distinguishing between an ETC lane of a tollbooth and a general lane.

SUMMARY OF THE INVENTION

[0003] In Japan, a method of performing billing processing through a tollbooth having a tollgate has become mainstream, and thus it is helpful to display guidance to the tollgate. However, other countries having an automatic toll collection system also include a country that adopts a method of performing billing processing through, for example, road-vehicle wireless communication or a process of imaging a vehicle number without providing a tollgate. In the above-described country, the display of guidance to the tollgate is not necessary. Normal navigation devices also include a navigation device that displays guidance to a tollgate without distinguishing an automatic toll collection system not having a tollgate, and thus there have been demands for an improvement.

[0004] The invention provides a navigation device, a navigation method, and a non-transitory computer-readable storage medium storing a navigation program which are capable of changing the display of guidance to a tollgate in accordance with the presence or absence of a tollgate of an automatic toll collection system.

[0005] A first aspect of the invention relates to a navigation device including a storage device, a position detection device, a determination unit, and a display device. The storage device is configured to store positional information on an automatic toll collection system and information indicating the presence or absence of a tollgate of the automatic toll collection system in association with each other. The position detection device is configured to detect positional information on a vehicle. The determination unit is configured to determine the presence or absence of the tollgate of an automatic toll collection system through which the vehicle is expected to pass, based on the positional information on the vehicle detected by the position detection device, the positional information on the automatic toll collection system which is stored in the storage device, and the information indicating the presence or absence of the tollgate which is stored in the storage device. The display device is configured to display guidance to the tollgate in a case where the determination unit determines that the automatic toll collection system through which the vehicle is expected to

pass has the tollgate, and not to display guidance to a tollgate in a case where the determination unit determines that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.

[0006] According to the navigation device of the first aspect of the invention, it is possible to change the display of guidance to a tollgate in accordance with the presence or absence of a tollgate of the automatic toll collection system through which the vehicle is expected to pass.

[0007] In the first aspect of the invention, the determination unit may determine whether or not the vehicle is in a state where wireless billing is able to be performed between the vehicle and the automatic toll collection system.

[0008] A second aspect of the invention relates to a navigation method including storing positional information on an automatic toll collection system and information indicating the presence or absence of a tollgate of the automatic toll collection system in association with each other by a computer system, detecting positional information on a vehicle by the computer system, determining the presence or absence of the tollgate of the automatic toll collection system through which the vehicle is expected to pass by the computer system, based on the detected positional information on the vehicle, the stored positional information on the automatic toll collection system, and the stored information indicating the presence or absence of the tollgate, and displaying guidance to the tollgate by the computer system in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass has the tollgate, and not displaying guidance to the tollgate by the computer system in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.

[0009] A third aspect of the invention relates to a non-transitory computer-readable storage medium storing a navigation program. The navigation program executes a step of storing positional information on an automatic toll collection system and information indicating the presence or absence of a tollgate of the automatic toll collection system in association with each other, a step of detecting positional information on a vehicle, a step of determining the presence or absence of the tollgate of an

automatic toll collection system through which the vehicle is expected to pass, based on the detected positional information on the vehicle, the stored positional information on the automatic toll collection system, and the stored information indicating the presence or absence of the tollgate, and a step of displaying guidance to the tollgate in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass has the tollgate, and not displaying guidance to a tollgate in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Features, advantages, and technical and industrial significance of exemplary embodiments of the invention will be described below with reference to the accompanying drawings, in which like numerals denote like elements, and wherein:

FIG. 1 is a diagram illustrating a hardware configuration of a navigation device according to an embodiment of the invention;

FIG. 2 is a table of attribute information on an automatic toll collection system according to the embodiment of the invention;

FIG. 3 is a flowchart illustrating a flow of processing of a navigation method according to the embodiment of the invention;

FIG. 4 is a diagram illustrating an example of a display screen according to the embodiment of the invention;

FIG. 5 is a diagram illustrating an example of a display screen according to the embodiment of the invention;

FIG. 6 is a diagram illustrating an example of a display screen according to the embodiment of the invention; and

FIG. 7 is a diagram illustrating an example of a display screen according to the embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0011] Hereinafter, an embodiment of the invention will be described with

CLAIMS

1. A navigation device characterized by comprising:

a storage device configured to store positional information on an automatic toll collection system and information indicating presence or absence of a tollgate of the automatic toll collection system in association with each other;

a position detection device configured to detect positional information on a vehicle;

a determination unit configured to determine presence or absence of the tollgate of the automatic toll collection system through which the vehicle is expected to pass, based on the positional information on the vehicle detected by the position detection device, the positional information on the automatic toll collection system which is stored in the storage device, and the information indicating the presence or absence of the tollgate which is stored in the storage device; and

a display device configured to display guidance to the tollgate in a case where the determination unit determines that the automatic toll collection system through which the vehicle is expected to pass has the tollgate, and the display device being configured not to display guidance to the tollgate in a case where the determination unit determines that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.

2. The navigation device according to claim 1, wherein the determination unit determines whether or not the vehicle is in a state where wireless billing is able to be performed between the vehicle and the automatic toll collection system.

3. A navigation method characterized by comprising:

storing positional information on an automatic toll collection system and information indicating presence or absence of a tollgate of the automatic toll collection system in association with each other by a computer system;

detecting positional information on a vehicle by the computer system;

determining presence or absence of the tollgate of the automatic toll collection system through which the vehicle is expected to pass by the computer system, based on the positional information on the vehicle, the positional information on the automatic toll collection system, and the information indicating the presence or absence of the tollgate; and

displaying guidance to the tollgate by the computer system in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass has the tollgate, and not displaying guidance to the tollgate by the computer system in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.

4. A non-transitory computer-readable storage medium storing a navigation program executing:

a step of storing positional information on an automatic toll collection system and information indicating presence or absence of a tollgate of the automatic toll collection system in association with each other;

a step of detecting positional information on a vehicle;

a step of determining presence or absence of the tollgate of an automatic toll collection system through which the vehicle is expected to pass, based on the positional information on the vehicle, the positional information on the automatic toll collection system, and the information indicating the presence or absence of the tollgate; and

a step of displaying guidance to the tollgate in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass has the tollgate, and not displaying guidance to the tollgate in a case where the determining step confirms that the automatic toll collection system through which the vehicle is expected to pass does not have the tollgate.