DESCRIPTION

TITLE OF INVENTION

MARKER DETECTION SYSTEM AND MARKER DETECTION METHOD

TECHNICAL FIELD

[0001] The present invention relates to a marker detection system and marker detection method for detecting magnetic markers laid in a road.

BACKGROUND ART

[0002] Conventionally, marker detection systems for vehicles using magnetic markers laid in a road for vehicle control have been known (for example, refer to Patent Literature 1). By using this marker detection system to detect, for example, magnetic markers laid along a lane by a vehicle's magnetic sensor or the like, various driving assists can be achieved, such as automatic steering control, lane departure warning, and automatic driving.

CITATION LIST

PATENT LITERATURE

[0003] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2005-202478

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] However, the above-described conventional marker detection system has the following problem. That is, there is a problem in which reliability of magnetic marker detection may be impaired due to various external disturbances of magnetism acting on the magnetic sensors or the like. For example, a vehicle

traveling alongside and an oncoming vehicle passing by can become a generation source of external disturbance of magnetism.

[0005] The present invention was made in view of the above-described conventional problem, and is to provide a marker detection system and marker detection method capable of reducing erroneous detection.

SOLUTION TO PROBLEM

[0006] One aspect of the present invention resides in a marker detection system which detects magnetic markers laid in a road by a magnetic detection unit attached to a vehicle, wherein the system including:

at least two magnetic detection units arranged so as to be separated in a longitudinal direction of the vehicle; and

at least two magnetic markers as many as said at least two magnetic detection units and arranged at spacings equal thereto so as to be simultaneously detectable by said at least two magnetic detection units; and

a unit which sets a temporal range in which each of said at least two magnetic detection units do not detect different magnetic markers, with reference to, among detection times of detecting magnetism generation sources by said at least two magnetic detection units, a detection time that is earlier in time than the other detection time; and

a unit which determines whether the other detection time belongs to the temporal range; and

a unit which regards said at least two magnetic detection units to have simultaneously detected magnetism generation sources when the other detection time belongs to the temporal range and determines the magnetism generation sources simultaneously detected as the magnetic markers.

[0007] One aspect of the present invention resides in a

marker detection method for detecting magnetic markers laid in a road by a magnetic detection unit attached to a vehicle, wherein

as the magnetic detection units, at least two magnetic detection units arranged so as to be separated in a longitudinal direction of the vehicle are included, and

as the magnetic markers, at least two magnetic markers as many as said at least two magnetic detection units and arranged at spacings equal thereto so as to be simultaneously detectable by said at least two magnetic detection units are included, and

with reference to, among detection times of detecting magnetism generation sources by said at least two magnetic detection units, a detection time that is earlier in time than the other detection time, a temporal range is set in which said at least two magnetic detection units do not detect different magnetic markers, and

when the other detection time belongs to the temporal range, said at least two magnetic detection units are regarded to have simultaneously detected magnetism generation sources and the magnetism generation sources simultaneously detected are determined as the magnetic markers.

CLAIMS

1. A marker detection system which detects magnetic markers laid in a road by a magnetic detection unit attached to a vehicle, the system comprising:

at least two magnetic detection units arranged so as to be separated in a longitudinal direction of the vehicle; and

at least two magnetic markers as many as said at least two magnetic detection units and arranged at spacings equal thereto so as to be simultaneously detectable by said at least two magnetic detection units; and

a unit which sets a temporal range in which each of said at least two magnetic detection units do not detect different magnetic markers, with reference to, among detection times of detecting magnetism generation sources by said at least two magnetic detection units, a detection time that is earlier in time than the other detection time; and

a unit which determines whether the other detection time belongs to the temporal range; and

a unit which regards said at least two magnetic detection units to have simultaneously detected magnetism generation sources when the other detection time belongs to the temporal range and determines the magnetism generation sources simultaneously detected as the magnetic markers.

2. The marker detection system according to claim 1, wherein said at least two magnetic markers are arranged so that magnetic polarities form a predetermined pattern including both of the N pole and the S pole, and

the unit which determines the magnetism generation sources simultaneously detected as the magnetic markers is configured to determine the magnetism generation sources simultaneously

detected by said at least two magnetic detection units as the magnetic markers when a combination of the magnetic polarities of the magnetism generation sources simultaneously detected by said at least two magnetic detection units matches the predetermined pattern.

3. The marker detection system according to claim 1 or 2, wherein the system comprises another magnetic detection unit which can detect the magnetic markers but is different from said at least two magnetic detection units, and

the other magnetic detection unit is attached to the vehicle so as not to detect the magnetic markers when said at least two magnetic detection units simultaneously detect said at least two magnetic markers, and

the unit which determines the magnetism generation sources simultaneously detected as the magnetic markers is configured to determine the magnetism generation sources simultaneously detected by said at least two magnetic detection units as the magnetic markers when said at least two magnetic detection units are regarded to have simultaneously detected the magnetism generation sources while the other magnetic detection unit does not detect a magnetism generation source.

4. The marker detection system according to any one of claims 1 to 3, wherein the respective magnetic markers including said at least two magnetic markers are arranged at substantially constant spacings in a road direction.

5. A marker detection method for detecting magnetic markers laid in a road by a magnetic detection unit attached to a vehicle, wherein

as the magnetic detection units, at least two magnetic

detection units arranged so as to be separated in a longitudinal direction of the vehicle are included, and

as the magnetic markers, at least two magnetic markers as many as said at least two magnetic detection units and arranged at spacings equal thereto so as to be simultaneously detectable by said at least two magnetic detection units are included, and

with reference to, among detection times of detecting magnetism generation sources by said at least two magnetic detection units, a detection time that is earlier in time than the other detection time, a temporal range is set in which said at least two magnetic detection units do not detect different magnetic markers; and

when the other detection time belongs to the temporal range, said at least two magnetic detection units are regarded to have simultaneously detected magnetism generation sources and the magnetism generation sources simultaneously detected are determined as the magnetic markers.

6. The marker detection method according to claim 5, wherein said at least two magnetic markers are arranged so that magnetic polarities form a predetermined pattern including both of the N pole and the S pole, and

when a combination of magnetic polarities of magnetism generation sources simultaneously detected by said at least two magnetic detection units matches the predetermined pattern, the magnetism generation sources simultaneously detected by said at least two magnetic detection units are determined as the magnetic markers.

7. The marker detection method according to claim 5 or 6, wherein

another magnetic detection unit which can detect the

magnetic markers but is different from said at least two magnetic detection units is included,

the other magnetic detection unit is attached to the vehicle so as not to detect the magnetic markers when said at least two magnetic detection units simultaneously detect said at least two magnetic markers, and

when said at least two magnetic detection units are regarded to have simultaneously detected magnetism generation sources while the other magnetic detection unit does not detect a magnetism generation source, the magnetism generation sources simultaneously detected by said at least two magnetic detection units are determined as the magnetic markers.