[Document Name] Claims

[Claim 1]

An automatic tableware washing system comprising:

a tableware washing section for washing tableware input from a tableware input section from which the tableware is input;

a tableware transport section for transporting the tableware washed in the tableware washing section;

a tableware information acquisition section for using a plurality of image acquisition sections to identify ~~for identifying~~ the tableware transported by the tableware transport section and ~~acquiring~~ to acquire information on the tableware;

a tableware placement section, and on which the tableware transported by the tableware transport section is placed; and

a tableware pick-up section for picking up the tableware from the tableware transport section and placing the tableware on the tableware placement section, wherein

the information acquired by the tableware information acquisition section includes at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and wherein

when the tableware information acquisition section identifies the tableware being transported by the tableware transport section, the tableware pick-up section keeps tracking the position and the posture of the identified tableware by mixing the information of the identified tableware measured by the plurality of image acquisition sections, and uses the information including the position and the posture of the identified tableware to pick up the tableware in a state where the tableware is being transported by the tableware transport section~~picks up the tableware according to a state of the tableware on the basis of the information acquired by the tableware information acquisition section~~.

[Claim 2]

An automatic tableware washing system comprising:

a tableware washing section for washing tableware input from a tableware input section from which the tableware is input;

a tableware transport section for transporting the tableware washed in the tableware washing section;

a tableware information acquisition section for identifying the tableware transported by the tableware transport section and acquiring information on the tableware;

a tableware placement section on which the tableware transported by the tableware transport section is placed; and

a tableware pick-up section for using an articulated robot to pick up the tableware from the tableware transport section and to place the tableware on the tableware placement section, wherein

the information acquired by the tableware information acquisition section includes at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and wherein

when the tableware information acquisition section identifies the tableware being transported by the tableware transport section, the tableware pick-up section simulates a range of a motion of the articulated robot based on the information including the position and the posture of the tableware acquired by the tableware information acquisition unit, and when the articulated robot has a joint which have possibility of exceeding a movable range, first the angle of the joint is adjusted to an angle close to the goal angle, and then the articulated robot is drive controlled to the position where the tableware is picked up.

[Claim 3]

An automatic tableware washing system comprising:

a tableware washing section for washing tableware input from a tableware input section from which the tableware is input;

a tableware transport section for transporting the tableware washed in the tableware washing section;

a tableware information acquisition section for identifying the tableware transported by the tableware transport section and acquiring information on the tableware;

a tableware placement section on which the tableware transported by the tableware transport section is placed; and

a tableware pick-up section for using an articulated robot with a force sensor to pick up the tableware from the tableware transport section and to place the tableware on the tableware placement section,

wherein

the information acquired by the tableware information acquisition section includes at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and

wherein

when the tableware information acquisition section identifies the tableware being transported by the tableware transport section, the tableware pick-up section picks up the tableware according to a state of the tableware on the basis of the information acquired by the tableware information acquisition section and the information of the force to be pressed detected by the force sensor, and the position and the posture of the picked-up tableware are controlled to follow the direction according to the state of the tableware placement section.

~~[Claim 2]~~

~~The automatic tableware washing system according to claim 1, wherein the tableware information acquisition section picks up the tableware in a state where the tableware is being transported by the tableware transport section.~~

[Claim ~~3~~4]

The automatic tableware washing system according to claim ~~1~~ 2 or ~~2~~3, wherein the tableware information acquisition section includes ~~an~~ one or more image acquisition section.

[Claim 5]

The automatic tableware washing system according to any one of claims 1 to 4, wherein the tableware information acquisition section includes an imaging section and can acquire the information on the tableware from one or a plurality of images acquired by the imaging sections.

[Claim 6]

The automatic tableware washing system according to any one of claims 1 to 5, wherein the tableware information acquisition section picks up the tableware in a state where the tableware is being transported by the tableware transport section.

[Claim ~~4~~7]

The automatic tableware washing system according to any one of claims 1 to ~~3~~6, wherein if the information acquired by the tableware information acquisition section is a marker,

the marker is provided by at least any one of

(1) being attached as a sticker,

(2) being formed by laser processing,

(3) being printed,

(4) being coated, or

(5) attaching another member on which the marker is printed.

[Claim ~~5~~8]

The automatic tableware washing system according to any one of claims 1 to ~~3~~7, wherein the tableware is identified in a state where the tableware is not provided with a marker.

[Claim ~~6~~9]

The automatic tableware washing system according to any one of claims 1 to ~~5~~8, wherein the tableware information acquisition section or the tableware pick-up section predicts the position of the tableware.

[Claim ~~7~~10]

The automatic tableware washing system according to any one of claims 1 to ~~6~~9, wherein the tableware pick-up section includes an elastic member.

[Claim ~~8~~11]

The automatic tableware washing system according to any one of claims 1 to ~~7~~10, wherein at least any one of the tableware input section, the tableware information acquisition section, or the tableware pick-up section is controlled by using machine learning.

~~[Claim 9]~~

~~The automatic tableware washing system according to any one of claims 1 to 8, wherein the tableware information acquisition section includes one or more imaging sections and can acquire the information on the tableware from one or a plurality of images acquired by the imaging sections.~~

[Claim ~~10~~12]

The automatic tableware washing system according to any one of claims 1 to ~~9~~11, wherein the tableware pick-up section includes an articulated robot for picking up the tableware using a suction portion, and wherein

the suction portion includes a plurality of suction portions in which suction directions thereof are different.

[Claim ~~11~~13]

The automatic tableware washing system according to any one of claims 1 to ~~10~~12, a container storage robot is further used to store the tableware in a container.

[Claim ~~12~~14]

An automatic tableware washing method including:

a tableware washing process for washing input tableware;

a tableware transport process for transporting the tableware washed in the tableware washing process;

a tableware information acquisition process for using a plurality of image acquisition sections to identify ~~identifying~~ the tableware transported in the tableware transport process and ~~acquiring~~ to acquire information on the tableware; and

a tableware pick-up process for picking up the tableware being transported in the tableware transport process and placing the picked-up tableware, wherein

the information acquired in the tableware information acquisition process includes at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and wherein

when the tableware being transported in the tableware transport process is identified in the tableware information acquisition process, in the tableware pick-up process, the position and the posture of the identified tableware keep being tracked by mixing the information of the identified tableware measured by the plurality of image acquisition sections, and the information including the position and the posture of the identified tableware is used to pick up the tableware in a state where the tableware is being transported by the tableware transport section~~the tableware is picked up according to a state of the tableware on the basis of the information acquired in the tableware information acquisition process~~.

[Claim 15]

An automatic tableware washing method including:

a tableware washing process for washing input tableware;

a tableware transport process for transporting the tableware washed in the tableware washing process;

a tableware information acquisition process for identifying the tableware transported in the tableware transport process and acquiring information on the tableware; and

a tableware pick-up process for using an articulated robot to pick up the tableware being transported in the tableware transport process and to place the picked-up tableware, wherein

the information acquired in the tableware information acquisition process includes

at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and wherein

when the tableware being transported in the tableware transport process is identified in the tableware information acquisition process, in the tableware pick-up process, a range of a motion of the articulated robot is simulated based on the information including the position and the posture of the tableware acquired by the tableware information acquisition unit, and when the articulated robot has a joint which have possibility of exceeding a movable range, first the angle of the joint is adjusted to an angle close to the goal angle, and then the articulated robot is drive controlled to the position where the tableware is picked up.

[Claim 16]

An automatic tableware washing method including:

a tableware washing process for washing input tableware;

a tableware transport process for transporting the tableware washed in the tableware washing process;

a tableware information acquisition process for identifying the tableware transported in the tableware transport process and acquiring information on the tableware; and

a tableware pick-up process for using an articulated robot with a force sensor to pick up the tableware being transported in the tableware transport process and to place the picked-up tableware on the tableware placement section, wherein

the information acquired in the tableware information acquisition process includes at least any one of a type of the tableware, size of the tableware, a shape of the tableware, color of the tableware, a position of the tableware, posture of the tableware, orientation of the tableware, a marker attached to the tableware, or a code attached to the tableware, and wherein

when the tableware being transported in the tableware transport process is identified in the tableware information acquisition process, in the tableware pick-up process, the tableware is picked up according to a state of the tableware on the basis of the information acquired in the tableware information acquisition process and the information of the force to be pressed detected by the force sensor, and the position and the posture of the picked-up tableware are controlled to follow the direction according to the state of the tableware placement section.

[Claim ~~13~~17]

An automatic tableware washing program, characterized in that each process in the automatic tableware washing method according to any one of claims 14 to 16 ~~claim 12~~ can be executed by a computer section.

[Claim ~~14~~18]

A storage medium storing the automatic tableware washing program according to claim ~~13~~17.