CLAIMS

Claim 1:

An object transporting method, adapted for a cube storage system including a control system and a cube storage structure, the cube storage structure including a first vertical storage structure, the object transporting method comprising performing following steps using the control system:

in response to a first transporting task of a first target object stored in the first vertical storage structure, determining whether there is a blocking object stored in the first vertical storage structure relative to the first target object, wherein a first transporting task indicates to transport the first target object from a current position to a first target position, the first vertical storage structure comprises a plurality of first object storage positions arranged vertically, and the current position of the first target object corresponds to one of the first object storage positions;

in response to determining that there is the blocking object stored in the first vertical storage structure relative to the first target object, controlling at least one assisting transporting robot to move along a bottom of the cube storage structure to a bottom of the first vertical storage structure, then to climb vertically upward to below the blocking object in the first vertical storage structure, such that after the at least one auxiliary handling robot accesses the blocking object, the at least one assisting transporting robot climbs vertically downward to the bottom of the first vertical storage structure in the first vertical storage structure, thereby removing the blocking object from the first vertical storage structure;

in response to determining that there is no blocking object in the first vertical storage structure relative to the first target object, controlling a first transporting robot to move along the bottom of the cube storage structure to the bottom of the first vertical storage structure, then to climb vertically upward to the current position, such that after the first transporting

robot accesses the first target object, the first transporting robot climbs vertically downward to the bottom of the first vertical storage structure in the first vertical storage structure, thereby transporting the first target object to the first target position.

Claim 2:

The object transporting method as claimed in claim 1, wherein the first vertical storage structure comprises a first entry point located at the bottom of the first vertical storage structure, and the object transporting method comprises:

in response to determining that at least one object is stored in the first object storage positions between the current position of the first target object and the first entry point, determining each object as the at least one blocking object relative to the first target object.

Claim 3:

The object transporting method as claimed in claim 1, wherein the first vertical storage structure comprises a first entry point located at the bottom of the first vertical storage structure, and in response to determining that there are a plurality of blocking objects stored in the first vertical storage structure relative to the first target object, controlling the at least one assisting transporting robot to remove the plurality of blocking objects from the first vertical storage structure comprises:

(a) finding a specific blocking object closest to the first entry point among the plurality of blocking objects;

(b) controlling a transporting robot as one of the at least one assisting transporting robot to move along the bottom of the cube storage structure to the first entry point, and controlling the transporting robot to climb vertically upward to below the specific blocking object from the first entry point in the first vertical storage structure, such that after the

transporting robot accesses the specific blocked object, the transporting robot climbs vertically downward to the bottom of the first entry point in the first vertical storage structure, thereby removing the specific blocking object from the first vertical storage structure;

(c) controlling the transporting robot to move the specific blocked object to a second object storage position of the cube storage structure, wherein the second object storage position belongs to a second vertical storage structure of the cube storage structure;

(d) repeating steps (a) to (c) until there is no blocking object in the first vertical storage structure relative to the first target object.

Claim 4:

The object transporting method as claimed in claim 3, wherein the second vertical storage structure comprises a second entry point located at bottom of the second vertical storage structure, and the step (c) comprises:

controlling the transporting robot to move along the bottom of the cube storage structure from the first entry point of the first vertical storage structure to the second entry point of the second vertical storage structure;

controlling the transporting robot to climb vertically upward to the second object storage position from the second entry point in the second vertical storage structure, and fixing the specific blocking object to the second object storage position.

Claim 5:

The object transporting method as claimed in claim 4, wherein before controlling the transporting robot to move along the bottom of the cube storage structure from the first entry point of the first vertical storage structure to the second entry point of the second

vertical storage structure, the object transporting method further comprises:

determining whether the second vertical storage structure is locked;

in response to determining that the second vertical storage structure is not locked, locking the second vertical storage structure, and controlling the transporting robot to move from the first entry point of the first vertical storage structure to the second entry point of the second vertical storage structure;

in response to determining that the second vertical storage structure has been locked, controlling the transporting robot to move from the first entry point of the first vertical storage structure to the second entry point of the second vertical storage structure.

Claim 6:

The object transporting method as claimed in claim 1, wherein the first vertical storage structure comprises a first entry point located at bottom of the first vertical storage structure, and controlling the first transporting robot to move to the current position to transport the first target object to the first target position comprises:

controlling the first transporting robot to move along the bottom of the cube storage structure to the first entry point, and controlling the first transporting robot to climb vertically upward to the current position of the first target object from the first entry point in the first vertical storage structure, such that the first transporting robot accesses the first target object;

controlling the first transporting robot to move the first target object from the current position to the first target position.

Claim 7:

The object transporting method as claimed in claim 6, wherein controlling the first transporting robot to move the first target object from the current position to the first target position comprises:

controlling the first transporting robot to climb vertically downward from the current position of the first target object to the first entry point of the first vertical storage structure, and controlling the first transporting robot to move from the first entry point of the first vertical storage structure to the first target position.

Claim 8:

The object transporting method as claimed in claim 1, wherein the first target position is an outbound point of the cube storage structure.

Claim 9:

The object transporting method as claimed in claim 8, wherein the first transporting task corresponds to a sorting task, and after controlling the first transporting robot to move along the bottom of the cube storage structure to the bottom of the first vertical storage structure, then to climb vertically upward to the current position, such that after the first transporting robot accesses the first target object, the first transporting robot climbs vertically downward to the bottom of the first vertical storage structure in the first vertical storage structure, thereby transporting the first target object to the first target position, the object transporting method further comprises:

in response to determining that the first target object has been transported to the first target position, determining whether a sorting workstation is available;

in response to determining that the sorting workstation is available, controlling an object moving robot to move the first target object from the first target position to the sorting

workstation.

Claim 10:

The object transporting method as claimed in claim 9, wherein the first target object is a goods storage object that stores at least one goods, and the object transporting method further comprises:

determining whether the first target object located at the sorting workstation is empty after the sorting task is completed;

in response to determining that the first target object is not empty, controlling a second transporting robot to store the first target object in the cube storage structure through a return process.

Claim 11:

The object transporting method as claimed in claim 10, wherein the return process comprises:

determining that the first target object is in a third object storage position in the cube storage structure, wherein the third object storage position belongs to a third vertical storage structure in the cube storage structure, and a third entry point is at bottom of the third vertical storage structure;

controlling the second transporting robot to move to an inbound point of the cube storage structure, and controlling the object moving robot to move the first target object from the sorting workstation to the second transporting robot located at the inbound point;

controlling the second transporting robot to move from the inbound point of the cube storage structure to the third entry point of the third vertical storage structure;

controlling the second transporting robot to climb vertically upward to the third

object storage position in the third vertical storage structure, and fixing the first target object to the third object storage position.

Claim 12:

The object transporting method as claimed in claim 11, wherein before controlling the second transporting robot to move from the inbound point of the cube storage structure to the third entry point of the third vertical storage structure, the object transporting method further comprises:

determining whether the third vertical storage structure is locked;

in response to determining that the third vertical storage structure is not locked, locking the third vertical storage structure, and controlling the second transporting robot to move from the inbound point of the cube storage structure to the third entry point of the third vertical storage structure;

in response to determining that the third vertical storage structure has been locked, controlling the second transporting robot to move from the inbound point of the cube storage structure to the third entry point of the third vertical storage structure.

Claim 13:

The object transporting method as claimed in claim 11, wherein after fixing the first target object to the third object storage position, the object transporting method further comprises:

controlling the second transporting robot to climb vertically downward to the third entry point of the third vertical storage structure, and unlocking the third vertical storage structure.

Claim 14:

The object transporting method as claimed in claim 10, further comprising:

in response to determining that the first target object is empty, controlling the object moving robot to move the first target object to a third transporting robot, and controlling the third transporting robot to transport the first target object to an empty object station.

Claim 15:

The object transporting method as claimed in claim 9, wherein the first target object is a goods storage object that stores at least one goods, the first transporting task corresponds to a stock taking task, and the object transporting method further comprises:

in response to determining that the at least one goods stored in the first target object is correct after stock-taking, controlling a second transporting robot to store the first target object in the cube storage structure through a return process.

Claim 16:

The object transporting method as claimed in claim 1, further comprising:

obtaining a loading task, and associating the loading task with a second target object, wherein the second target object is a goods storage object and is initialized to be empty, and the loading task indicates to load at least one goods into the second target object;

determining whether a weight of the second target object is about to exceed a weight threshold during a process of loading the at least one goods into the second target object;

in response to determining that the weight of the second target object is not about to exceed the weight threshold, allowing the at least one goods to continue to be loaded into the second target object;

in response to determining that the weight of the second target object is about to exceed the weight threshold, controlling a second transporting robot to store the second target object in a third object storage position in the cube storage structure through a return process, and introducing a third target object to support the loading task, wherein the third object storage position belongs to a third vertical storage structure in the cube storage structure,

the return process comprises:

controlling the second transporting robot to climb vertically upward to the third object storage position in the third vertical storage structure, and fixing the second target object to the third object storage position.

Claim 17:

A cube storage system, comprising:

a cube storage structure, comprising a first vertical storage structure, the first vertical storage structure comprising a plurality of first object storage positions arranged vertically; and

a control system, configured to execute:

in response to a first transporting task of a first target object storing in the first vertical storage structure, determining whether there is a blocking object stored in the first vertical storage structure relative to the first target object, wherein the first transporting task indicates to transport the first target object from a current position to a first target position, and the current position of the first target object corresponds to one of the first object storage positions;

in response to determining that there is the blocking object stored in the first vertical storage structure relative to the first target object, controlling at least one

assisting transporting robot to move along a bottom of the cube storage structure to a bottom of the first vertical storage structure, then to climb vertically upward to below the blocking object in the first vertical storage structure, such that after the at least one auxiliary handling robot accesses the blocking object, the at least one assisting transporting robot climbs vertically downward to the bottom of the first vertical storage structure in the first vertical storage structure, thereby removing the blocking object from the first vertical storage structure;

in response to determining that there is no blocking object in the first vertical storage structure relative to the first target object, controlling a first transporting robot to move along the bottom of the cube storage structure to the bottom of the first vertical storage structure, then to climb vertically upward to the current position, such that after the first transporting robot accesses the first target object, the first transporting robot climbs vertically downward to the bottom of the first vertical storage structure in the first vertical storage structure, thereby transporting the first target object to the first target position.