the captured at least one sound within the vehicle interior and (optionally) based on preferences of the user. The computer program product is configured to perform the aforementioned steps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The drawing figures depict one or more implementations, by way of example only, not by way of limitations. In the figures, like reference numerals refer to the same or similar elements.

[0007] FIG. **1** depicts a schematic diagram of a vehicle and a mobile device connected to the vehicle.

[0008] FIG. **2** depicts a schematic diagram of a system including a vehicle and a mobile device for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior.

[0009] FIG. **3** is a schematic diagram of a computer program according to an embodiment.

[0010] FIG. **4** is a flowchart depicting an overall method for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior.

DETAILED DESCRIPTION

[0011] In the following detailed description, numerous specific details are set forth by way of examples in order to provide a thorough understanding of the relevant teachings. However, it should be apparent to those skilled in the art that the present teachings may be practiced without such details. In other instances, well known methods, procedures, components, and/or circuitry have been described at a relatively high-level, without detail, in order to avoid unnecessarily obscuring aspects of the present teachings.

[0012] FIG. **1** depicts an exemplary vehicle **100**. The vehicle **100** can be an electric vehicle having a rechargeable battery **101**, a charging port **103** used for charging the battery **101**, and one or more electric motors **105**, for example. Regardless of the type of vehicle **100**, vehicle **100** has a computer **102** for controlling functions related to the operations of vehicle **100** and an infotainment system **107** including audio speakers, a smartphone mirroring system app (e.g., CarPlay), an optional microphone **118**, navigation, telematics, internet access, etc. Infotainment system **107** may be considered as forming part of computer **102**. An electronic mobile device **200** (otherwise referred to herein as a smartphone) is connected to vehicle computer **102** via a wired or wireless connection (e.g., Wi-Fi, cellular or Bluetooth connection). It is noted that components that are shown in broken lines in FIG. **1** are optional.

[0013] Vehicle computer **102** includes a processor, a visual display **114** having means for both inputting data and displaying data (e.g., touchscreen), a transmitter/receiver for communicating with mobile device **200** in a conventional manner, and a GPS device **110**. For example, vehicle computer **102** may send and receive data via Wi-Fi or 4G/LTE radios built into vehicle **100**, by way of example. Mobile device **200** includes a processor, a visual display having means for both inputting data and displaying data (e.g., touchscreen), a transmitter/receiver for communicating with vehicle **100** in a conventional manner, and a microphone **118**.

[0014] At least one interior light **116**, such as a light emitting diode ("LED"), for example, can be arranged in different areas within the interior **109** of the vehicle **100**. For example, the LED **116** can be arranged and configured to provide illumination around the dashboard, the center console, the door handles, the cupholders, the door panels, the door and dash trim, the climate control vents, the speaker surrounds, and/or the footwells of the vehicle **100**. Although only one LED **116** is illustrated in FIG. **1**, several LEDs **116** can be arranged in arrays in different areas within the interior **109** of the vehicle **100**.

[0015] A computer program **104** or a software application (e.g., "app") is downloaded to, installed on, and stored in, either electronic mobile device **200** or computer **102** of vehicle **100** (or both). According to one embodiment, program **104** is stored within the mobile device **200**; information can be inputted into program **104** via the display **114** of mobile device **200**; and information can be outputted from program **104** via the display of vehicle computer **102** (e.g., via Apple CarPlay or Android Auto). According to another embodiment, program **104** is stored within the vehicle computer **102**; information can be inputted into program **104** via the touchscreen display **114** of vehicle computer **102**; and information can be outputted from program **104** via the display of vehicle computer **102** (e.g., via Apple CarPlay or Android Auto).

[0016] According to yet another embodiment, program **104** is a mobile application stored within the mobile device **200**; information can be inputted into program **104** via the display of mobile device **200**; and information can be outputted from program **104** via the display of mobile device **200**. According to still another embodiment, program **104** is stored within the mobile device **200**; information can be inputted into program **104** via the display of mobile device **200**; and information can be outputted from program **104** via both the display of mobile device **200** and the display of vehicle computer **102**.

[0017] Program **104** can be displayed on the touchscreen display **114** of vehicle computer **102**. The functionality of program **104** can be enabled or disabled by user input on the touchscreen display **114** of vehicle computer **102**.

[0018] In certain embodiments, users of the vehicle **100** may be identified by program **104** based on paired device data maintained in the memory **112** of program **104**. The paired device data can indicate, for example, unique device identifiers of mobile devices that were previously paired with program **104** of the vehicle **100**, such that program **104** may automatically reconnect previously connected mobile devices without user intervention.

[0019] In certain embodiments, program **104** can be configured to interact with an AI chatbot model, such as ChatGPT, for example, which can run as a third-party software application (e.g., "app") AI **106** on vehicle computer **102** or on the mobile device **200** of the user of the vehicle **100**. In other embodiments, the AI model can be a different AI-enabled software application **106** running on vehicle computer **102** or on the mobile device **200** of the user of the vehicle **100**. Program **104** can be configured to interact with the AI model or ChatGPT app **106** and use ChatGPT's API to perform an action (e.g., query) specified by the user. Further details of the AI model are described in U.S. patent application Ser. No. 18/201,799 filed on May 25, 2023, which is incorporated by reference herein in its entirety and for all purposes.

[0020] Program **104** can be designed and configured to connect directly to the network of the vehicle **100** and/or a third-party software applications (e.g., other "apps") or devices via a direct connection application programming interface (API). For example, program **104** can be configured to interact with other apps installed on vehicle computer **102**, such as different apps for social media, messaging, providing maps and navigation, playing music or podcasts, etc., that may be installed on, and be available via the display of, vehicle computer **102** (e.g., via Apple CarPlay or Android Auto), for example, or with other similar apps installed on mobile device **200**. In these situations, because these apps are integrated with program **104**, program **104** can use each specific app's API to perform an action specified by the user.

[0021] In certain embodiments, program **104** can appear as a selectable icon within Apple CarPlay. Program **104** can be configured to connect the network of the vehicle **100** with the Apple ecosystem (e.g., with the different Apple devices, such as iPhone, iPad, MacBook, Apple Watch, AirPods, Apple TV, Apple CarPlay, etc.) that may be connected and integrated with each other, and that may be accessible within the vehicle **100**. Once connected to the Apple ecosystem, program **104** can run in the background of Apple CarPlay, for example.

[0022] The network of the vehicle **100** can include one or more of a vehicle controller area network ("CAN") or an Ethernet network, for example. The network of the vehicle **100** can allow, after proper and successful authentication, program **104** to communicate with various systems or components of vehicle **100**, such as a vehicle modem (if available), GPS device **110** and various electronic control units ("ECUs") configured to interface with program **104**. For example, the vehicle ECUs may include a vehicle interior control module configured to monitor and control power control functions, such as interior lighting or infotainment system **107**, for example; a radio transceiver module configured to provide radio services and communicate with mobile devices inside vehicle **100**; etc.

[0023] Program **104** can be configured to include different components to facilitate access to one or more features of vehicle **100** that may be provided with a default configuration by the manufactures of vehicle **100** and may be configured for changes or customization by the user of vehicle **100**. For example, program **104** can include a Data Manager, a Connection Manager, an API Controller, and a Change Manager, as illustrated in FIG. **3**, for example. The Data Manager can be configured, for example, to provide, process, and update an RSI Request-Response Interface authorization and RSI resource mapping. The Connection Manager can be configured, for example, to check network conditions through a network controller, re-check connection when network conditions change, search for an infotainment web interface protocol, such as the Volkswagen Infotainment Web Interface ("VIWI") RSI service, for example, handle authentication, collect initial information (e.g., vehicle data) about different components of the vehicle **100**, and process updates to vehicle data requested by the user of vehicle **100**.

[0024] Program **104** can be configured to access a list of available features of the vehicle **100**, including but not limited to initial or default values of the available features of the vehicle **100**, before allowing the user of vehicle **100** access to modify or customize the available features of the

vehicle **100**. Once program **104** has gathered and parsed the initial vehicle data, program **104** can monitor for any changes to the initial vehicle data. For example, program **104** can open a WebSocket API as a two-way interactive communication session between the user's interface of program **104** and a server connected to a two-way interactive communication session between the user's browser and a server to observe, process, and store any and all changes by the user to the initial vehicle data. After the user's modifications to any of the available features of the vehicle **100** are processed and stored in the memory **112** of program **104**, program **104** can be configured to synchronize the modified features of the vehicle **100** with the corresponding system or component of the vehicle **100**.

[0025] In addition, program **104** can be configured to auto detect any smart devices (e.g., smart phones, smart watches, tablets, etc.) that are compatible with program **104**, and that may be accessible within the vehicle **100**, and auto connect with these devices as soon as they are setup, without the necessity for the user to set up these devices each time. As another example, program **104** can connect to a smart device via a direct connection application programming interface (API).

[0026] Program **104** can be configured to capture sound within the vehicle interior **109** using microphone **118** of the mobile device **200** or the vehicle, for example. The sound within the vehicle interior can be music played by the vehicle infotainment system **107** or by different apps for streaming and playing music. The different music apps can run on the mobile device **200** or on the vehicle infotainment system **107**. The sounds captured by microphone **118** are transmitted to the processor of the mobile device **200**, which analyzes the characteristics of the captured sounds. The characteristics of the captured sounds may include, for example, parameters related to the tempo of the music, such as beats per minute ("BPM"), for example. The program **104** can include a BPM module (FIG. **2**) that can be configured to apply a trained sound model to the captured sounds. The trained sound model can be part of the AI model **106** or part of a different trained sound model programmed in the software application **104** running on the mobile device **200**. For example, the BPM module can be configured to apply a Fourier transform analysis to the captured sounds to determine distinguishing parameters of the sound (e.g., beats, frequency of beats, tempo, etc.), for example. Further details of a trained sound model that applies a Fourier transform analysis to the captured sounds are described in U.S. Patent Application Publication No. 2009/0287323, which is incorporated by reference herein in its entirety and for all purposes.

[0027] Program **104** can be configured to access, via the mobile device **200** (for example), a list of different user-configurable appearances of the ambient light system within the vehicle interior. For example, the program **104** can associate each of the user-configurable appearances of the ambient light system with a specific kind of music (e.g., disco, dance, pop, rap, rock, classical, etc.). In particular, each of the user-configurable appearances of the ambient light system can be associated with, or correspond to, at least one characteristic, such as beats per minute ("BPM"), for example, of the music played within the vehicle interior **109**.

[0028] Program **104** is configured to change the appearance of at least one portion of the ambient light system within the vehicle interior (e.g., the illumination around a dashboard, a center console, door handles, cupholders, door panels, and footwells of the vehicle) based on the captured at least one sound within the vehicle interior **109**.

[0029] Saved in the memory **112** of the program **104** are a plurality of different appearances of the ambient light system, each of which corresponding to a different audio characteristic, such as beats per minute ("BPM"), for example, of the music played within the vehicle interior **109** and sensed by the microphone **118**. The different appearances of the ambient light system within the vehicle interior can include, but are not limited to, at least one of color, brightness, color sequence, or flash sequence, of the LED(s) **116** in at least one of a plurality of zones (e.g., front right zone, front left zone, rear right zone, and a rear left zone) within the vehicle interior **109**. For example, high tempo music or even the sound of an emergency vehicle near the vehicle could correspond to flashing red interior lights. The flash sequence of the light may also correspond to particular beats in the audio, e.g., a light flash for every beat having a particular wavelength. The computer program **104** runs at a sufficient speed such that any time lag between a beat and a light flash would be imperceptible to the passenger.

[0030] Alternatively, using the user interface of the program **104**, the user can configure and customize multiple user-configurable appearances of the ambient light system to his or her unique preferences. For example, in certain embodiments, the user can configure, on the mobile device **200** (for example), that the same user-configurable appearance of the ambient light system applies to all portions of the ambient light system within the vehicle interior (e.g., the illumination around a dashboard, a center console, door handles, cupholders, door panels, and footwells of the vehicle). In other embodiments, the user can configure, on the mobile device **200**, that a certain user-configurable appearance of the ambient light system applies only to certain (but not to all) portions of the ambient light system within the vehicle interior. For example, the user can configure, on the mobile device **200**, that a certain user-configurable appearance of the ambient light system applies only to the illumination around the dashboard, the center console, and the driver's footwell of the vehicle.

[0031] After the user's modifications to any of the available user-configurable appearances of the ambient light system are processed and stored in the memory **112** of program **104**, program **104** can be configured to synchronize the modified user-configurable appearances of the ambient light system with the corresponding portion of the ambient light system (e.g., the illumination around a dashboard, a center console, door handles, cupholders, door panels, and footwells of the vehicle) controlled by the mobile device **200**.

[0032] The list of multiple different user-configurable appearances of the ambient light system within the vehicle interior can include, but is not limited to, initial or default appearances of the ambient light system, before allowing the user of mobile device **200** access to modify or customize the available user-configurable appearances of the ambient light system. Once program **104** has gathered and parsed the initial appearances of the ambient light system, program **104** can monitor for any changes to the initial appearances of the ambient light system. For example, program **104** can open a WebSocket API as a two-way interactive communication session between the user's interface of program **104** and a server connected to a two-way interactive communication

session between the user's browser and a server to observe, process, and store any and all changes by the user to the initial appearances of the ambient light system. After the user's modifications to any of the available user-configurable appearances of the ambient light system are processed and stored in the memory **112** of program **104**, program **104** can be configured to synchronize the modified user-configurable appearances of the ambient light system with the corresponding portion of the ambient light system (e.g., the illumination around a dashboard, a center console, door handles, cupholders, door panels, and footwells of the vehicle) controlled by the mobile device **200**.

[0033] FIG. **4** is a flowchart depicting an overall method **400** for analyzing sounds within a vehicle interior and controlling ambient light system within the interior of the vehicle **100**. The user of the vehicle **100** can be a driver of the vehicle **100** or a passenger in the vehicle **100**. It is also noted that method **400** uses mobile device **200** along with vehicle **100** to accomplish method **400**, however, it should be understood that vehicle computer **102** of vehicle **100** may be omitted and the steps of method **400** may be completed using only mobile device **200**. Alternatively, mobile device **200** may be omitted and the steps of method **400** may be completed using only vehicle computer **102** of vehicle **100**.

[0034] At step **410** of method **400**, mobile device **200** connects to vehicle **100** in either a wired or wireless manner, as described above. If the steps of method **400** are completed by vehicle **100** itself (and without the assistance of mobile device **200**), then this step may be omitted.

[0035] Optionally, after the connection between the mobile device **200** and the vehicle **100** is established, program **104** can initiate an authentication of the mobile device **200** and/or the vehicle **100**. The authentication can be performed using known methods, such as Transport Layer Security ("TLS") 1.2 security protocol, public pinning hash, local certificate pinning, PIN numbers that can be entered by the user or QR codes that can be scanned by the mobile device **200**, for example. Further functionality of program **104** can be disabled until after the mobile device **200** and/or the vehicle **100** successfully complete the authentication process (e.g., the mobile device **200** confirms that the saved user and vehicle information is stored in the vehicle **100**).

[0036] At step **412** of method **400**, the microphone **118** of mobile device **200** captures sound within the vehicle interior **109**, as described above. The sound within the vehicle interior **109** can be music played by the vehicle infotainment system (e.g., infotainment system **107**) or by different music apps running on the mobile device **200** or on the vehicle computer **112** or local sounds (e.g., sirens) that are not being played via infotainment system **107**. The sounds captured by microphone **118** are transmitted to the program **104** installed on the mobile device **200**, which analyzes the characteristics of the captured sounds. The characteristics of the captured sounds may include, for example, parameters related to the tempo of the music, such as beats per minute ("BPM"), for example. The program **104** can apply a trained sound model using a Fourier transform analysis to the captured sounds to determine distinguishing parameters of the sound (e.g., beats, tempo, etc.), for example, as explained above.

[0037] At step **414**, the user (e.g., driver or passenger of vehicle **100**) launches program **104** on mobile device **200** or on vehicle computer **102**. Step **414** may occur automatically at step **410**, or either prior to a vehicle trip or during the vehicle trip.

[0038] At optional step **416**, if the user desires to select an appearance for a unique experience, program **104** displays a plurality of different user-configurable appearances of the ambient light system within the vehicle interior. For example, each of the user-configurable appearances of the ambient light system can include, but is not limited to, at least one of color, brightness, color sequence, or flash sequence, of the LED(s) **116** in at least one of a plurality of zones (e.g., front right zone, front left zone, rear right zone, and a rear left zone) within the vehicle **100**.

[0039] Before displaying to the user, in step **416**, the internal listing of user-configurable appearances of the ambient light system within the vehicle interior, the listing may be sorted, arranged and organized in a certain fashion. As one example for sorting the listing, program **104** checks for the most recently used or the most often used appearances of the ambient light system and automatically organizes the appearances of the ambient light system such that the most recently used or the most often used appearances of the ambient light system appear at the top of the list.

[0040] As another example, program **104** can recognize the user of the vehicle **100** (e.g., in case multiple users use the same vehicle **100**) and can automatically display the ambient light system configurations that were most recently used or are most often used by the recognized user.

[0041] At optional step **418**, program **104** receives from the user (e.g., driver or passenger) of the vehicle **100** user input associating, in program **104**, each of the user-configurable appearances of the ambient light system with a specific captured sound or kind of music (e.g., disco, dance, pop, rap, rock, classical, etc.). In particular, each of the user-configurable appearances of the ambient light system can be associated with, or correspond to, at least one characteristic, such as beats per minute ("BPM"), for example, of the music played within the vehicle interior. The user input can be in the form of the user selecting an icon or pressing a button on the touchscreen **114** of the user interface of program **104**. Alternatively, the user input can be in the form of a voice command by the user over an audio system of the mobile device **200**. In certain embodiments, for example, Apple Siri can be expanded to enable user input, selection, and modification of vehicle functions and external functions through the program **104**.

[0042] The user-configurable appearances of the ambient light system associated with a specific kind of music may be saved in the memory **112** of the mobile device **200**, for example.

[0043] The user's selection can be saved in the memory **112** of the mobile device **200** for either current use or later use. The user's selection saved in memory **112** is made available for use by program **104**. Once saved, the saved appearances of the ambient light system associated with a specific kind of music may be presented to the user as selectable icons (e.g., icons named "Disco," "Dance," "Pop," "Rap," "Rock," etc.), for example, on the display of mobile device **200**. Each icon may be in the form of a single softkey button on the display and within the user interface of program **104**, for example.

[0044] The optional step **418** of configuring the plurality of user-configurable appearances of the ambient light system based on the user's preferences can be executed by program **104** running on the smartphone **200** or on the vehicle computer **100**, in real time between the smartphone **200** and the infotainment system of the vehicle **100**.

[0045] Turning back to FIG. **4**, at step **420**, without any user intervention, program **104** changes the appearance of at least one portion of the ambient light system within the vehicle interior based on the captured sound within the vehicle interior and (optionally) based on the preferences of the user (e.g., using the user-configurable appearances of the ambient light system).

[0046] It should be understood that method **400** is not limited to any particular step or sequence of steps.

[0047] In the context of the present description, the functions of program **104** may be carried out by a processor. The processor can be understood to mean a machine or an electronic circuit, for example. In particular, a processor can be a central processing unit (CPU), a microprocessor or microcontroller, for example an application-specific integrated circuit or digital signal processor, possibly in combination with a data storage unit for storing program commands, etc. Additionally, a processor can be understood to be a virtual processor, a virtual machine or soft CPU. The program **104** may be stored in the memory of the machine.

[0048] It will be understood that the operational steps are performed by the computers or processors described herein upon loading and executing software code or instructions which are tangibly stored on a tangible, non-transitory computer readable storage medium, such as on a magnetic medium, e.g., a computer hard drive, an optical medium, e.g., an optical disc, solid-state memory, e.g., flash memory, or other storage media known in the art. Thus, any of the functionality performed by the computers or processors described herein described herein is implemented in software code or instructions which are tangibly stored on a tangible, non-transitory computer readable storage medium. Upon loading and executing such software code or instructions by the computers or processors, the computers or processors may perform any of the functionality of the computers or processors described herein, including any steps of the methods described herein.

[0049] The term "software code" or "code" used herein refers to any instructions or set of instructions that influence the operation of computers or processors. They may exist in a computer-executable form, such as machine code, which is the set of instructions and data directly executed by a computer's central processing unit or by a controller, a human-understandable form, such as source code, which may be compiled in order to be executed by a computer's central processing unit or by a controller, or an intermediate form, such as object code, which is produced by a compiler. As used herein, the term "software code" or "code" also includes any human-understandable computer instructions or set of instructions, e.g., a script, that may be executed on the fly with the aid of an interpreter executed by a computer's central processing unit or by a controller.

[0050] It will also be understood that the terms and expressions used herein have the ordinary meaning as is accorded to such terms and expressions with respect to their corresponding respective areas of inquiry and study except where specific meanings have otherwise been set forth herein. The terms "comprises," "comprising," "includes," "including," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that has, comprises or includes a list of elements or steps does not include only those elements or steps but may include other elements or steps not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "a" or "an" does not, without further constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

[0051] While the foregoing has described what are considered to be the best mode and/or other examples, it is understood that various modifications may be made therein and that the subject matter disclosed herein may be implemented in various forms and examples, and that they may be applied in numerous applications, only some of which have been described herein. It is intended by the following claims to claim any and all modifications and variations that fall within the true scope of the present concepts.

What is claimed is:

1. A computer-implemented method for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior, said method comprising the steps of:

(a) connecting a software application to a vehicle network;

(b) capturing, by the software application, at least one sound within the vehicle interior;

(c) analyzing, by the software application, the at least one sound captured within the vehicle interior; and

(d) changing an appearance of at least one portion of the ambient light system within the vehicle interior based on the captured at least one sound within the vehicle interior.

2. The computer-implemented method of claim **1**, wherein the at least one portion of the ambient light system within the vehicle interior comprises light emitting diodes ("LEDs") arranged and configured to provide illumination around a dashboard, a center console, door handles, cupholders, door panels, or footwells of the vehicle.

3. The computer-implemented method of claim **1**, wherein the software application includes a memory having a plurality of different saved appearances of the ambient light system within the vehicle interior, each saved appearance corresponding with a unique sound.

4. The computer-implemented method of claim **3**, wherein the software application is installed on a mobile device.

5. The computer-implemented method of claim **3**, wherein the plurality of different appearances of the ambient light system within the vehicle interior comprises at least one of color, brightness, color sequence, or flash sequence, or at least one of color, brightness, color sequence, or flash sequence of at least one of a plurality of zones within the vehicle.

6. The computer-implemented method of claim **5**, wherein the plurality of zones within the vehicle comprise a front right zone, a front left zone, a rear right zone, and a rear left zone.

7. The computer-implemented method of claim **3**, wherein each of the plurality of different appearances of the ambient lights within the vehicle interior corresponds to at least one type of music played within the vehicle interior.

8. The computer-implemented method of claim **7**, wherein each of the plurality of different appearances of the ambient lights within the vehicle interior corresponds to at least one characteristic of the music played within the vehicle interior.

9. The computer-implemented method of claim **8**, wherein the at least one characteristic of the music played within the vehicle interior comprises beats per minute ("BPM").

10. The computer-implemented method of claim **1**, wherein the software application comprises a microphone and the at least one sound within the vehicle interior is captured by the microphone.

11. The computer-implemented method of claim **1**, further comprising displaying the software application on a screen of the vehicle.

12. The computer-implemented method of claim **11**, further comprising one of enabling or disabling of the software application on the screen of the vehicle.

13. The computer-implemented method of claim **1**, wherein the ambient light system within the vehicle interior is operatively connected to or forms part of an infotainment system of the vehicle.

14. The computer-implemented method of claim **13**, wherein the software application is loaded on a mobile device and the changing the appearance of the ambient light system within the vehicle interior is performed by an infotainment system of the vehicle based on a control signal from the software application.

15. The computer-implemented method of claim **14**, wherein the changing the appearance of the ambient light system within the vehicle interior is performed by the software application via a vehicle network application programming interface ("API").

16. A computer program product for analyzing sounds within a vehicle interior and controlling ambient light system within the vehicle interior, the computer program product being stored in a non-transitory computer-readable recording medium, wherein the computer program product is configured for:

(a) connecting to a vehicle network;

(b) capturing, by the software application, of at least one sound within the vehicle interior; and

(c) changing an appearance of the ambient light system within the vehicle interior based on the captured at least one sound within the vehicle interior.

17. A vehicle comprising the computer program product of claim **16**.

18. A smartphone comprising the computer program product of claim **16**.

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