CLAIMS

1. A position estimation method for a vehicle including a magnetic sensor which measures magnetism acting from a road surface forming a surface of a traveling road to estimate an own vehicle position, comprising:

a magnetic measurement process of acquiring magnetic measurement values from the magnetic sensor;

a magnetic distribution generation process of generating a measured magnetic distribution indicating a distribution of magnetic data based on the magnetic measurement values acquired from the magnetic measurement process; and

a position estimation process of, by referring to a map associated with a road-surface magnetic distribution indicating a distribution of magnetic data based on quantities of magnetism at respective points on the road surface, specifying an area of the road-surface magnetic distribution corresponding to the measured magnetic distribution and estimating the own vehicle position based on a position of the area corresponding to the measured magnetic distribution on the map, wherein

the magnetic data based on the magnetic measurement values and the magnetic data based on the quantities of magnetism at the respective points on the road surface are magnetic gradients, and each of the measured magnetic distribution and the road-surface magnetic distribution is a distribution of the magnetic gradients.

2. The position estimation method in claim 1, comprising a conversion process of converting the road-surface magnetic distribution into a distribution at an attachment height of the magnetic sensor, wherein

in the position estimation process, the distribution after conversion by the conversion process and the measured magnetic distribution are collated to specify an area corresponding to the

measured magnetic distribution.

3. The position estimation method in claim 1, comprising a conversion process of converting the measured magnetic distribution into a distribution at a height of the road surface, wherein

in the position estimation process, the distribution after conversion by the conversion and the road-surface magnetic distribution are collated to specify the area corresponding to the measured magnetic distribution.

4. The position estimation method in claim 2 or 3, wherein the conversion process is a process of converting the distribution in accordance with a ratio of magnetic measurement values from two magnetic sensors with different attachment heights.

5. The position estimation method in any one of claims 2 to 4, wherein the conversion process is a process of converting the distribution in accordance with a magnitude of the magnetic measurement value acquired by the magnetic sensor for a magnetic marker which is a magnetism generation source laid on the road surface and having known magnetic intensity.

6. The position estimation method in any one of claims 1 to 5, wherein magnetic markers as magnetism generation sources are laid on the traveling road as spaced in a state in which absolute positions can be specified,

in the position estimation process, when any of the magnetic markers is detected by the vehicle, the own vehicle position is estimated with reference to the absolute position of the magnetic marker, and

when none of the magnetic markers is detected, the own vehicle position is estimated based on the position of the area corresponding

to the measured magnetic distribution on the map.

7. The position estimation method in claim 6, wherein when none of the magnetic markers is detected, an arrival position of the vehicle after detecting any magnetic marker is estimated, a range to which the arrival position belongs on the map is selected, and the area corresponding to the measured magnetic distribution is specified in the range on the map.

8. The position estimation method in claim 6 or 7, wherein the positions of the magnetic markers laid on the road surface are specified in the road-surface magnetic distribution and the measured magnetic distribution, and

in the position estimation process, the area corresponding to the measured magnetic distribution is specified among areas where the position of the magnetic marker coincides in the road-surface magnetic distribution.

9. A position estimation system for a vehicle including a magnetic sensor which measures magnetism acting from a road surface forming a surface of a traveling road to estimate an own vehicle position, comprising:

a storage part which stores a map associated with a road-surface magnetic distribution, which is a distribution of magnetic data based on quantities of magnetism at respective points on the road surface;

a magnetic distribution generation part which acquires magnetic measurement values from the magnetic sensor and generates a measured magnetic distribution, which is a distribution of magnetic data based on the magnetic measurement values; and

a position estimation part which specifies an area corresponding to the measured magnetic distribution in the

road-surface magnetic distribution associated with the map stored in the storage part and estimates the own vehicle position based on a position of the area corresponding to the measured magnetic distribution on the map, wherein

the magnetic data based on the magnetic measurement values and the magnetic data based on the quantities of magnetism at the respective points on the road surface are magnetic gradients, and each of the measured magnetic distribution and the road-surface magnetic distribution is a distribution of the magnetic gradients.

10. The position estimation system in claim 9, wherein the road surface is a surface of a pavement made of a pavement material having magnetic powder, which is powder of a magnetic material, dispersed therein and the magnetic powder dispersed in the pavement is magnetized so that a magnetic distribution of the road surface forms a predetermined pattern.

11. The position estimation system in claim 9 or 10, wherein magnetic markers are laid along the traveling road.

12. The position estimation system in claim 11, wherein the positions of the magnetic markers are specified in the road-surface magnetic distribution and the measured magnetic distribution, and

the position estimation part is configured to specify the area corresponding to the measured magnetic distribution among areas of where the position of the magnetic marker coincides in the road-surface magnetic distribution.