CLAIMS

[Claim 1]

A toll collection system, comprising:

a roadside antenna which wirelessly communicates with an on-board device mounted in a vehicle;

a communication processing unit for carrying out communication processing based on predetermined communication specifications with the on-board device via the roadside antenna;

a communication control unit for acquiring the results of communication processing from the communication processing unit and creating information for toll collection with regard to the on-board device; and

a toll collection processing unit for accepting the input of the information for toll collection from the communication control unit and carrying out toll collection processing based on this information for toll collection,

wherein, in any of a communication pair of the roadside antenna and the communication processing unit, a communication pair of the communication processing unit and the communication control unit, and a communication pair of the communication control unit and the toll collection processing unit,

when a first component, which is one part configuring the communication pair, accepts the input of a predetermined confirmation signal, the first component outputs a predetermined response signal, and

a second component, which is the other part configuring the communication pair, outputs the confirmation signal to the first component and determines whether the first component is operating normally based on whether the input of the response signal has been accepted,

the toll collection system further comprising:

a radio wave receiving soundness determination unit for determining whether the roadside antenna is operating normally based on whether the time width, in which radio waves are not received from the on-board device, continues for a predetermined determination reference time or longer,

wherein the radio wave receiving soundness determination unit is configured to apply the determination reference time suitable for a number of passing vehicles for each time span and determine a soundness of the roadside antennas, when the number of passing vehicles per unit time changes in accordance with a time span.

[Claim 2]

The toll collection system according to claim 1, further comprising: a communication processing soundness determination unit, which determines that at least one of the roadside antenna or the communication processing unit is not operating normally in a case where the radio waves are received from the on-board device and the results of the communication processing have not been correctly acquired from the communication processing unit.

[Claim 3]

The toll collection system according to claim 1 or 2, wherein, in the event the second component determines that the first component is not operating normally,

the second component orders the restart of the first component.

[Claim 4]
The toll collection system according to any one of claims 1 to 3, wherein, in the event the second component determines that the first component is not operating normally,
the second component outputs an abnormality signal notifying that the first component is not operating normally.

[Claim 5]
The toll collection system according to any one of claims 1 to 4, wherein,
in the event the first component accepts the input of the first confirmation signal serving as the confirmation signal, the first component outputs a first response signal serving as the response signal,
the second component outputs the first confirmation signal to the first component, and determines whether the first component is operating normally based on whether the input of the first response signal has been accepted,
while in the event the second component accepts the input of a predetermined second confirmation signal, the second component further outputs a predetermined second response signal, and
the first component further outputs the second confirmation signal to the second component, and determines whether the second component is operating normally based on whether the input of the second response signal has been accepted.

[Claim 6]
The toll collection system according to any one of claims 1 to 5, further comprising: a system soundness determination unit, which determines that at least one of the roadside antenna, the communication processing unit, the communication control unit, and the toll collection processing unit is not operating normally in a case where the frequency of toll collection processing executed per unit time is lower than a predetermined reference processing frequency.

[Claim 7]
A soundness determination method for determining the soundness of a toll collection system, the toll collection system including:
a roadside antenna which wirelessly communicates with an on-board device mounted in a vehicle;
a communication processing unit for carrying out communication processing based on predetermined communication specifications with the on-board device via the roadside antenna;
a communication control unit for acquiring the results of communication processing from the communication processing unit and creating information for toll collection with regard to the on-board device; and
a toll collection processing unit for accepting the input of the information for toll collection from the communication control unit and carrying out toll collection processing based on this information for toll collection, the method comprising
in any of a communication pair of the roadside antenna and the communication processing unit, a communication pair of the communication processing unit and the communication control unit, and a communication pair of the communication control unit and the toll collection processing unit

a step, wherein, when a first component, which is one part configuring the communication pair, accepts the input of a predetermined confirmation signal, the first component outputs a predetermined response signal; and

a step, wherein a second component, which is the other part configuring the communication pair, outputs the confirmation signal to the first component and determines whether the first component is operating normally based on whether the input of the response signal has been accepted,

the soundness determination method further including:

a step of determining whether the roadside antenna is operating normally based on whether the time width, in which radio waves are not received from the on-board device, continues for a predetermined determination reference time or longer,

wherein the step of determining whether the roadside antenna is operating normally includes a step of applying the determination reference time suitable for a number of passing vehicles for each time span and determining a soundness of the roadside antennas, when the number of passing vehicles per unit time changes in accordance with a time span.

[Claim 8]

A toll collection system, comprising:

a roadside antenna which wirelessly communicates with an on-board device mounted in a vehicle;

a communication processing unit for carrying out communication processing based on predetermined communication specifications with the on-board device via the roadside antenna;

a communication control unit for acquiring the results of communication processing from the communication processing unit and creating information for toll collection with regard to the on-board device; and

a toll collection processing unit for accepting the input of the information for toll collection from the communication control unit and carrying out toll collection processing based on this information for toll collection,

wherein, in any of a communication pair of the roadside antenna and the communication processing unit, a communication pair of the communication processing unit and the communication control unit, and a communication pair of the communication control unit and the toll collection processing unit,

when a first component, which is one part configuring the communication pair, accepts the input of a predetermined confirmation signal, the first component outputs a predetermined response signal, and

a second component, which is the other part configuring the communication pair, outputs the confirmation signal to the first component and determines whether the first component is operating normally based on whether the input of the response signal has been accepted,

the toll collection system further comprising: a system soundness determination unit, which determines that at least one of the roadside antenna, the communication processing unit, the communication control unit, and the toll collection processing unit is not operating normally in a case where the frequency of toll collection processing executed per unit time is lower than a predetermined reference processing frequency.