

VEHICLE OBJECT DETECTION SYSTEM AND METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 09/891,432, filed Jun. 26, 2001 which is a continuation-in-part of U.S. patent application Ser. No. 09/838,920 filed Apr. 20, 2001, which is a continuation-in-part of U.S. patent application Ser. No. 09/563,556 filed May 3, 2000, which is a continuation-in-part of U.S. patent application Ser. No. 09/437,535 filed Nov. 10, 1999, which in turn is a continuation-in-part of U.S. patent application Ser. No. 09/047,703 filed Mar. 25, 1998, now U.S. Pat. No. 6,039,139, which in turn is:

[0002] 1) a continuation-in-part of U.S. patent application Ser. No. 08/640,068 filed Apr. 30, 1996, now U.S. Pat. No. 5,829,782, which in turn is a continuation application of U.S. patent application Ser. No. 08/239,978 filed May 9, 1994, now abandoned, which is a continuation-in-part of U.S. patent application Ser. No. 08/040,978 filed Mar. 31, 1993, now abandoned, which is a continuation-in-part of U.S. patent application Ser. No. 07/878,571 filed May 5, 1992, now abandoned; and

[0003] 2) a continuation-in-part of U.S. patent application Ser. No. 08/905,876 filed Aug. 4, 1997, now U.S. Pat. No. 5,848,802, which is a continuation of U.S. patent application Ser. No. 08/505,036 filed Jul. 21, 1995, now U.S. Pat. No. 5,653,462, which is a continuation of the Ser. No. 08/040,978 application which is a continuation-in-part of the Ser. No. 07/878,571 application.

[0004] This application is also a continuation-in-part of U.S. patent application Ser. No. 09/639,299 filed Aug. 15, 2000 which is a continuation of U.S. patent application Ser. No. 08/905,877 filed Aug. 4, 1997, now U.S. Pat. No. 6,186,537, which is a continuation of U.S. patent application Ser. No. 08/505,036 filed Jul. 25, 1995, now U.S. Pat. No. 5,653,462, which is a continuation of the Ser. No. 08/040,978 application which is a continuation-in-part of the Ser. No. 07/878,571 application.

[0005] This application is also a continuation-in-part of U.S. patent application Ser. No. 09/543,678 filed Apr. 7, 2000 which in turn is a continuation-in-part of U.S. patent application Ser. No. 09/047,704 filed Mar. 25, 1998, now U.S. Pat. No. 6,116,639, which is: 1) a continuation-in-part of the Ser. 08/640,068 application which is a continuation application of the Ser. 08/239,978 application; and 2) a continuation-in-part of the Ser. No. 08/905,876 application, which is a continuation of the Ser. No. 08/505,036 application, which is a continuation of the Ser. No. 08/040,978 application which is a continuation-in-part of the Ser. No. 07/878,571 application.

[0006] This application is also related to (in view of common subject matter), but does not claim priority from, U.S. patent application Ser. No. 09/084,641 filed May 26, 1998, now U.S. Pat. No. 5,901,978, U.S. patent application Ser. No. 09/737,138 filed Dec. 14, 2000, now U.S. Pat. No. 6,325,414, U.S. patent application Ser. No. 09/409,625 filed Oct. 1, 1999, U.S. patent application Ser. No. 10/058,706

filed Jan. 28, 2002 and U.S. patent application Ser. No. 10/114,533 filed Apr. 2, 2002.

[0007] All of the foregoing patent applications and patents are incorporated by reference herein in their entirety.

FIELD OF THE INVENTION

[0008] The present invention relates generally to methods and arrangements for obtaining information about an occupying item in a vehicle or a part in the vehicle using a wave-detecting device which receives waves emanating from or generated by a reflector or resonator. The reflector or resonator is arranged in association with the vehicle or occupying item so that the waves emanating therefrom or generated thereby can be processed to provide information about the occupying item, such as its presence, position, or information about the vehicle, such as the position of the seat when the resonator is placed in the seat.

BACKGROUND OF THE INVENTION

[0009] 1. History and General Statement of the Problem

[0010] In 1984, the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation issued a requirement for frontal crash protection of automobile occupants. This regulation mandated "passive occupant restraints" for all passenger cars by 1992. A more recent regulation required both driver and passenger side airbags on all passenger cars and light trucks by 1998. In addition, the demand for airbags is constantly accelerating in both Europe and Japan (~36 million vehicles) and all vehicles produced in these areas and eventually worldwide (~50 million vehicles) will likely be equipped with airbags as standard equipment, if they do not include them already.

[0011] Whereas thousands of lives have been saved by airbags, significant improvements can be made. As discussed in detail in U.S. Pat. No. 5,653,462 referenced above, for a variety of reasons, vehicle occupants can be or get too close to the airbag before it deploys and can be seriously injured or killed upon deployment of the airbag.

[0012] Also, a child in a rear facing child seat, which is placed on the right front passenger seat, is in danger of being seriously injured if the passenger airbag deploys. This has now become an industry-wide concern and the U.S. automobile industry is continually searching for an easy, economical solution, which will prevent the deployment of the passenger side airbag if a rear facing child seat is present. An improvement on the invention disclosed in the above-referenced patent, as will be disclosed in greater detail below, includes more sophisticated means to identify objects within the passenger compartment and will solve this problem.

[0013] Initially, these systems will solve the out-of-position occupant and the rear facing child seat problems related to current airbag systems and prevent unneeded deployments when a seat is unoccupied. Airbags are now under development to protect rear seat occupants in vehicle crashes. A system is therefore needed to detect the presence of occupants, position, (to determine if they are out-of-position), and type (to identify the presence of a rear facing child seat) in the rear seat. Current and future automobiles may have eight or more airbags as protection is sought for rear seat occupants and from side impacts. In addition to eliminating the disturbance of unnecessary airbag deploy-