

In order to enable an autonomous mobile robot to autonomously cross a crosswalk in a safe manner without the accompaniment of an operator, there are strong demands for taking measures by considering the safety of vehicles driving on the road and the pedestrians crossing the crosswalk.

[0012]

The present invention was devised in view of the foregoing points, and an object of this invention is to propose an autonomous mobile body and a signal control system which enable an autonomous mobile body to travel while ensuring safety that is dramatically higher in comparison to conventional technologies.

## MEANS TO SOLVE THE PROBLEMS

[0013]

In order to achieve the foregoing object, an aspect of the present invention provides an autonomous mobile body which moves freely within a designated area including a sidewalk, comprising: a SLAM function part which creates a planar or three-dimensional environmental map of the designated area simultaneously with estimating its own position relative to an external environment within the designated area; a drive control unit which suitably changes a travel path of the autonomous mobile body so that the autonomous mobile body does not come into contact with peripheral objects based on an output of the SLAM function part; an imaging unit which captures images of an outside world of a predetermined range in front of the travel path; a signal light color determination unit which recognizes a pedestrian traffic light within the designated area and determines a signal light color and lighting/flashing switching of the pedestrian traffic light based on an imaging result of the imaging unit; and a pedestrian recognition unit which, when the autonomous mobile body moving on the sidewalk reaches a crosswalk, recognizes a number and position of pedestrians waiting for a traffic light on an opposing side of the crosswalk based on the imaging result of the imaging unit, wherein the drive control unit is configured to predict a degree of congestion of pedestrians at the time of crossing before the pedestrian traffic light switches to a blue color lighting based on a determination result by the signal light color determination unit and the recognition result by the pedestrian recognition unit; and wherein the drive control unit causes the

autonomous mobile body to cross the crosswalk in synch with a timing of the signal light color of the pedestrian traffic light switching from a red color to the blue color, and causes the autonomous mobile body to avoid collision with a pedestrian based on a prediction result of the drive control unit.

[0014]

According to the autonomous mobile body described above, by causing the autonomous mobile body to start crossing the crosswalk from the sidewalk at a

timing of starting its movement to cross the crosswalk with plenty of time to spare, it is possible to prevent a situation where the autonomous mobile body is unable to cross the entire length of the crosswalk within the blue color lighting duration.

[0015]

Furthermore, a further aspect of the present invention additionally provides a signal control system which coordinates with an autonomous mobile body which moves freely within a designated area including a sidewalk, comprising: a signal light color control unit which controls a signal light color and lighting/flashing switching of a pedestrian traffic light within the designated area; and a signal transmission unit which transmits signals from the signal light color control unit, wherein the autonomous mobile body comprises: a SLAM function part which creates a planar or three-dimensional environmental map of the designated area simultaneously with estimating its own position relative to an external environment within the designated area; a drive control unit which suitably changes a travel path of the autonomous mobile body so that the autonomous mobile body does not come into contact with peripheral objects based on an output of the SLAM function part; a signal reception unit which receives control signals from the signal transmission unit; an imaging unit which captures images of an outside world of a predetermined range in front of the travel path; and a pedestrian recognition unit which, when the autonomous mobile body moving on the sidewalk reaches a crosswalk, recognizes a number and position of pedestrians waiting for a traffic light on an opposing side of the crosswalk based on the imaging result of the imaging unit; wherein the drive control unit is configured to predict a degree of congestion of pedestrians at the time of crossing before the pedestrian traffic light switches to a blue color lighting based on a determination result by the signal light color control unit and the recognition result by the pedestrian recognition unit; and wherein the drive control unit causes the autonomous mobile body to cross the crosswalk in synch with a timing of the signal light color of the pedestrian traffic light switching from a red color to the blue color, and causes the autonomous mobile body to avoid collision with a pedestrian based on a prediction result of the drive control unit.

[0016]

According to the signal control system described above, by causing the autonomous mobile body to start crossing the crosswalk from the sidewalk at a timing of starting its movement to cross the crosswalk with plenty of time to spare, it is possible to prevent a situation where the autonomous mobile body is unable to cross the entire length of the crosswalk within the blue color lighting duration.

#### ADVANTAGEOUS EFFECTS OF THE INVENTION

[0017]

## CLAIMS

### [Claim 1]

An autonomous mobile body which moves freely within a designated area including a sidewalk, comprising:

a SLAM function part which creates a planar or three-dimensional environmental map of the designated area simultaneously with estimating its own position relative to an external environment within the designated area;

a drive control unit which suitably changes a travel path of the autonomous mobile body so that the autonomous mobile body does not come into contact with peripheral objects based on an output of the SLAM function part;

an imaging unit which captures images of an outside world of a predetermined range in front of the travel path;

a signal light color determination unit which recognizes a pedestrian traffic light within the designated area and determines a signal light color and lighting/flashing switching of the pedestrian traffic light based on an imaging result of the imaging unit; and

a pedestrian recognition unit which, when the autonomous mobile body moving on the sidewalk reaches a crosswalk, recognizes a number and position of pedestrians waiting for a traffic light on an opposing side of the crosswalk based on the imaging result of the imaging unit;

wherein, the drive control unit is configured to predict a degree of congestion of pedestrians at the time of crossing before the pedestrian traffic light switches to a blue color lighting based on a determination result by the signal light color determination unit and the recognition result by the pedestrian recognition unit; and

wherein the drive control unit causes the autonomous mobile body to cross the crosswalk in synch with a timing of the signal light color of the pedestrian traffic light switching from a red color to the blue color, and causes the autonomous mobile body to avoid collision with a pedestrian based on a prediction result of the drive control unit.

[Claim 2]

The autonomous mobile body according to claim 1, further comprising:

an audio microphone which recognizes the presence or the approaching state of the pedestrian while collecting sound around the autonomous mobile body;

wherein the drive control unit recognizes the presence of a vehicle entering a vehicle traffic signal by ignoring the red lighting of the vehicle traffic signal based on the detection result of the SLAM function part, the imaging unit and the audio microphone when the autonomous mobile body starts to cross; and

wherein when it is determined there is insufficient time to cross the entire length of the crosswalk, the autonomous mobile body is kept in standby until a subsequent timing of starting its movement to cross the crosswalk.

[Claim 3]

The autonomous mobile body according to claim 2,

wherein, when the drive control unit recognizes the pedestrians on an opposing side of the crosswalk based on an output of the SLAM function part when the autonomous mobile body starts crossing the crosswalk, the drive control unit causes the

A signal control system which coordinates with an autonomous mobile body which moves freely within a designated area including a sidewalk, comprising:

a signal light color control unit which controls a signal light color and lighting/flashing switching of a pedestrian traffic light within the designated area; and

a signal transmission unit which transmits signals from the signal light color control unit,

wherein the autonomous mobile body comprises:

a SLAM function part which creates a planar or three-dimensional environmental map of the designated area simultaneously with estimating its own position relative to an external environment within the designated area;

a drive control unit which suitably changes a travel path of the autonomous mobile body so that the autonomous mobile body does not come into contact with peripheral objects based on an output of the SLAM function part;

a signal reception unit which receives control signals from the signal transmission unit;

an imaging unit which captures images of an outside world of a predetermined range in front of the travel path; and

a pedestrian recognition unit which, when the autonomous mobile body moving on the sidewalk reaches a crosswalk, recognizes a number and position of pedestrians waiting for a traffic light on an opposing side of the crosswalk based on the imaging result of the imaging unit;

wherein, the drive control unit is configured to predict a degree of congestion of pedestrians at the time of crossing before the pedestrian traffic light switches to a blue color lighting based on a determination result by the signal light color control unit and the recognition result by the pedestrian recognition unit; and

wherein the drive control unit causes the autonomous mobile body to cross the crosswalk in synch with a timing of the signal light color of the pedestrian traffic light switching from a red color to the blue color, and causes the autonomous mobile body to avoid collision with a pedestrian based on a prediction result of the drive control unit.

[Claim 9]

The signal control system according to claim 8, further comprising:

an audio microphone which recognizes the presence or the approaching state of the pedestrian while collecting sound around the autonomous mobile body;

wherein the drive control unit recognizes the presence of a vehicle entering a vehicle traffic signal by ignoring the red lighting of the vehicle traffic signal based on the detection result of the SLAM function part, the imaging unit and the audio microphone when the autonomous mobile body starts to cross; and

wherein it is determined there is insufficient time to cross the entire length of the crosswalk, the autonomous mobile body is kept in standby until a subsequent timing of starting its movement to cross the crosswalk.

[Claim 10]

The signal control system according to claim 9,

wherein, when the drive control unit recognizes the pedestrians on an opposing side of the crosswalk based on an output of the SLAM function part when the autonomous mobile body starts crossing the crosswalk, the drive control unit causes the autonomous mobile body to move forward by shifting the autonomous mobile body in