

ORIGINAL

ABSTRACT

COLLISION MONITOR FOR A MOTOR VEHICLE

Described herein is a method for collision monitoring for a motor vehicle (10). The method includes providing a reference condition for at least one first object (18) located in a surrounding region (14) as a reference object during a first stopping procedure; determining during a subsequent stopping procedure whether the motor vehicle (10) has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or whether a predefined minimum time has elapsed; updating the reference condition by a positional data of at least one second object (18) based on the determining; further determining an actual positional data of said at least one second object (18) as the actual condition in case of a subsequent starting request; and detecting a potential collision when the actual condition and the reference condition indicate a distance of more than a predefined value.

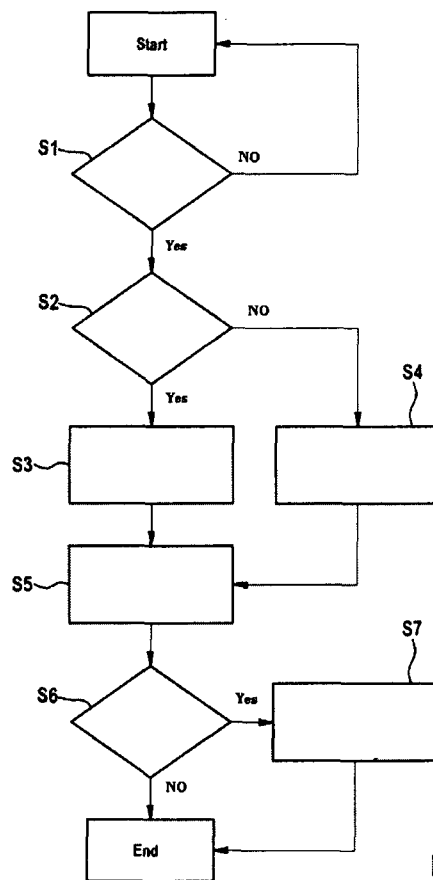


Fig. 2

I/We claim:

1. A method for collision monitoring for a motor vehicle (10), wherein a surrounding region (14) is monitored, the method comprising:

providing a reference condition for at least one first object (18) located in the surrounding region (14) as a reference object during a first stopping procedure, wherein the reference condition comprises reference position data of said at least one first object (18);

determining during a subsequent second stopping procedure whether the motor vehicle (10) has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or whether a predefined minimum time has elapsed;

updating the reference condition by a positional data of at least one second object (18) located in the surrounding region (14) when it is determined that the motor vehicle (10) has travelled a distance greater than the predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or that a time greater than the predefined minimum time has elapsed;

determining an actual positional data of said at least one second object (18) as the actual condition in case of a subsequent starting request; and

detecting a potential collision when the actual condition and the reference condition indicate a distance of more than a predefined value.

2. The method as claimed in claim 1, wherein when the motor vehicle (10) has either travelled the predefined minimum distance or the predefined minimum time has elapsed, updating the reference condition determined during the first stopping procedure by the positional data of the motor vehicle (10).

3. The method as claimed in claim 1 or 2, further comprising selecting a length of the predefined minimum distance in such a manner that the length corresponds to at least a stretch of a region not visible to a driver of the motor vehicle in the surrounding region of the motor vehicle (10).

4. The method as claimed in claim 1 or 2, wherein the predefined minimum distance corresponds to a length of the motor vehicle (10).

5. The method as claimed in one of the claims 1 to 3, wherein the predefined minimum distance corresponds to a sum of the length of the motor vehicle (10) and lengths of the surrounding regions (14) in front of and behind the motor vehicle (10).

6. The method as claimed in one of the claims 1 to 5 further comprising monitoring the surrounding region (14) by means of object sensors (12) fixed on the motor vehicle (10), wherein the object sensors (12) comprise ultrasonic sensors and/or radar sensors and/or laser sensors and/or analysis of a video footage of the surrounding region (14).

7. The method as claimed in one of the claims 1 to 6 further comprising issuing a warning signal to the driver in case of the detecting of a potential collision.

8. A device for collision monitoring for a motor vehicle (10) having at least one object sensor (12) for monitoring a surrounding region (14), wherein the device is configured to:

provide a reference condition for at least one first object (18) located in the surrounding region (14) as a reference object during a first stopping procedure, wherein the reference condition comprises reference position data of said at least one first object (18);

determine during a subsequent second stopping procedure whether the motor vehicle (10) has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or whether a predefined minimum time has elapsed,

update the reference condition by a positional data of at least one second object (18) located as a reference object located in the surrounding region (14) when it is determined that the motor vehicle (10) has travelled a distance greater than the predefined minimum distance between the first and the second stopping procedures, and/or that a time greater than the predefined minimum time has elapsed;

determine an actual positional data of said at least one second object (18) as an actual condition in case of a subsequent starting request; and,

detect a potential collision when the actual condition and the reference condition indicate a distance of more than a predefined value.

9. A computer program for a control unit (16) in a motor vehicle (10) for carrying out a method as claimed in one of the claims 1 to 7.

**Dated this 13<sup>th</sup> day of February 2012**



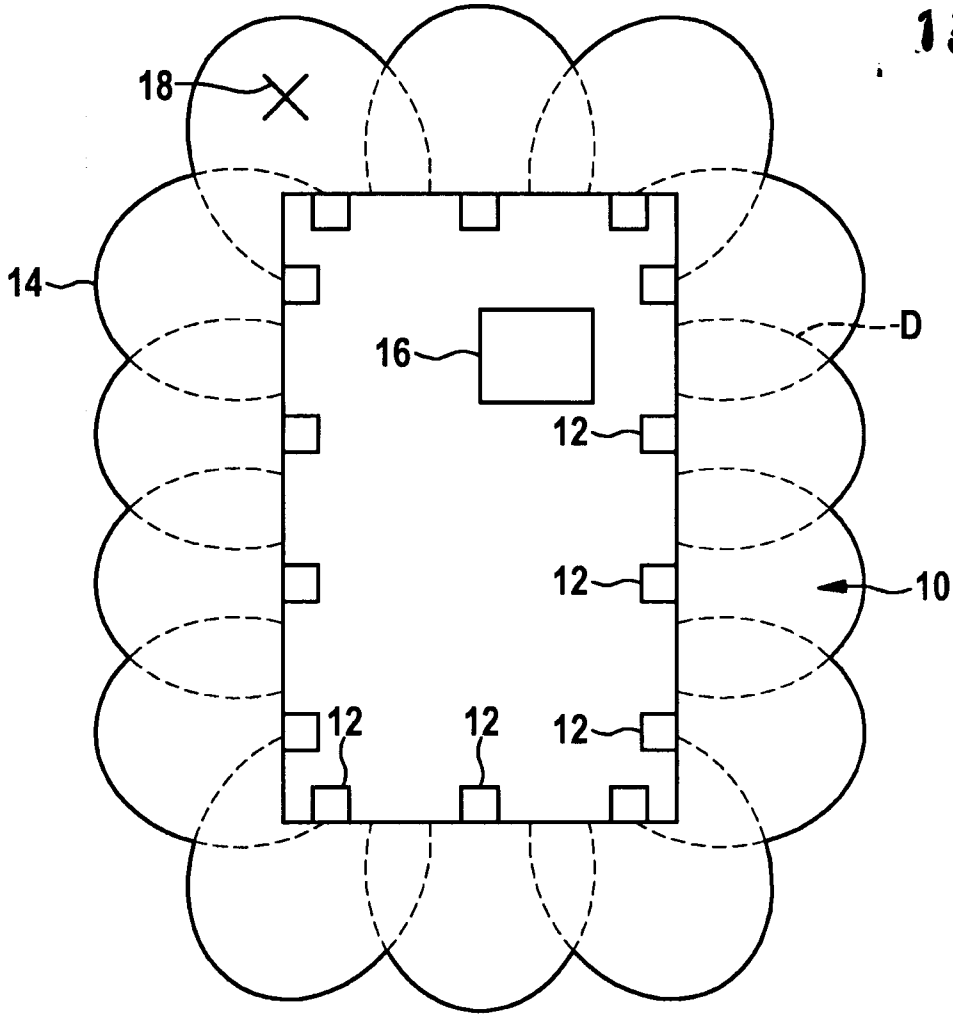
**S. JAYARAM  
IN/PA-1347**

**AGENT FOR THE APPLICANT**

**To  
The Controller of Patents  
The Patent office at New Delhi**

**ORIGINAL**

**13 FEB 2012**



**Fig. 1**

*S. Jayaram*  
**S. JAYARAM**  
IN/PA-1347  
of Lakshmikumaran & Sridharan  
Agent for the Applicant

ORIGINAL

13 FEB 2014

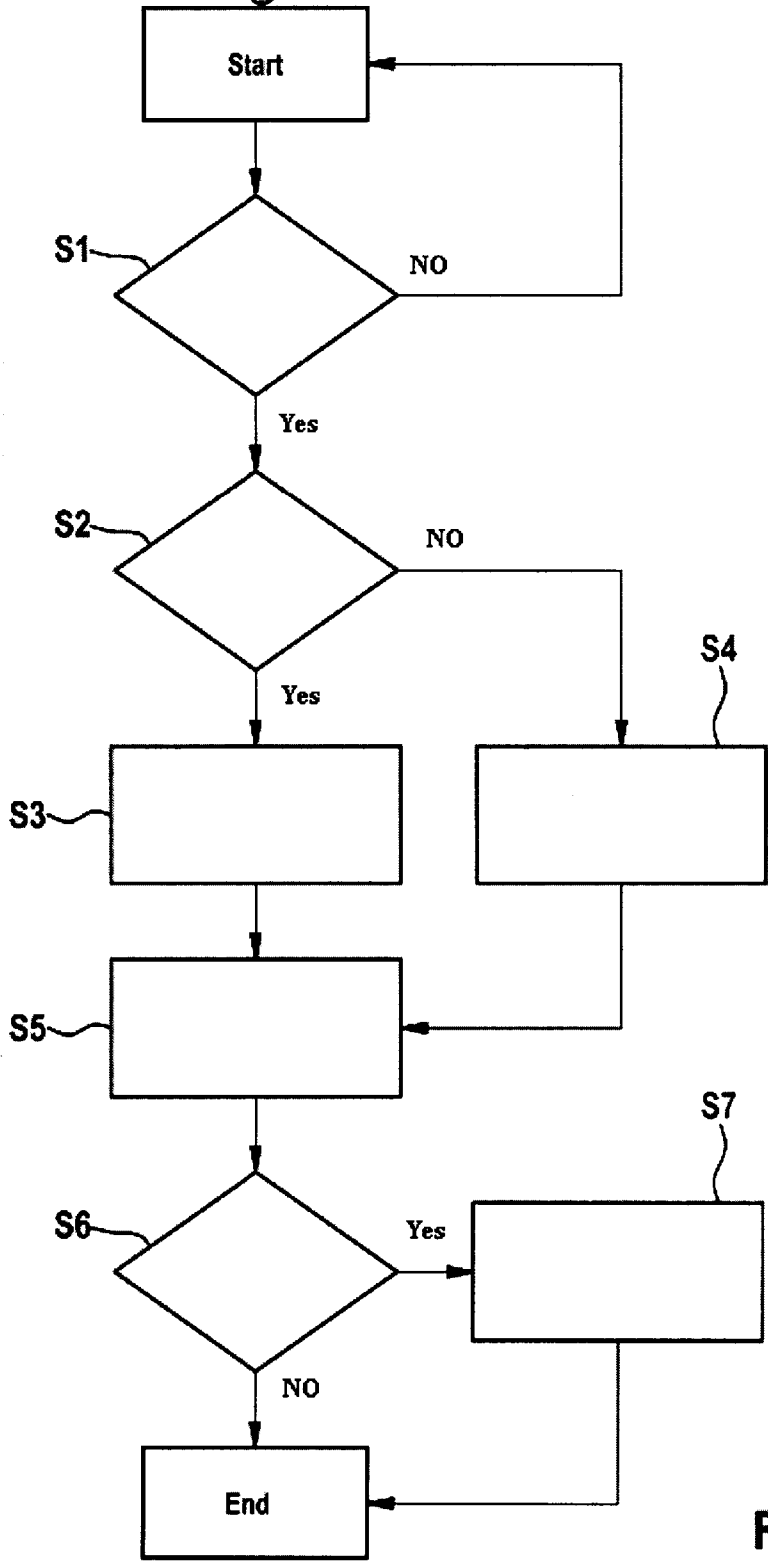


Fig. 2

*S. Jayaram*

S. JAYARAM  
IN/PA-1347

of Lakshmikumaran & Sridharan  
Agent for the Applicant

## TECHNICAL FIELD

The present subject matter relates to a method and a device for collision monitoring for motor vehicles by monitoring a surrounding region of the motor vehicle by means of object sensors.

## BACKGROUND

A method and a device for collision monitoring in a motor vehicle are known from the published patent application DE 10 2006 002 232 A1. During each stoppage of the motor vehicle, initially, positional data is generated as a reference condition of objects located in a surrounding region. At regular time intervals or at predefined events, as for example, in case of a starting request of the driver, further positional data is determined as an actual condition. If it is detected by comparing the respective actual condition with the reference condition that at least one object has come closer to the motor vehicle, a potential collision is recognized and a warning signal is issued to a driver.

In case, the driver moves his motor vehicle only by a very short distance (for example, only few centimetres during maneuvering in a parking lot), a new reference condition is generated during a renewed stoppage in this known method. For example, during the movement of the individuals in the surrounding region during the maneuvering process, these individuals are classified as reference objects during the renewed standstill condition.

This known method has a disadvantage that the driver had no opportunity to see all objects, which are located within the surrounding region, himself before stopping, because in just few centimetres of distance travelled, the driver cannot see a dead area directly behind the motor vehicle (or, according to vehicle type, also directly before and/or at sides of the motor vehicle) during the entire distance travelled. Thus, initially, the driver does not receive any information about further objects going to be appeared in the surrounding region.

Only when in the further course, after determination of the reference condition, the individuals come still closer to the motor vehicle, the driver is warned about a potential collision. However, possibly, at that instant, the driver can only poorly judge this warning, because he does not expect that in the reference condition determined during the renewed standstill condition, those objects are included, which the driver could not see as the objects have moved in the surrounding region only during the maneuvering process.

## SUMMARY

This summary is provided to introduce concepts related to collision monitor for a motor vehicle and the concepts are further described below in the detailed description. This summary is neither intended to identify essential features of the claimed subject matter nor is it intended for use in determining or limiting the scope of the claimed subject matter.

In one embodiment, a method for collision monitoring for a motor vehicle is disclosed, in which a surrounding region is monitored. The method includes providing a reference condition for at least one first object located in the surrounding region as a reference object during a first stopping procedure, wherein the reference condition comprises reference position data of said at least one first object; determining during a subsequent second stopping procedure whether the motor vehicle has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or whether a predefined minimum time has elapsed; updating the reference condition by a positional data of at least one second object located in the surrounding region when it is determined that the motor vehicle has travelled a distance greater than the predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or that a time greater than the predefined minimum time has elapsed; determining an actual positional data of said at least one second object as the actual condition in case of a subsequent starting request; and detecting a potential collision when the actual condition and the reference condition indicate a distance of more than a predefined value.

## BRIEF DESCRIPTION OF DRAWINGS

In the following, an embodiment of the present subject matter is described as an example with the help of the accompanying drawings.

Fig. 1 shows a schematic representation of a motor vehicle having a device for collision monitoring, according to an embodiment of the present subject matter.

Fig. 2 shows a flow diagram of a method for collision monitoring, according to an embodiment of the present subject matter.

## DETAILED DESCRIPTION

An object of the present subject matter is to provide a method for collision monitoring for a motor vehicle, which provides an improved warning to a driver of the motor vehicle against objects present in a surrounding region.

This object is achieved by a method according to claim 1, a device according to claim 8, and a computer program according to claim 9.

Further embodiments and/or implementations of the subject matter are claimed in the dependent claims.

According to an embodiment of the subject matter, a method is provided for collision monitoring for a motor vehicle, in which a surrounding region is monitored. The method includes:

providing a reference condition for at least one first object located in a surrounding region as a reference object during a first stopping procedure, wherein the reference condition contains a reference position data of said at least one first object;

determining during a subsequent second stopping procedure as to whether the motor vehicle has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or a predefined minimum time has elapsed;

updating the reference condition by a positional data of at least one second object located in the surrounding region, if has been determined that the motor vehicle has travelled a distance greater than the predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or that a time greater than the predefined minimum time has elapsed;

determining an actual positional data of said at least one second object as the actual condition, in case of a subsequent starting request; and

detecting a potential collision, if the actual condition and the reference condition indicate a distance of more than a predefined value.

The fact that the a reference condition is determined afresh only when the motor vehicle has travelled a predefined minimum distance between the first and the preceding second stopping procedure, and/or when a predefined minimum time has elapsed, it can be ensured that the driver has the opportunity to take a notice of the surrounding region completely before a stopping procedure. In this way, the reference condition includes only the positional data of objects, which are known to the driver, and it can be ensured

that the driver is warned about each object unknown to him, which is moving in the surrounding region.

Thus in case, the motor vehicle travels only a very short distance during the manoeuvring process, no new reference condition is formed, according to the present subject matter, but the reference condition determined during the second last stopping procedure is used. For example, if during the manoeuvring process, persons move in the surrounding region of the motor vehicle, then, according to the present subject matter, they are also not recorded during the renewed stopping procedure as reference objects in the reference condition; however, the driver is warned about these persons, because they are not included in the reference condition determined before.

In this way, the driver is reliably warned about objects in the surrounding region, which he himself cannot see, even if these move in the surrounding region during the manoeuvring process, for example, in a parking lot.

In addition, it can be provided here that if the motor vehicle has either travelled the predefined minimum distance, or the predefined minimum time has elapsed, the reference condition determined during the first stopping procedure is updated by the positional data of the motor vehicle.

A relative movement between the motor vehicle and the reference objects can be taken into consideration by such an actualization of the reference condition determined during the second last stopping procedure, without requiring that unnecessary warning signals are generated, for example, if the motor vehicle has moved only a few centimetres closer to an object known to the driver.

In one implementation, the length of the predefined minimum distance is selected in such a manner that it is at least as long as the region not visible to the driver in the surroundings of the motor vehicle, to ensure that a new reference condition is formed only if the driver had opportunity before the stopping procedure to take a stock of the entire surrounding region of the motor vehicle.

For example, the length of the predefined minimum distance is selected in such a manner that it corresponds to the length of the vehicle, or the minimum distance can be the sum of the lengths of the motor vehicle and the lengths of the surrounding regions in front of and behind the motor vehicle.

In an embodiment of the subject matter, the surrounding region is monitored by means of the object sensors fixed on the motor vehicle, where the object sensors include

ultrasonic sensors and/or radar sensors and/or laser sensors and analysis of the video footage of the surrounding region.

While detecting a potential collision, a warning signal can be issued to the driver, wherein it can be an optical, an acoustic and/or haptic warning signal. Different warning signals can also be issued for different situations respectively, for example, for different driving conditions (starting request of the driver), different distances of the objects threatened by collision, or different directions of the potential collision.

According to another embodiment of the subject matter, a device is provided for collision monitoring for a motor vehicle having at least one object sensor for monitoring a surrounding region. The device is configured:

to provide a reference condition for at least one first object located in the surrounding region, as a reference object during a first stopping procedure, wherein the reference condition contains a reference position data of said at least one first object;

to determine during a subsequent second stopping procedure as to whether the motor vehicle has travelled a predefined minimum distance between the first stopping procedure and the second stopping procedure, and/or a predefined minimum time has elapsed,

to update the reference condition by a positional data of at least one second object located as a reference object in the surrounding region, if it is determined that the motor vehicle has travelled a distance greater than the predefined minimum distance between the first and the second stopping procedure, and/or that a time greater than the predefined minimum time has elapsed;

to determine an actual positional data of said at least one second object as the actual condition, in case of a subsequent starting request; and,

to detect a potential collision, if the actual condition and the reference condition indicate a distance of more than a predefined value.

As can be seen from Fig. 1, a motor vehicle 10 is equipped with a plurality of object sensors 12, as for example ultrasonic sensors. Each object sensor 12 has a detection field D, as is represented by dashed lines in Fig. 1. Therefore, the individual detection fields D of the object sensors 12 overlap in such a manner that the sum of all the detection fields D covers a surrounding region 14 of the motor vehicle 10.

Instead of the ultrasonic sensors, radar sensors, laser sensors, or any other type of suitable object sensor can also be used. In addition, it can be conceived that the surrounding region 14 is monitored with the help of one or several video cameras, and

that the object sensors 12 analyze a video footage to detect objects located in the surrounding region 14. The object sensors 12 can detect the presence of objects 18 in the surrounding region 14 of the motor vehicle 10 and, in addition, can be configured in such a manner that they can also determine distances between the respective object 18 and the motor vehicle 10.

A control unit 16 is connected with the object sensors 12 and from signals of the object sensors 12, determines a position of an object 18 detected by the object sensors 12 in the surrounding region 14 of the motor vehicle 10. Therefore, the presence or absence of the objects 18 in the individual detection fields D of the object sensors 12 can be determined, or the distance and the direction of each object 18 from the motor vehicle 10 can be determined, or the position of each object 18 in a suitable coordinate system can be determined.

The function of the previously described device is explained in the following with reference to Fig. 2. Here, the subsequently described method is carried out in the control unit 16.

At first, it is checked in step S1, as to whether the motor vehicle 10 has stopped, i.e. whether it has just come to a standstill condition. Since, the method according to the embodiment of the subject matter described here can be carried out only during the standstill condition of the motor vehicle 10, this query is repeated until it is determined that the motor vehicle 10 stands still.

If the motor vehicle 10 has stopped (alternatively “yes” in S1), it is checked in step S2, whether a minimum distance was travelled between two last stopping procedures of the motor vehicle 10. This can be obtained either by determining the position of the motor vehicle 10, for example, by a GPS receiver, or alternatively it can be checked, whether the motor vehicle 10 was driven for a minimum time between two last stopping procedures.

Here, the minimum distance can be selected in such a manner that after travelling the minimum distance, the driver could take stock of the entire region not visible in front of and behind the motor vehicle 10 immediately before the stopping procedure of the motor vehicle 10.

For example, the minimum distance can precisely be a length of the motor vehicle 10; it can be the sum of the length of the motor vehicle 10 and lengths of regions in front of and behind the motor vehicle 10 which cannot be seen by the driver; or it can be the

sum of the length of the motor vehicle 10 and the length of the surrounding region 14 in front of and behind the motor vehicle 10, which is monitored by the object sensor 12.

The minimum time can be defined as: Minimum time = Minimum distance (after any one of the above mentioned definitions)/average speed of the motor vehicle 10 between two last stopping procedures, or can be a fixed predefined time.

If the motor vehicle 10 has travelled at least the minimum distance between the last two stopping procedures (alternatively “yes” in S2), a reference condition of a reference position data is then determined subsequently in step S3. For this purpose, in the surrounding region 14 of the motor vehicle 10, the reference position data of one or several objects 18 is determined with the help of the object sensors 12. Here, a reference position data of an object 18 may include the presence of an object in a detection field D of an object sensor 12, and/or the distance of the object 18 from the motor vehicle 10, and/or the direction of the object 18 from the motor vehicle 10.

During the determination of the reference condition, should there be no object 18 in the surrounding region 14, no reference position data can be determined as described above. In this case, one or several preset distance values, for example, which are same as the length of the respective detection field D for each detection field D of each of the object sensors 12, can be used as the reference position data.

If it is determined in step S2 that the motor vehicle 10 has travelled a shorter distance than the minimum distance between the last two stopping procedures (alternatively “no” in S2), then the reference condition, which was determined during the last standstill condition, is taken over in step S4 and adjusted to the new position of the motor vehicle 10.

Here, the new position of the motor vehicle 10 can be determined by means of GPS sensors or by means of an assessment from the distance travelled between the last two stopping procedures (on the basis of time-, speed- and yaw angle determination). By vector addition of the paths travelled by the motor vehicle 10 between the last two stopping procedures, the stored reference position data can be converted into adjusted distances of the reference objects 18 from the motor vehicle 10 in its new position. In case, the reference position data condition merely specifies the presence or absence of objects 18 in the respective detection fields D of the object sensors 12, it can be calculated by the movement of the motor vehicle 10 whether an object 18 would now appear in the detection field D of another object sensor 12.

Subsequently, an actual position data is determined in step S5. This step is carried out at predefined time intervals or at predetermined events if, for example, a starting request of the driver is detected with the help of the position of the brake and/or gas pedal and/or with the help of the position of the power train of a manual or automatic gear transmission. Here, the presence and/or actual positions of the objects 18 located in the surrounding region 14 are determined. As during the determination of the reference condition in step S3, here also, the actual position data of the objects 18 can be determined in a suitable coordinate system, or the distance values and direction data of the objects 18 from the motor vehicle 10 can be determined.

In step S6, it is determined by a comparison of an actual condition with the reference condition, as to whether at least one object 18 has come close to the motor vehicle 10. As a result of this, the case is detected that an object 18 that was already in the surrounding region 14 of the motor vehicle 10 during the determination of the reference condition has moved towards the motor vehicle 10, as well as the case that an object 18 that was still not in the surrounding region 14 during the determination of the reference condition has moved into the surrounding region 14.

If no object 18 has come close to the motor vehicle 10 (alternatively “no” in S6), the method is ended, because no risk of collision has been detected.

If it is determined in step S6 that at least one object 18 has come close to the motor vehicle 10 (alternatively “yes” in S6), a risk of collision is detected and an acoustic, optical, and/or haptic warning signal is issued to the driver in step S7.

Here, the previously described method is carried out continuously and cyclically during the operation of the motor vehicle 10. During the standstill condition of the motor vehicle 10, in this way, an actual condition can be determined several times respectively and can be compared with the reference condition.

It can be conceived that different warning signals are issued depending on different driving situations of the motor vehicle 10. Thus for example, a first warning signal can be issued during the standstill condition of the motor vehicle 10 if a risk of collision is detected, and a second warning signal can be issued if, additionally, a starting request of the driver is also recognized.