

signals at least at the excitation frequency of each resonator, an energy signal detector for detecting the energy signal emitted by each resonator upon receipt of the signal at the excitation frequency, and a processor coupled to the detector for obtaining information about the object upon analysis of the energy signal detected by the detector.

**[0080]** The information obtained about the object may be a distance between each resonator and the detector, which positional information is useful for controlling components in the vehicle such as the occupant restraint or protection device

**[0081]** If the object is a seat, the information obtained about the seat may be an indication of the position of the seat, the position of the back cushion of the seat, the position of the bottom cushion of the seat, the angular orientation of the seat, and other seat parameters.

**[0082]** The resonator(s) may be arranged within the object and may be a SAW device, antenna and/or RFID tag. When several resonators are used, each may be designed to emit an energy signal upon receipt of a signal at a different excitation frequency. The resonators may be tuned resonators including an acoustic cavity or a vibrating mechanical element.

**[0083]** If the object is a seatbelt, the information obtained about the seatbelt may be an indication of whether the seatbelt is in use and/or the position of the seatbelt.

**[0084]** If the object is a child seat, the information obtained about the child seat may be whether the child seat is present and whether the child seat is rear-facing, front-facing, etc. (i.e., its orientation).

**[0085]** If the object is a window of the vehicle, the information obtained about the window may be an indication of whether the window is open or closed, or the state of openness.

**[0086]** If the object is a door, a resonator may be arranged in a surface facing the door such that closure of the door prevents emission of the energy signal from the resonator, whereby the information obtained about the door is an indication of whether the door is open or closed.

**[0087]** In another embodiment, the vehicle comprises at least one reflector arranged in association with the object and arranged to reflect an energy signal, a transmitter for transmitting energy signals in a direction of each of reflector, an energy signal detector for detecting energy signals reflected by the reflector(s), and a processor coupled to the detector for obtaining information about the object upon analysis of the energy signal detected by the detector. The reflector may be a parabolic-shaped reflector, a corner cube reflector, a cube array reflector, an antenna reflector and other types of reflector or reflective devices. The transmitter may be an infrared laser system in which case, the reflector comprises an optical mirror.

**[0088]** The information obtained about the object may be a distance between each reflector and the detector, which positional information is useful for controlling components in the vehicle such as the occupant restraint or protection device. If the object is a seat, the information obtained about the seat may be an indication of the position of the seat, the position of the back cushion of the seat, the position of the bottom cushion of the seat, the angular orientation of the seat, and other seat parameters. If the object is a seatbelt, the

information obtained about the seatbelt may be an indication of whether the seatbelt is in use and/or the position of the seatbelt. If the object is a child seat, the information obtained about the child seat may be whether the child seat is present and whether the child seat is rear-facing, front-facing, etc. If the object is a window of the vehicle, the information obtained about the window may be an indication of whether the window is open or closed, or the state of openness. If the object is a door, a reflector may be arranged in a surface facing the door such that closure of the door prevents reflection of the energy signal from the reflector, whereby the information obtained about the door is an indication of whether the door is open or closed.

**[0089]** Another embodiment of a motor vehicle detection system to achieve some of the above-listed objects comprises at least one transmitter for transmitting energy signals toward a target in a passenger compartment of the vehicle, at least one reflector arranged in association with the target, and at least one detector for detecting energy signals reflected by the reflector(s). A processor is optionally coupled to the detector(s) for obtaining information about the target upon analysis of the energy signal detected by the detector(s).

**[0090]** Principle objects and advantages of other disclosed inventions that can be used in conjunction with the claimed invention are:

**[0091]** 6. To recognize the presence of a human on a particular seat of a motor vehicle and to use this information to affect the operation of another vehicle system such as the entertainment system, airbag system, heating and air conditioning system, pedal adjustment system, mirror adjustment system, wireless data link system or cellular phone, among others.

**[0092]** 7. To recognize the presence of a human on a particular seat of a motor vehicle and then to determine his/her position and to use this position information to affect the operation of another vehicle system.

**[0093]** 8. To affect the vehicle entertainment system, e.g., the speakers, based on a determination of the number, size and/or location of various occupants or other objects within the vehicle passenger compartment.

**[0094]** 9. To determine the location of the ears of one or more vehicle occupants and to use that information to control the entertainment system, e.g., the speakers, so as to improve the quality of the sound reaching the occupants' ears through such methods as noise canceling sound.

**[0095]** 10. To recognize the presence of a human on a particular seat of a motor vehicle and then to determine his/her velocity relative to the passenger compartment and to use this velocity information to affect the operation of another vehicle system.

**[0096]** 11. To determine the position of a seat in the vehicle using sensors remote from the seat and to use that information in conjunction with a memory system and appropriate actuators to position the seat to a predetermined location.