

*Networks*, Vol. 1, pp. 75-89, 1988, and "Learned Classification of Sonar Targets Using a Massively Parallel Network", IEEE Transactions on Acoustics, Speech, and Signal Processing, Vol. 36, No. 7, July 1988.

[0027] 4. Definitions

[0028] Some embodiments of the invention are described below and unless specifically noted, it is the applicants' intention that the words and phrases in the specification and claims be given the ordinary and accustomed meaning to those of ordinary skill in the applicable art(s). If the applicant intends any other meaning, he will specifically state he is applying a special meaning to a word or phrase.

[0029] Likewise, applicants' use of the word "function" here is not intended to indicate that the applicants seek to invoke the special provisions of 35 U.S.C. §112, sixth paragraph, to define their invention. To the contrary, if applicants wish to invoke the provisions of 35 U.S.C. §112, sixth paragraph, to define their invention, they will specifically set forth in the claims the phrases "means for" or "step for" and a function, without also reciting in that phrase any structure, material or act in support of the function. Moreover, even if applicants invoke the provisions of 35 U.S.C. §112, sixth paragraph, to define their invention, it is the applicants' intention that their inventions not be limited to the specific structure, material or acts that are described in the preferred embodiments herein. Rather, if applicants claim their inventions by specifically invoking the provisions of 35 U.S.C. §112, sixth paragraph, it is nonetheless their intention to cover and include any and all structure, materials or acts that perform the claimed function, along with any and all known or later developed equivalent structures, materials or acts for performing the claimed function.

[0030] "Pattern recognition" as used herein will generally mean any system which processes a signal that is generated by an object, or is modified by interacting with an object, in order to determine which one of a set of classes that the object belongs to. Such a system might determine only that the object is or is not a member of one specified class, or it might attempt to assign the object to one of a larger set of specified classes, or find that it is not a member of any of the classes in the set. The signals processed are generally electrical signals coming from transducers which are sensitive to either acoustic or electromagnetic radiation and if electromagnetic, they can be either visible light, infrared, ultraviolet, radar or other part of the electromagnetic spectrum, or electric or magnetic fields.

[0031] "To identify" as used herein will generally mean to determine that the object belongs to a particular set or class. The class may be one containing all rear facing child seats, one containing all human occupants, all human occupants not sitting in a rear facing child seat, or all humans in a certain height or weight range, all humans that are in a position where they can be protected by an airbag, all humans that are in a position where they are at risk to be seriously injured by an airbag depending on the purpose of the system. In the case where a particular person is to be recognized, the set or class will contain only a single element, the person to be recognized.

[0032] 5. Some Examples of the Invention

[0033] In a passive infrared system a detector receives infrared radiation from an object in its field of view, in this

ease the vehicle occupant, and determines the temperature of the occupant based on the infrared radiation. The VIMS can then respond to the temperature of the occupant, which can either be a child in a rear facing child seat or a normally seated occupant, to control some other system. This technology can provide input data to a pattern recognition system but it has limitations related to temperature. The sensing of the child could pose a problem if the child is covered with blankets. It also might not be possible to differentiate between a rear facing child seat and a forward facing child seat. In all cases, the technology will fail to detect the occupant if the ambient temperature reaches body temperature as it does in hot climates. Nevertheless, for use in the control of the vehicle climate, for example, a passive infrared system that permits an accurate measurement of each occupant's temperature is useful.

[0034] In a laser optical system an infrared laser beam is used to momentarily illuminate an object, occupant or child seat in the manner as described, and illustrated in FIG. 8, of U.S. Pat. No. 5,653,462 cross-referenced above. In some cases, a charge-coupled device (a type of TV camera also referred to as a CCD array) or a CMOS device is used to receive the reflected light. In other cases when a scanning laser is used a pin or avalanche diode or other photo detector can be used. The laser can either be used in a scanning mode, or, through the use of a lens, a cone of light, swept line of light, or a pattern or structured light can be created which covers a large portion of the object. Additionally, one or more LEDs can be used as a light source. Also triangulation can be used in conjunction with an offset scanning laser to determine the range of the illuminated spot from the light detector. Various focusing systems also can have applicability in some implementations to measure the distance to an occupant. In most cases, a pattern recognition system, as defined above, is used to identify and classify, and can be used to locate, the illuminated object and its constituent parts. The optical systems generally provide the most information about the object and at a rapid data rate. Its main drawback is cost which is considerably above that of ultrasonic or passive infrared systems. As the cost of lasers and imagers comes down in the future, this system will become more competitive. Depending on the implementation of the system, there may be some concern for the safety of the occupant if a laser light can enter the occupant's eyes. This is minimized if the laser operates in the infrared spectrum particularly at the "eye-safe" frequencies.

[0035] Radar systems have similar properties to the laser system discussed above. The wavelength of a particular radar system can limit the ability of the pattern recognition system to detect object features smaller than a certain size. Also, depending on the radar frequency, the detecting method can be based on the modification of the waves in different ways such as reflection, absorption, scattering or transmission. Once again, however, there is some concern about the health effects of radar on children and other occupants. This concern is expressed in various reports available from the United States Food and Drug Administration Division of Devices.

[0036] Naturally, electromagnetic waves from other parts of the electromagnetic spectrum can also be used such as, for example, those used with what are sometimes referred to as capacitive or electric field sensors, for example as described in By Kithil et al. U.S. Pat. Nos. 5,366,241, 5,602,734,