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(54) **APPARATUS FOR ASSISTED DRIVING OF A VEHICLE IN RELATION TO KEEPING THE SAFETY DISTANCE WITH RESPECT TO A VEHICLE OR OBSTACLE IN FRONT**

VORRICHTUNG ZUM UNTERSTÜTZTEN STEUERN EINES FAHRZEUGS HINSICHTLICH DER EINHALTUNG DES SICHERHEITSABSTANDES ZU EINEM FAHRZEUG ODER HINDERNIS VOR DEM FAHRZEUG

APPAREIL D'ASSISTANCE A LA CONDUITE DE VEHICULE PERMETTANT DE GARDER LA DISTANCE DE SECURITE PAR RAPPORT A UN VEHICULE OU A UN OBSTACLE A L'AVANT

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Description

[0001] The present invention relates to an apparatus for assisted driving of a vehicle, particularly for keeping the safety distance with respect to a vehicle in front.

[0002] More particularly, the invention relates to an apparatus for assisted driving, which is capable of giving an indication of the degree of risk that the vehicle driver is running at a given instant in relation to the distance from the vehicle in front.

Background Art

[0003] As is known, one of the most frequent causes of road accidents is failure to observe the safety distance between two vehicles. Substantially, it is a common habit for a driver to reach a distance from a vehicle in front which is extremely limited and inadequate to ensure braking spaces sufficient to prevent collision with the vehicle in front, if said vehicle has to perform emergency braking.

[0004] Failure to comply with the safety distance, in addition to being a cause of accidents, generates a sense of unease in the driver of the vehicle in front, since for example in night driving conditions the headlights of the vehicle behind tend to dazzle the driver of the vehicle in front when the driver looks into the internal rear-view mirror.

[0005] However, even if the driver is extremely careful to observe the safety distance prescribed by the law, he is never in any way aware whether he is actually keeping the adequate safety distance or not, since such an assessment has no elements allowing objective verification.

[0006] Essentially, in normal conditions, while driving the vehicle, the driver acts so as to keep a distance which he believes is optimum with respect to the vehicles in front. The assurance of avoiding collision is therefore entrusted exclusively to a subjective assessment, which he performs by viewing the external scene and by means of the instruments provided on board the vehicle.

[0007] The assessment of one's own speed can be determined, with a varying degree of precision, by viewing the scene and/or by reading the indications of the onboard speedometer.

[0008] The distance from the vehicle in front, or in any case the obstacle-free space, must instead be assessed exclusively by viewing the scene, since in common practice currently there are no instruments capable of giving this indication objectively.

[0009] The same occurs as regards the relative speed of one's own vehicle and the vehicle in front: also in this case, the driver has no instruments capable of giving an objective assessment of this value.

[0010] The situation described above is further worsened when driving in low-visibility conditions, such as in rain, mist or fog. It is well-known that in these conditions the assessment of the external conditions (speed and distance) can be altered even substantially due to reasons linked to perceptual difficulties, so as to compromise the efficiency of the driver in assessing and maintaining a specific and adequate condition of safety during driving.

[0011] The main drawback that arises from what has been described above is that two of the three mentioned factors, i.e., the distance from the vehicle in front and the relative speed of the two vehicles, are not available to the driver in the form of objective measurements and as such provided by the onboard instruments. Further, even if such information were available as instrument-provided values, their display would occur in the form of different and distinct values. Therefore, the driver would always have the task of deducing constantly a summary of this information, so as to establish whether the current driving conditions ensure or not adequate safety against possible collision with the vehicle in front.

[0012] US 5 278 764 discloses an automatic braking system with proximity detection to a preceding vehicle having a combination of features as set forth in the pre-characterizing portion of the appended claim 1.

Disclosure of the Invention

[0013] The aim of the present invention is to provide an apparatus for assisted driving of a vehicle which allows to objectivize the assessments of the distance from the vehicle in front which the driver normally performs subjectively.

[0014] Within this aim, an object of the present invention is to provide an apparatus for assisted driving which allows to provide the driver with a constantly updated degree of risk.

[0015] Another object of the present invention is to provide an apparatus for assisted driving which is capable of giving the driver an assessment of the risk of collision in an extremely straightforward and simple way.

[0016] Another object of the present invention is to provide an apparatus for assisted driving which also takes into account the environmental conditions in order to assess the risk status.

[0017] A further object of the present invention is to provide an assisted driving apparatus which is highly reliable, relatively simple to manufacture and at competitive costs.

[0018] In accordance with the invention, there is provided an apparatus for assisted driving, particularly for maintaining the safety distance between two vehicles, as defined in the appended claims.

Brief description of the Drawings

[0019] Further characteristics and advantages of the invention will become better apparent from the following detailed description of preferred but not exclusive embodiments of the apparatus according to the invention, illustrated in the accompanying drawing, wherein the only figure is a block diagram of the apparatus according to the invention.

Ways of carrying out the Invention

[0020] An apparatus according to the invention, generally designated by the reference numeral 1, comprises at least one sensor 2, which is adapted to measure the obstacle-free space in the direction of travel of the vehicle and at the same time to determine the relative speed with respect to the vehicle (or obstacle) in front. Such sensor can be constituted conveniently by a radar device, which operates by emitting a narrow microwave beam 3 in the forward direction of the vehicle, said beam being reflected by a vehicle or obstacle 4 that lies ahead and then reaching again the radar sensor device 2. The reflected beam is designated by the reference numeral 5 in the figure.

[0021] The sensor device 2 comprises a processing circuit 6, which compares the signal emitted by the radar sensor 2 with the reflected signal and obtains from them an additional signal in order to determine the distance and relative-speed information. This signal is conveniently sent to a processing and control unit 7, which further receives other signals which arrive from the vehicle or from the external environment.

[0022] In particular, the processing and control unit 7 receives a speed signal 8 from a speedometer 9 which is normally present on board the vehicle, temperature signal 10 acquired by an external temperature sensor 11, and a wheel rolling signal 12, which is detected by an appropriate sensor 13 (if the output signal 8 is not sent to the processing and control unit 7). The processing and control unit 7 further receives a windshield wiper activation signal 14 obtained from the onboard electrical system 15.

[0023] These signals are then processed by the processing and control unit 7 so that said unit can perform a calculation in order to determine the degree of risk of the actual position of the vehicle with respect to the vehicle in front or with respect to the obstacle.

[0024] Substantially, the processing and control unit 7 processes the following signals:

distance signal;
signal indicating the relative speed of the two vehicles;
signal indicating the vehicle's own speed;
external temperature signal;
windshield wiper activation signal.

[0025] Moreover, the apparatus according to the invention can comprise at least one, and preferably a plurality of, parking sensors 16, managed by an independent control unit 17 connected to the processing and control unit 7.

[0026] Finally, the apparatus has a display unit 18, which is suitable to display information for the driver, such as an excessive speed alarm and/or the indication of the distance margin of the vehicle, in addition to the possibility to select various possible functions of the apparatus by operating appropriate setup buttons.

[0027] Further, the apparatus according to the invention can be provided with an acoustic alarm capable of adequately alerting the driver if the estimated degree of risk exceeds a certain threshold.

[0028] With reference to the figure, the operation of the apparatus according to the invention is as follows.

[0029] First of all, the radar sensor emits a narrow beam of microwaves from the moving vehicle and detects the return beam, which can be reflected by an obstacle or by a vehicle in front, which is also moving.

[0030] By processing the data between the emitted beam and the reflected beam, the circuit 6 is capable of determining distance and relative-speed information. The signal which contains distance and relative-speed information is then sent to the processing and control unit 7, which performs the necessary processing; in particular, such unit uses the signal received from the sensor device 2 together with a signal indicating the vehicle's own speed 8, with the external temperature signal 10, and with the windshield wiper activation signal 14, to perform a whole series of processing operations so as to obtain an indication of the degree of risk correlated to the current position of the vehicle with respect to the vehicle in front or with respect to any fixed obstacle.

[0031] In particular, the physical values measured by the apparatus according to the invention are as follows:

- speed of one's own vehicle;
- speed of the vehicle in front;
- distance from the vehicle in front.

[0032] Some parameters are also considered and are assigned to the appropriate value:

- reaction time (expressed in seconds);
- efficiency of the braking system (dimensionless parameter comprised for example between 0 and 100);
- safety factor (dimensionless parameter comprised for example between 0 and 100);
- scale start (time-dependent parameter which indicates the minimum safety margin that is considered "safe": if the safety margin is higher than the scale start value, the danger level is nil);
- maximum theoretical deceleration.

[0033] The calculation described below is performed both for one's own vehicle and for the vehicle in front.

Vehicle deceleration:

[0034]

$$\text{Deceleration} = \text{max\_dec} * \text{effic} / 100 \ [\text{m/s}^2] \quad [1]$$

Braking time:

[0035]

$$\text{brk\_time} = \text{speed/deceleration} \ [\text{s}] \quad [2]$$

Braking space:

[0036]

$$\text{brk\_space} = 0.5 * \text{speed} * \text{brk\_time} \ [\text{m}] \quad [3]$$

Reaction space:

[0037]

$$\text{rea\_space} = \text{rea\_time} * \text{speed} \ [\text{m}] \quad [4]$$

Stopping space:

[0038]

$$\text{stop\_space} = \text{brk\_space} + \text{rea\_space} \ [\text{m}] \quad [5]$$

[0039] Once these values have been obtained for both vehicles, the safety distance is determined:

$$\text{safe\_dist} = \text{own\_stop\_space} - \text{other\_veh\_stop\_space} \ [\text{m}] \quad [7]$$

[0040] Finally, the safety margin and the degree of risk are determined:

$$safety\_marg = (obj\_dist - min\_dist) / own\_speed\ [s]\ (3) \quad [8]$$

$$risk = 1\text{-}safety\_marg / scale\_start\ [dimensionless,\ 0\text{-}1]\ (4) \quad [9]$$

[0041] However, the calculations listed above are merely examples, since it is possible to find different algorithms capable of expressing the degree of risk, where this expression is used to reference the degree of risk of collision experienced by the driver who is driving the vehicle.

[0042] Further, it should be noted that the safety factor used previously in the calculation is a parameter which expresses the extent to which it is necessary to consider the instantaneous stopping of the vehicle in front. A zero value leads to considering in its entirety the braking space of the vehicle in front, whereas a value 100 means considering only one's own stopping space, as if the vehicle in front could stop instantly with a nil stopping space.

[0043] The safety margin is instead the time that elapses between the current instant and the last instant when it is possible to start braking and yet be able to stop in time.

[0044] Finally, the danger is the complement of the safety margin with respect to the scale start value, applied to the interval 0-1 (negative values are limited to zero).

[0045] Therefore, the method according to the present invention provides for a first step, in which values related to one's own vehicle and to the vehicle in front are determined, and a second step, in which the degree of risk of collision is calculated.

[0046] Moreover, the apparatus is capable of performing some auxiliary functions, which are also oriented toward vehicle safety. In particular, the apparatus activates a visual/acoustic alarm, which intervenes if the speed of one's own vehicle exceeds a limit and can be preset by the driver. Another function is to provide the driver with an indication of the distance margin during parking maneuvers. This function is performed by using the unit 17 with the corresponding parking sensors 16 arranged so as to detect the front and rear distance with respect to obstacles.

[0047] In practice it has been found that the apparatus according to the invention fully achieves the intended aim and objects, since it allows to provide an unambiguous and summary assessment of the current degree of risk during driving, said degree of risk being expressed optionally in other terms, such as the degree of safety, and being reported to the driver by means of an appropriate visual and/or acoustic system, which is capable of communicating straightforwardly and unambiguously said information to the driver.

[0048] Therefore, the assessment of safety with respect to a possible collision with a vehicle (or with any obstacle) which lies in front is no longer entrusted to subjective perception on the part of the driver, with all the consequent risks of error and ambiguity, but to an apparatus which is capable of performing a mathematical calculation by means of an appropriate algorithm and by using physical values of the vehicle in front in addition to physical values acquired from the outside environment, so as to determine the conditions of the road surface.

[0049] The indication provided to the driver allows said driver to change his behavior during travel and therefore constantly remain at a distance from the vehicle in front which accordingly ensures adequate safety.

Claims

1. An apparatus (1) for assisted driving, particularly for maintaining the adequate safety distance between two vehicles, comprising at least one sensor (2) adapted to detect a signal (5) from which information on distance and relative speed with respect to the vehicle (4) in front can be determined;
   a processing and control unit (7), which is suitable to process said information together with signals (8,12) which indicate the status of the vehicle and signals (10,14) which indicate the external environmental condition;
   said processing and control unit (7) being adapted to provide a signal indicating the degree of collision risk in order to provide said user with a unique and objective indication of the current degree of risk with the current status of the vehicle and the current status of the external atmospheric conditions,
   characterized by said processing and control unit (7) providing said degree of risk dependent upon: an efficiency of the braking system of the user vehicle; a scale start parameter that is an assigned time-dependent value which indicates a minimum safety margin considered safe wherein if the safety margin is greater than a scale start value the danger level is nil; and a safety factor that is a dimensionless parameter expressing an extent of the need to consider an instantaneous stopping of the vehicle (4) in front.

2. The apparatus according to claim 1, **characterized in that** said at least one sensor is a radar sensor (2).

3. The apparatus according to claim 1, **characterized in that** said processing and control unit (7) receives a speed signal (8) from the speedometer (9) of said vehicle.

4. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises an electronic circuit (6) which is adapted to compare a signal (3) emitted by said sensor (2) with a reflected signal (5) so as to determine said distance and relative-speed information.

5. The apparatus according to one or more of the preceding claims, **characterized in that** said processing and control unit (7) receives a wheel rotation signal (12) detected by at least one wheel rotation sensor (13).

6. The apparatus according to one or more of the preceding claims, **characterized in that** said processing and control unit (7) receives a signal (14) which indicates the activation of the windshield wiper of the vehicle.

7. The apparatus according to one or more of the preceding claims, **characterized in that** said processing and control unit (7) receives an external temperature signal (10).

8. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises at least one parking sensor (16) controlled by a management unit (17), which in turn is connected to said processing and control unit (7).

9. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises a display unit (18) which is adapted to provide indications to the driver.

10. A method for determining the degree of risk of collision of a vehicle with respect to the vehicle in front or with respect to a fixed obstacle, comprising the steps of:

    determining, with respect to a vehicle (4) in front, distance and relative-speed information;
    processing said distance and relative-speed information together with signals (8,12) which indicate the status of the vehicle and signals (10,14) which indicate external environmental conditions, and obtaining an indication of the current degree of risk of collision for the vehicle in the current conditions, **characterized in that** the degree of risk is obtained using the following parameters: the efficiency of the braking system of the user vehicle; a scale start parameter that is an assigned time-dependent value which indicates a minimum safety margin considered safe wherein if the safety margin is greater that a scale start value the danger level is nil; and a safety factor that is a dimensionless parameter expressing an extent of the need to consider an instantaneous stopping of the vehicle (4) in front.

11. The method according to claim 10, **characterized in that** it comprises the steps of measuring the speed of the vehicle in front, the speed of one's own vehicle and the distance from the vehicle in front.

12. The method according to one or more of claims 10 or 11, **characterized in that** said efficiency of the braking system is assigned a dimensionless value comprised between 0 and 100, and said safety factor being comprised between 0 for considering a braking space of the vehicle (4) in front in its entirety, and 100 for considering only one's own stopping space as if the vehicle (4) in front could stop instantly with a nil stopping space.

Patentansprüche

1. Vorrichtung (1) zum unterstützen Steuern eines Fahrzeugs, insbesondere zum Einhalten eines ausreichenden Sicherheitsabstandes zwischen zwei Fahrzeugen, mit wenigstens einem Sensor (2), der ausgebildet ist, ein Signal (5) zu erfassen, aus dem Informationen über Abstand und relative Geschwindigkeit bezogen auf ein Vorfahrzeug (4) ermittelt werden können;
einer Verarbeitungs- und Steuereinheit (7), die geeignet ist, die genannten Informationen zusammen mit Signalen (8, 12), die den Zustand des Fahrzeugs anzeigen, und Signalen (10, 14), die äußere Umweltbedingungen anzeigen, zu verarbeiten;
wobei die Verarbeitungs- und Steuereinheit (7) so ausgebildet ist, dass sie ein Signal bereitstellt, das den Grad eines Kollisionsrisikos anzeigt, um den Benutzer mit einer eindeutigen und objektiven Meldung über den gegenwärtigen Risikograd mit dem gegenwärtigen Zustand des Fahrzeugs und dem gegenwärtigen Zustand äußerer atmosphärischer Bedingungen zu versorgen,

dadurch gekennzeichnet, dass die Verarbeitungs- und Steuereinheit (7) den Risikograd bereitstellt in Abhängigkeit von: einer Effizienz des Bremssystems des Fahrzeugs des Benutzers; einem Anzeige-Startparameter, der ein festgesetzter zeitabhängiger Wert ist, der eine minimale Sicherheitsspanne anzeigt, die als sicher angesehen wird, wobei das Gefährdungsniveau null ist, falls die Sicherheitsspanne größer ist als ein Anzeige-Startwert; und einem Sicherheitsfaktor, der ein dimensionsloser Parameter ist, der ein Maß für das Erfordernis ausdrückt, ein augenblickliches Anhalten des Vorfahrzeuges in Erwägung zu ziehen.

2. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der wenigstens eine Sensor ein Radarsensor (2) ist.

3. Vorrichtung gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Verarbeitungs- und Steuereinheit (7) ein Geschwindigkeitssignal (8) des Tachometers (9) des Fahrzeugs erhält.

4. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine elektronische Schaltung (6) umfasst, die eingerichtet ist, ein Signal (3), das durch den Sensor (2) abgegeben wurde, mit einem reflektierten Signal (5) zu vergleichen, um die Abstands- und relative Geschwindigkeitsinformationen zu ermitteln.

5. Vorrichtung gemäß einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verarbeitungs- und Steuereinheit (7) ein Radrotationssignal (12) erhält, das von wenigstens einem Radrotationssensor (13) erfasst wurde.

6. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verarbeitungs- und Steuereinrichtung (7) ein Signal (14) erhält, dass die Einschaltung des Scheibenwischers des Fahrzeugs anzeigt.

7. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verarbeitungs- und Steuereinheit (8) ein externes Temperatursignal (10) erhält.

8. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** sie wenigstens einen Parksensor (16) umfasst, der von einer Managementeinheit (17) gesteuert wird, die wiederum mit der Verarbeitungs- und Steuereinheit (7) verbunden ist.

9. Vorrichtung nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** sie eine Anzeigeeinheit (18) umfasst, die eingerichtet ist, Anzeigen dem Fahrer zur Verfügung zu stellen.

10. Verfahren zum Ermitteln des Kollisionsrisikograde eines Fahrzeuges bezüglich eines Vorfahrzeuges oder bezüglich eines feststehenden Hindemisses, das die folgenden Schritte umfasst:

Feststellen von Abstands- und relativen Geschwindigkeitsinformationen bezüglich eines Vorfahrzeuges (4);
Verarbeiten der Abstands- und relativen Geschwindigkeitsinformationen zusammen mit Signalen (8, 12) die den Zustand des Fahrzeugs anzeigen, und Signalen (10, 14), die äußere Umweltbedingungen anzeigen und Beschaffen einer Angabe des gegenwärtigen Kollisionsrisikograde für das Fahrzeug in den gegenwärtigen Bedingungen, **dadurch gekennzeichnet, dass** der Risikograd unter Benutzung der folgenden Parameter erhalten wird; der Effizienz des Bremssystems des Fahrzeugs des Benutzers; einem Anzeige-Startparameter, der ein zugeordneter zeitabhängiger Wert ist, der eine minimale Sicherheitsspanne anzeigt, die als sicher angenommen wird, wobei der Gefährdungsgrad null ist, falls die Sicherheitsspanne größer ist als ein Anzeige-Startparameter; und ein Sicherheitsfaktor, der ein dimensionsloser Parameter ist, der ein Maß für das Bedürfnis anzeigt, ein augenblickliches Anhalten des Vorfahrzeugs (4) zu berücksichtigen.

11. Verfahren nach Anspruch 10, **dadurch gekennzeichnet, dass** es den Schritt des Messens der Geschwindigkeit des Vorfahrzeuges, der Geschwindigkeit des eigenen Fahrzeuges und des Abstandes vom Vorfahrzeug umfasst.

12. Verfahren gemäß einem oder mehreren der Ansprüche 10 oder 11, **dadurch gekennzeichnet, dass** der Effizienz des Bremssystems ein dimensionsloser Wert zwischen 0 und 100 zugeordnet wird und der Sicherheitsfaktor zwischen 0 für das Einbeziehen des Bremsweges des Vorfahrzeuges (4) in seiner Gänze und 100 für die Einbeziehung lediglich des eigenen Anhalteweges, als wenn das Vorfahrzeug (4) augenblicklich mit null Anhalteweg anhalten könnte, gewählt wird.

Revendications

1. Dispositif (1) de conduite assistée, particulièrement pour maintenir la distance de sécurité adéquate entre deux véhicules, comprenant au moins un capteur (2) adapté pour détecter un signal (5) à partir duquel peuvent être déterminées des informations sur la distance et la vitesse relative par rapport au véhicule (4) situé devant ;

   une unité de traitement et de commande (7) qui est adaptée pour traiter lesdites informations conjointement avec des signaux (8, 12) qui indiquent l'état du véhicule et des signaux (10, 14) qui indiquent les conditions environnementales externes ;
   ladite unité de traitement et de commande (7) étant adaptée pour fournir un signal indiquant le degré de risque de collision afin de fournir audit utilisateur une indication unique et objective du degré de risque actuel avec l'état actuel du véhicule et l'état actuel des conditions atmosphériques externes,

   caractérisé en ce que ladite unité de traitement et de commande (7) fournit ledit degré de risque en fonction de : une efficacité du système de freinage du véhicule de l'utilisateur ; un paramètre de démarrage sur échelle qui est une valeur attribuée asservie au temps qui indique une marge de sécurité minimale considérée comme sûre, dans lequel, si la marge de sécurité est supérieure à une valeur de démarrage sur échelle, le niveau de danger est nul ; et un facteur de sécurité qui est un paramètre sans dimension exprimant une étendue de la nécessité de prendre en compte un arrêt instantané du véhicule (4) situé devant.

2. Dispositif selon la revendication 1, **caractérisé en ce que** ledit au moins un capteur est un capteur radar (2)

3. Dispositif selon la revendication 1, **caractérisé en ce que** ladite unité de traitement et de commande (7) reçoit un signal de vitesse (8) du compteur de vitesse (9) dudit véhicule.

4. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend un circuit électronique (6) qui est adapté pour comparer un signal (3) émis par ledit capteur (2) à un signal réfléchi (5) de manière à déterminer lesdites informatisons de distance et de vitesse relative.

5. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de traitement et de commande (7) reçoit un signal de rotation de roue (12) détecté par au moins un capteur de rotation de roue (13).

6. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de traitement et de commande (7) reçoit un signal (14) qui indique l'activation des essuie-glaces du véhicule.

7. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite unité de traitement et de commande (7) reçoit un signal de température externe (10).

8. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend au moins un capteur de recul (16) commandé par une unité de gestion (17), qui est connectée à son tour à ladite unité de traitement et de commande (7).

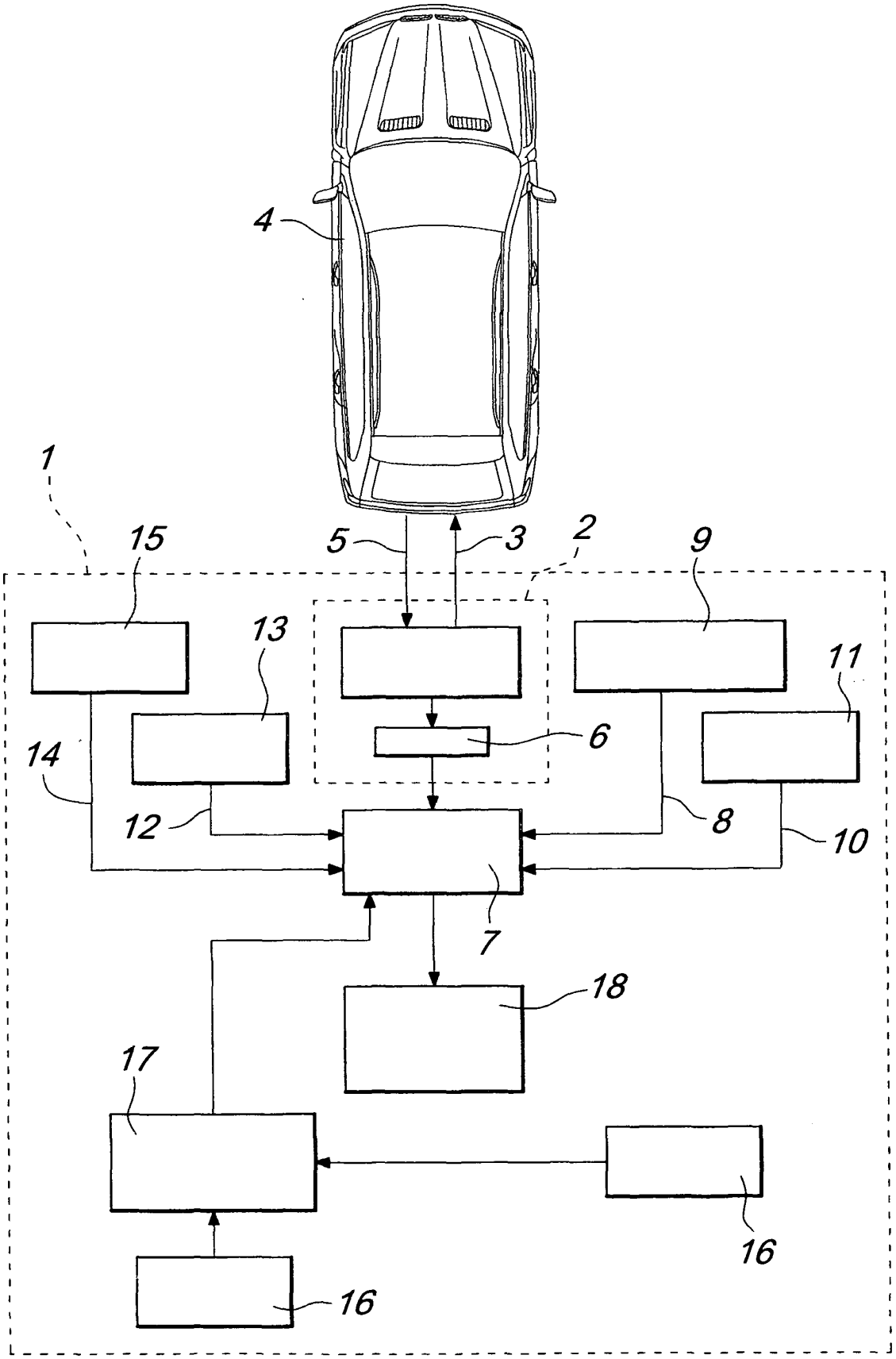
9. Dispositif selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend une unité d'affichage (18) qui est adaptée pour fournir des indications au conducteur.

10. Un procédé de détermination du degré de risque de collision d'un véhicule par rapport au véhicule situé devant ou par rapport à un obstacle fixe, comprenant les étapes consistant à :

    déterminer, par rapport à un véhicule (4) situé devant, des informations de distance et de vitesse relative ;
    traiter lesdites informations de distance et de vitesse relative conjointement avec des signaux (8, 12) qui indiquent l'état du véhicule et des signaux (10, 14) qui indiquent les conditions environnementales externes, et obtenir une indication du degré de risque de collision actuel pour le véhicule dans les conditions actuelles, **caractérisé en ce que** le degré de risque est obtenu au moyen des paramètres suivants : l'efficacité du système de freinage du véhicule de l'utilisateur ; un paramètre de démarrage sur échelle qui est une valeur attribuée asservie au temps qui indique une marge de sécurité minimale considérée comme sûre, dans lequel, si la marge de sécurité est supérieure à une valeur de démarrage sur échelle, le niveau de danger est nul ; et un facteur de sécurité qui est un paramètre sans dimension exprimant une étendue de la nécessité de prendre en compte un arrêt instantané du véhicule (4) situé devant.

11. Procédé selon la revendication 10, **caractérisé en ce qu'**il comprend les étapes consistant à mesurer la vitesse du véhicule situé devant, la vitesse de son propre véhicule et la distance par rapport au véhicule situé devant.

12. Procédé selon l'une ou plusieurs des revendications 10 ou 11, **caractérisé en ce qu'**une valeur sans dimension comprise entre 0 et 100 est attribuée à ladite efficacité du système de freinage, et **en ce que** ledit facteur de sécurité est compris entre 0 pour prendre en compte un espace de freinage du véhicule (4) situé devant dans son intégralité, et 100 pour prendre en compte uniquement son propre espace comme si le véhicule (4) situé devant pouvait s'arrêter instantanément avec un espace d'arrêt nul.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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5278764 A **[0012]**