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Detection of a Vehicle Occupant's Dropped Items After Vehicle Entry or Exit

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FIG. 1 is a flowchart showing a method 100 for using a lidar and/or other sensors (such as cameras, depth scanners, etc.) on board the vehicle to detect any dropped personal items on the ground near the vehicle. Block 102 represents taking a reference scan, or other data collection, of the ground before occupant enters or exits the vehicle. Block 104 represents taking a scan (or other data collection) after the occupant enters/exits the vehicle. Data collection may be ongoing as part of other vehicle operation, so blocks 102 and 104 can represent identifying a time when an occupant enters or exits and then selecting scan(s) before that time and after that time. Alternatively, blocks 102 and 104 may represent data collection or scanning performed solely to detect dropped items.

In any event, block 106 represents using a computer vision algorithm to compare the scan, or other data collection, taken shortly after the occupant entered or exited the vehicle to the scan from before the occupant entered/exited. The comparison is to determine if there is any change (i.e. are there one or more objects outside the vehicle) and if there is a change, that the changed scene is not simply due to seeing the occupant or occupants themselves in the process of entering or exiting or standing near the vehicle. If some other object is outside the vehicle that was not there before, then at block 108 an alert is provided. This alert could take any number of forms such as spoken message presented through external/internal car speakers, a beep by the vehicle, a notification sent to an application for interaction with the vehicle, a text message sent to a cell phone, or an email. An email or notification could also include an image showing the detected item.

FIG. 2 shows an automobile 200 that includes one or more computing devices configured to carry out the method noted in FIG. 1, using one or more sensors 202, 206, 208, 210 noted below. Automobile 200 may use the computing device and sensors to autonomously drive and/or for assisting a human operator. Automobile 200 could include a sensor unit 202, a wireless communication system 204, a LIDAR unit 206, a laser rangefinder unit 208, and a camera 210. The elements of automobile 200 could include some or all of the elements described for FIG. 1.

The sensor unit 202 could include one or more different sensors configured to capture information about an environment of the automobile 200. For example, sensor unit 202 could include any combination of cameras, RADARs, LIDARs, range finders, and acoustic sensors. Other types of sensors are possible. Depending on the embodiment, the sensor unit 202 could include one or more movable mounts that could be operable to adjust the orientation of one or more sensors in the sensor unit 202. In one embodiment, the movable mount could include a rotating platform that could scan sensors so as to obtain information from each direction around the automobile 200. In another embodiment, the movable mount of the sensor unit 202 could be moveable in a scanning fashion within a particular range of angles and/or azimuths. The sensor unit 202 could be mounted atop the roof of a car, for instance, however other mounting locations are possible. Additionally, the sensors of sensor unit 202 could be distributed in different

locations and need not be collocated in a single location. Some possible sensor types and mounting locations include LIDAR unit 206 and laser rangefinder unit 208. Furthermore, each sensor of sensor unit 202 could be configured to be moved or scanned independently of other sensors of sensor unit 202. Multiple instances of sensor unit 202 can be used.

A wireless communication system 204 could be located on a roof of the automobile 200 as depicted in FIG. 2. Camera 210 may be any camera (e.g., a still camera, a video camera, etc.) configured to capture a plurality of images of the environment of the automobile 200. To this end, the camera 210 may be configured to detect visible light, or may be configured to detect light from other portions of the spectrum, such as infrared or ultraviolet light. Other types of cameras are possible as well.

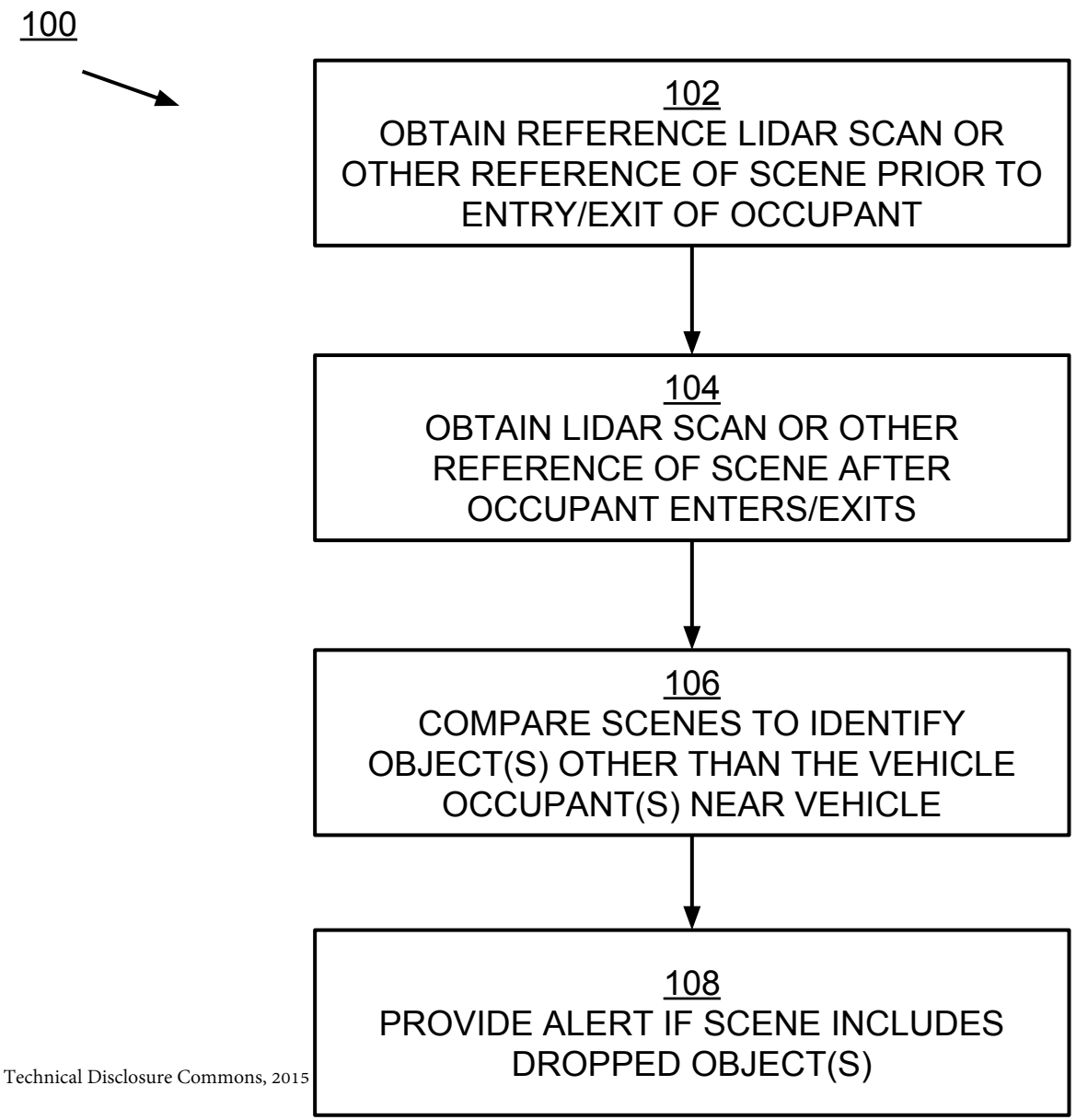
100
102
OBTAIN REFERENCE LIDAR SCAN OR OTHER REFERENCE OF SCENE PRIOR TO ENTRY/EXIT OF OCCUPANT
104
OBTAIN LIDAR SCAN OR OTHER REFERENCE OF SCENE AFTER OCCUPANT ENTERS/EXITS
106
COMPARE SCENES TO IDENTIFY OBJECT(S) OTHER THAN THE VEHICLE OCCUPANT(S) NEAR VEHICLE
108
PROVIDE ALERT IF SCENE INCLUDES DROPPED OBJECT(S)

FIG. 1

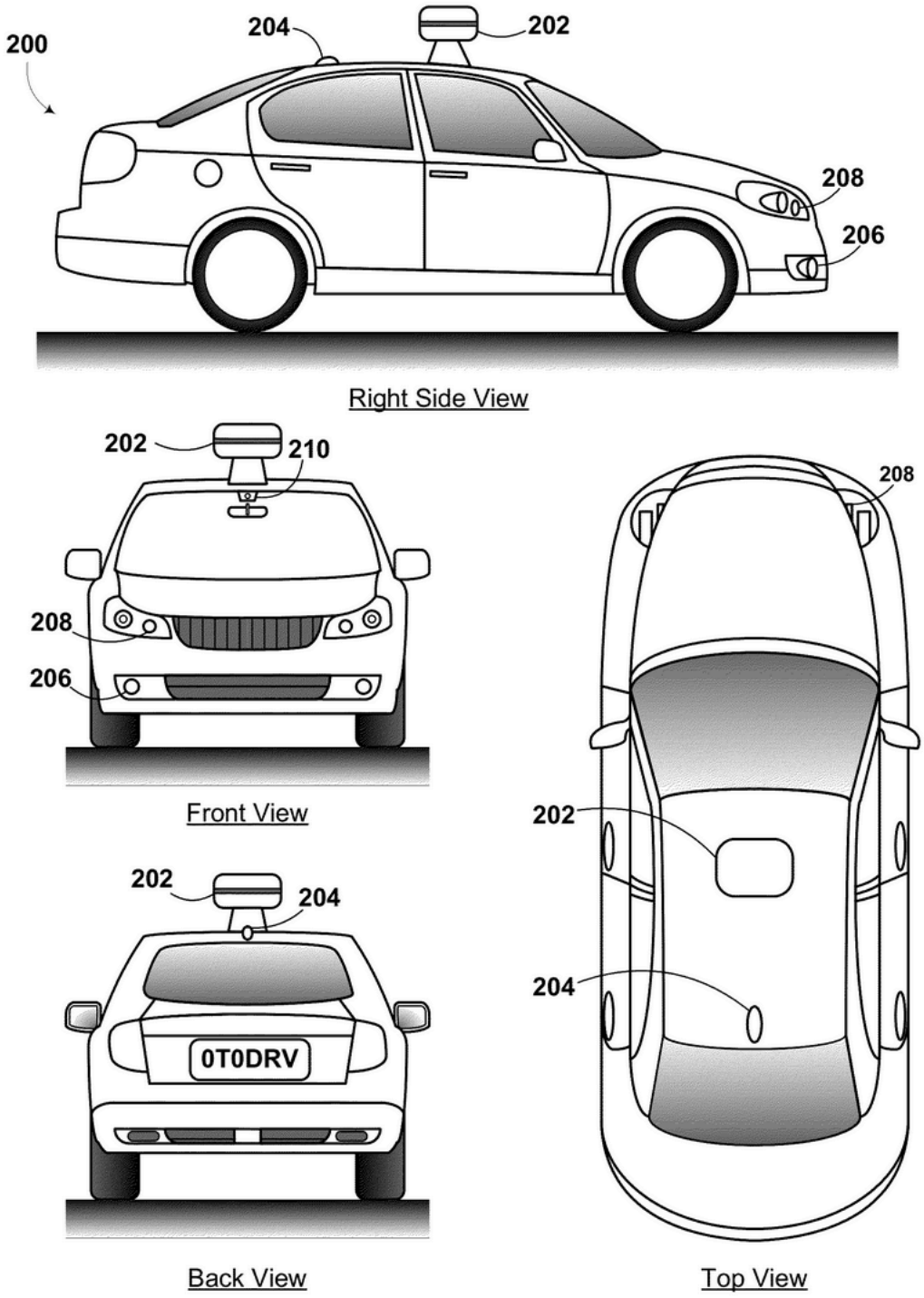
200
204
202
208
206
Right Side View
202
210
208
206
Front View
208
202
204
0T0DRV
Back View
202
204
Top View

FIGURE 2