

METHOD AND SYSTEM FOR DETECTING WAFER SHIPPING BOX

CROSS-REFERENCE TO RELATED PATENT APPLICATION

This application claims the benefit of priority to Taiwan Patent
5 Application No. 106138999, filed on November 10, 2017. The entire content of
the above identified application is incorporated herein by reference.

Some references, which may include patents, patent applications and
various publications, may be cited and discussed in the description of this
disclosure. The citation and/or discussion of such references is provided merely
10 to clarify the description of the present disclosure and is not an admission that
any such reference is “prior art” to the disclosure described herein. All
references cited and discussed in this specification are incorporated herein by
reference in their entireties and to the same extent as if each reference was
individually incorporated by reference.

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FIELD OF THE DISCLOSURE

The present disclosure relates to a detection method and a detection
system, and more particularly to a method and a system for detecting a wafer
shipping box by detecting whether an auxiliary member is disposed outside the
20 wafer shipping box.

BACKGROUND OF THE DISCLOSURE

During the manufacturing process, it is necessary to move wafers
between different manufacturing sites. Therefore, the wafers are often placed in
25 wafer shipping boxes in order to facilitate the transport of wafers. Also,
manufacturers provide detachable auxiliary members (such as handle structures
or relevant buckling structures) on the outside of the wafer shipping boxes so as
to facilitate the transport of wafer shipping boxes and allow the personnel and
robots of the manufacturing sites to handle the wafer shipping boxes more
30 easily. During the transport of wafer shipping boxes, it has become an

important issue to accurately determine whether a predetermined position of the wafer shipping box is provided with an auxiliary member. In practice, since the determination of whether the auxiliary member is disposed on the wafer shipping box is mostly performed manually, the problem of oversight may easily occur. Accordingly, the present disclosure is provided to improve on the above issues.

SUMMARY OF THE DISCLOSURE

The present disclosure provides a method and a system for detecting a wafer shipping box, used to improve the issue of oversight caused by manually determining whether a predetermined position of the wafer shipping box is provided with an auxiliary member.

The present disclosure provides a method for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box. The predetermined position is used to be disposed with an auxiliary member. The method includes the following steps: a detecting step and a determining step. The detecting step includes: using a plurality of detection modules to detect the predetermined position, and using a processing module to convert the detection results from the detection modules into a plurality of detection values; wherein, detection ranges of two detection modules disposed adjacent to each other are partially overlapped. The determining step includes: according to the plurality of detection values, using the processing module to determine whether the predetermined position of the wafer shipping box is provided with the auxiliary member; wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the

auxiliary member.

The present disclosure also provides a system for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box. The predetermined position is used to be disposed with an auxiliary member. The system includes: a platform, a plurality of detection modules and a processing module. The platform is used to carry the wafer shipping box. The plurality of detection modules separately detect the predetermined position, and detection ranges of two detection modules disposed adjacent to each other are partially overlapped. The processing module is electrically connected to the plurality of the detection modules, converting the detection results from the plurality of detection modules into a plurality of detection values, and determining whether the predetermined position of the wafer shipping box is provided with the auxiliary member according to the plurality of detection values. When the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member. When the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.

The present disclosure further provides a method for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box. The predetermined position is used to be disposed with an auxiliary member. The method includes the following steps: providing a system for detecting a wafer shipping box according to the above; using the processing module to control the plurality of detection modules to detect the predetermined position, and using the processing module to convert the detection results from the detection modules into a plurality of detection values; and according to the plurality of detection values, using the processing module to determine whether

the predetermined position of the wafer shipping box is provided with the auxiliary member; wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.

Therefore, the beneficial effects of the present disclosure lie in that the system and the method for detecting the wafer shipping box of the present disclosure are capable of accurately determining whether the predetermined position of the wafer shipping box is provided with the auxiliary member. Even when some detection modules cannot detect accurately, the system and the method for detecting the wafer shipping box of the present disclosure still can accurately determine whether the auxiliary member is disposed at the predetermined position of the wafer shipping box.

These and other aspects of the present disclosure will become apparent from the following description of the embodiment taken in conjunction with the following drawings and their captions, although variations and modifications therein may be affected without departing from the spirit and scope of the novel concepts of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will become more fully understood from the detailed description and the accompanying drawings, in which:

FIG. 1 is a schematic view of a system for detecting a wafer shipping box according to an embodiment of the present disclosure.

FIG. 2 is a schematic view of the system for detecting a wafer shipping box according to the embodiment of the present disclosure.

FIG. 3 is a partial top view of the system for detecting a wafer shipping box according to the embodiment of the present disclosure.

FIG. 4A, FIG. 4B and FIG. 4C are schematic views of the wafer shipping box being disposed with different auxiliary members.

5 FIG. 5 is a top view of FIG. 1.

FIG. 6 is a side view of FIG. 1.

FIG. 7 is a block diagram of the system for detecting a wafer shipping box according to the embodiment of the present disclosure.

10 FIG. 8 is a schematic view of the system for detecting a wafer shipping box according to another embodiment of the present disclosure.

FIG. 9 is a flow chart of a method for detecting a wafer shipping box according to the present disclosure.

FIG. 10 is a schematic view of the method for detecting a wafer shipping box according to the present disclosure.

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DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

The present disclosure is more particularly described in the following examples that are intended as illustrative only since numerous modifications and variations therein will be apparent to those skilled in the art. Like numbers in the drawings indicate like components throughout the views. As used in the description herein and throughout the claims that follow, unless the context clearly dictates otherwise, the meaning of “a”, “an”, and “the” includes plural reference, and the meaning of “in” includes “in” and “on”. Titles or subtitles can be used herein for the convenience of a reader, which shall have no influence on the scope of the present disclosure.

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The terms used herein generally have their ordinary meanings in the art. In the case of conflict, the present document, including any definitions given herein, will prevail. The same thing can be expressed in more than one way. Alternative language and synonyms can be used for any term(s) discussed herein, and no special significance is to be placed upon whether a term is

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elaborated or discussed herein. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms is illustrative only, and in no way limits the scope and meaning of the present disclosure or of any exemplified term. Likewise, the present disclosure is not limited to various embodiments given herein. Numbering terms such as “first”, “second” or “third” can be used to describe various components, signals or the like, which are for distinguishing one component/signal from another one only, and are not intended to, nor should be construed to impose any substantive limitations on the components, signals or the like.

FIG. 1 and FIG. 2 are schematic views of a system for detecting a wafer shipping box of the present disclosure. In FIG. 1, a system 1 for detecting a wafer shipping box includes a platform 10, a supporting structure 20, three detection modules 30, three auxiliary detection modules 40 and a processing module 50. The platform 10 is used to carry a wafer shipping box B. The supporting structure 20 is adjacent to the platform 10 and can be, according to practical requirements, disposed adjacent to each side surface of the wafer shipping box B that do not contact the platform 10. The number of the detection modules 30 and auxiliary detection modules 40 is not limited to that disclosed above, and can be changed as needed.

In practice, the supporting structure 20 may include a top structure 201 and two pillar structures 202. The top structure 201 may include a first lateral structure 2011, a second lateral structure 2012 and a longitudinal structure 2013. The first lateral structure 2011 and the second lateral structure 2012 may be substantially parallel to each other and the two ends of the longitudinal structure 2013 are respectively connected to the first lateral structure 2011 and the second lateral structure 2012. The first lateral structure 2011 substantially corresponds to a right side predetermined position P1 of the wafer shipping box B, the second lateral structure 2012 substantially corresponds to the above of a left side predetermined position P2 of the wafer shipping box B, and the

longitudinal structure 2013 substantially corresponds to the above of a top surface predetermined position P3 of the wafer shipping box B.

The two pillar structures 202 are connected to the first lateral structure 2011 and the second lateral structure 2012, respectively, and the two pillar structures 202 are not disposed within a movement range of the operated wafer shipping box B. Specifically, in FIG. 1, when the wafer shipping box B is moved by a person or a mechanical device, the movement range is roughly in a positive X-axis direction, a positive Y-axis direction and a negative Y-axis direction, and the two pillar structures 202 are preferably disposed in a negative X-axis direction of the platform 10. In this way, the two pillar structures 202 will not affect the person or the mechanical device moving the wafer shipping box B. The first lateral structure 2011 is provided with three detection modules 30, and each of the detection modules 30 is used to detect the right side predetermined position P1 of the wafer shipping box B. The second lateral structure 2012 is provided with three detection modules 30, and each of the detection modules 30 is used to detect the left side predetermined position P2 of the wafer shipping box B. The longitudinal structure 2013 is provided with three auxiliary detection modules 40, and each of them is used to detect the top surface predetermined position P3.

The processing module 50 is electrically connected to each of the detection modules 30 and the three auxiliary detection modules 40. The processing module 50 receives signals generated from each of the detection modules 30 and the auxiliary modules 40 by detecting the right side predetermined position P1, the left side predetermined position P2 and the top surface predetermined position P3, to determine whether the right side predetermined position P1, the left side predetermined position P2 and the top surface predetermined position P3 are provided with auxiliary members B1, B2 and B3. In practice, the processing module 50 may be any device or equipment that can process signals and information, such as, but not limited to, a computer device or a microprocessor. Through the cooperation of the detection modules

30, the three auxiliary detection modules 40 and the processing module 50, the detection system 1 determines whether the auxiliary members B1, B2 and B3 are disposed at the right side predetermined position P1, the left side predetermined P2 and the top predetermined position P3 of the wafer shipping box B. In practice, the plurality of detection modules 30 and auxiliary detection modules 40 may detect any side surface of the wafer shipping box B that is not in contact with the platform 10 according to particular implementations, and not limited to detecting the above three predetermined positions (P1, P2 and P3).

Referring to FIG. 1 to FIG. 3, each of the detection modules 30 may be a component that uses an occlusion detection method. For example, each of the detection modules 30 may include a receiving unit 31 and a transmitting unit 32. The receiving unit 31 is a sensing element capable of receiving light beams, such as various photo detectors, and the transmitting unit 32 may be a light emitting diode or an associated transmitting unit that can emit laser light. Preferably, the transmitting unit 32 may be a light emitting diode having an illumination range larger than that of the laser light, so that the detection effect is effectively improved. It should be mentioned that, in order to prevent the receiving unit 31 from being affected by light sources at the place where the platform 10 is disposed, preferably, the transmitting units 32 can be disposed on an upper surface 101 of the platform 10, emitting light beams in a direction away from the upper surface 101 of the platform 10. The receiving unit 31 is located above the predetermined position (i.e., the right side predetermined position P1, the left side predetermined P2 and the top predetermined position P3) and a receiving surface of the receiving unit 31 can face the upper surface 101 of the platform 10. In this way, the receiving unit 31 will not directly receive the light beams from the light source, which enables each of the detection modules 30 to have a relatively better detection effect.

In different applications, the detection module 30 used to detect a predetermined position of the wafer shipping box B may include different numbers of the receiving units 31 and the transmitting units 32, wherein the

number of receiving units 31 is an odd number greater than 1. For instance, the detection module 30 can include three receiving units 31 and four transmitting units 32, the three receiving units 31 can correspondingly generate the detection values according to the amount of light received, and the processing module 50
5 can conduct relevant determination according to the detection values transmitted by the odd numbers of receiving units 31.

In FIG. 3, the three detection modules 30 used to detect the right side predetermined position P1 or the left side predetermined P2 may be arranged side by side along an X-axis direction (the X-axis is not shown in the drawings),
10 and the detection ranges of two detection modules 30 disposed adjacent to each other are partially overlapped. That is, a detection range R2 of one of the detection modules 30 is overlapped with detection ranges R1 and R3 of the other two detection modules 30. Referring to FIG. 4A, 4B and 4C, auxiliary members B1, B1' and B1'' may be, for example, handle structures or buckling
15 structures of varied types, and be disposed at a specific position of the wafer shipping box B as needed.

In different applications, the arrangement of the three detection modules 30 used to detect the right side predetermined position P1 or the left side predetermined position P2 of the wafer shipping box B may be correspondingly
20 changed according to varied appearances and relative positions of the auxiliary members B1 and B2, and is not limited to the configuration shown in the drawings. Likewise, the number of the detection modules 30 used to detect the right side predetermined position P1 or the left side predetermined position P2 of the wafer shipping box B may be correspondingly changed according to the
25 appearances and arrangement positions of the auxiliary members B1 and B2 to be detected.

Referring to FIG. 1, FIG. 2, FIG. 5 and FIG. 6, the three auxiliary detection modules 40 may be disposed at the supporting structure 20, and the three auxiliary detection modules 40 may correspond to the upper surface 101
30 that faces the platform 10 and that is used to carry the wafer shipping box B.

That is, when the platform 10 carries the wafer shipping box B, the three auxiliary detection modules 40 correspond to the top surface predetermined position P3 of the wafer shipping box B for detection. In specific embodiments, each of the auxiliary detection modules 40 may include any component for measuring a distance, such as an ultrasonic measuring unit, so that the processing module 50 may determine whether the top surface predetermined position P3 of the wafer shipping box B is provided with the auxiliary member B3 according to the detection results measured by the three auxiliary detection modules 40. For instance, when the top surface predetermined position P3 of the wafer shipping box B does have the auxiliary member B3, a distance measured by at least two auxiliary detection modules 40 would be smaller than a distance measured by each of the auxiliary detection modules 40 when the top surface predetermined position P3 of the wafer shipping box B does not have the auxiliary member B3. The arrangement of the three auxiliary detection modules 40 may be changed according to particular implementations and is not limited to the manner shown in the drawings. Preferably, the detection ranges of two adjacent auxiliary detection modules 40 are partially overlapped.

FIG. 7 is a block diagram of the system for detecting a wafer shipping box according to the embodiment of the present disclosure. In FIG. 7, the processing module 50 is electrically connected to the plurality of detection modules 30 and the plurality of auxiliary detection modules 40. The processing module 50 can receive detection signals 301 and 401 generated from the plurality of detection modules 30 and the plurality of auxiliary modules 40 by detecting the corresponding positions of the wafer shipping box B, and the processing module 50 can correspondingly convert the detection signals 301 into the a plurality of detection values 501.

Then, the processing module 50 determines whether the right side predetermined position P1, the left side predetermined position P2 and the top surface predetermined position P3 of the wafer shipping box B are provided with the auxiliary members B1, B2 and B3 according to the plurality of

detection values 501. When the processing module 50 determines that more than half of the detection values 501 fall in a first predetermined value range, the processing module 50 determines that the predetermined positions P1, P2 and P3 are provided with the auxiliary members B1, B2 and B3; when the
5 processing module 50 determines that more than half of the detection values 501 fall in a second predetermined value range, the processing module 50 determines that the predetermined positions P1, P2 and P3 are not provided with the auxiliary members B1, B2 and B3.

Specifically, referring to FIG. 1, FIG. 3 and FIG. 7 together, the
10 processing module 50 receives the three detection modules 30 for detecting the right side predetermined position P1 and detects the right side predetermined position P1. After the three detection signals 301 are correspondingly generated, the processing module 50 correspondingly generates the three detection values 501, so that the processing module 50 can determine whether
15 each of the detection value 501 correspondingly falls in the first predetermined value range or the second predetermined value range.

If the processing module 50 determines that two or more detection values 501 fall in the first predetermined value range, the processing module 50 can determine that the corresponding detection module 30 detects that the right
20 side predetermined position P1 is provided with the auxiliary member B1.

If the processing module 50 determines that two or more detection values 501 fall in the second predetermined value range, the processing module 50 can determine that the corresponding detection module 30 detects that the right side predetermined position P1 is not provided with the auxiliary member
25 B1.

If the processing module 50 determines that two or more detection values 501 do not fall in the first and second predetermined value ranges, the processing module 50 can determine that the detection conducted by the corresponding detection module 30 has failed, and the processing module 50
30 can selectively control the plurality of detection modules 30 to detect the

predetermined position P1 again. That is to say, in practice, when the processing module 50 determines that two or more detection values 501 do not fall in the first and second predetermined value ranges, the processing module 50 controls the plurality of detection modules 30 to detect the predetermined position P1 again, or correspondingly controls an alert unit to notify the user that the detection has failed instead of detecting the predetermined position P1 again, as needed. If the processing module 50 determines that two of the detection values 501 respectively fall in the first and second predetermined value ranges, and the other detection value 501 does not fall in the first or second predetermined value range, the processing module 50 determines that the detection conducted by the corresponding detection module 30 has failed.

In other words, the processing module 50 determines whether the predetermined position P1 of the wafer shipping box B is provided with the auxiliary member B1 by using the plurality of detection modules 30 to detect the same predetermined position P1. When more than half of the detection modules 30 determine that the predetermined position P1 is provided with the auxiliary member B1, the processing module 50 determines that the predetermined position P1 is provided with the auxiliary member B1; and when more than half of the detection modules 30 determine that the predetermined position P1 is not provided with the auxiliary member B1, the processing module 50 determines that the predetermined position P1 is not provided with the auxiliary member B1; when less than half of the detection modules 30 determine that the predetermined position P1 is provided with or not provided with the auxiliary member B1, the processing module determines that the detection has failed. Therefore, the system for detecting a wafer shipping box of the present disclosure can determine whether the predetermined position P1 of the wafer shipping box B is provided with the auxiliary member B1 even if a part of the detection modules 30 are incapacitated.

In preferred applications, after the processing module 50 receives the detection signals 301 transmitted by the plurality of the detection modules 30

that detect the same predetermined position P1, the processing module 50 standardizes the plurality of detection signals 301, and then converts the plurality of detection signals 301 into the plurality of detection values 501. For example, in the standardization procedure, the processing module 50 converts the plurality of detection signals 301 into a plurality of initial values (V_x) 502, and then converts the initial values (V_x) 502 into the detection values (S) 501 by using a standardization formula according to a first value V1 and a second value V2, and the standardization formula is as follows:

$$\text{detection value} = \frac{\left(\text{initial value} - \frac{\text{first value} + \text{second value}}{2} \right)}{\frac{(\text{first value} - \text{second value})}{2}}$$

The above standardization formula is represented by the following symbols:

$$S = \frac{\left(V_x - \frac{V_1 + V_2}{2} \right)}{\frac{(V_1 - V_2)}{2}}$$

Specifically, the first value V1 may be set by a relevant technician according to the detection signals 301 of the plurality of detection modules 30 received by the processing module 50 when the predetermined position P1 of the wafer shipping box B is provided with the auxiliary member B1; and the second value V2 may be set by the relevant technician according to the detection signals 301 of the plurality of detection modules 30 received by the processing module 50 when the predetermined position P1 of the wafer shipping box B is not provided with the auxiliary member B1.

When the predetermined position P1 of the wafer shipping box B is provided with the auxiliary member B1, after converting the plurality of detection signals 301 into the plurality of initial values (V_x) 502, the processing module 50 converts each of the initial values (V_x) 502 into the detection value (S) 501 by using a standardization formula. If the detection value is 1, the first predetermined value range can be correspondingly set as 0.8 to 1.2. When the

predetermined position P1 of the wafer shipping box B is not provided with the auxiliary member B1, after converting the plurality of detection signals 301 into the plurality of initial values (V_x) 502, the processing module 50 converts each of the initial values 502 into the detection value (S) 501 by using a standardization formula. If the detection value is -1, the second predetermined value range can be correspondingly set as -1.2 to -0.8.

If the processing module 50 calculates the received initial value (V_x) 502 through the above standardization formula and the obtained detection value (S) 501 is between -1.2 and -0.8, the processing module 50 determines the detection result of the predetermined position P1 of the wafer shipping box B as “the predetermined position P1 is not provided with the auxiliary member B1.” If the processing module 50 calculates the received initial value (V_x) 502 through the above standardization formula and the obtained detection value (S) 501 is between 0.8 and 1.2, the processing module 50 determines the detection result of the predetermined position P1 of the wafer shipping box B as “the predetermined position P1 is provided with the auxiliary member B1.”

If the processing module 50 calculates the received initial value (V_x) 502 through the above standardization formula and the obtained detection value (S) 501 is between -0.8 and 0.8, the processing module 50 determines the detection result of the predetermined position P1 of the wafer shipping box B as “detection failure,” which signifies that the detection conducted by the corresponding detection module 30 may fail.

If the processing module 50 calculates the received initial value (V_x) 502 through the above standardization formula and the obtained detection value (S) 501 is less than -1.2 or more than 1.2, the processing module 50 determines the detection result of the predetermined position P1 of the wafer shipping box B as “the first value (V_1) and the second value (V_2) are incorrectly defined,” which signifies that the first value (V_1) and the second value (V_2) may be wrongly defined so as to result in detection failure of the detection module. In this circumstance, the relevant technician can reset the first value (V_1) and the

second value (V2) according to the detection signals 301 of the detection modules 30 received by the processing module 50.

In practice, the processing module 50 may be electrically connected to an information acquisition module 60 and a storage unit 70. The information acquisition module 60 is used to acquire predetermined information B41 stored in an information storage unit B4 of the wafer shipping box B. The information storage unit B4 may be, for example, various electronic tags, chips or labels printed with barcodes that can store data, but is not limited thereto. On the other hand, the information acquisition module 60 may correspondingly be any device that can read electronic labels, chips or labels printed with barcodes. The information acquisition module 60 is used to read the predetermined information B41 stored in the information storage unit B4 to correspondingly generate acquisition information 601. In addition to the predetermined information B41, the acquisition information 601 can further include other relevant information as needed, such as relevant information on reading time and on the information acquisition module.

The predetermined information B41 stored in the information storage unit B4 may be, for example, various information of the wafer shipping box B, especially information on whether each of the predetermined positions P1, P12 and P3 of the wafer shipping box B should be provided with the auxiliary members B1, B2 and B3, and information on the types of the auxiliary members B1, B2 and B3 disposed at each of the predetermined positions P1, P2 and P3.

The storage unit 70 may be an independent information storage unit of the processing module 50 or integrated in the processing module 50. The storage unit 70 may store a plurality of prestored information 701, and each prestored information 701 can be, such as, various types of auxiliary members, the corresponding first predetermined value range, the second predetermined value range, a first value (V1) 7011 and a second value (V2) 7012.

After the processing module 50 receives the acquisition information 601 of the information acquisition module 60, the processing module 50

correspondingly obtains relevant information on whether each of the predetermined positions P1, P2 and P3 should be provided with the auxiliary members B1, B2 and B3 and the types of the auxiliary members B1, B2 and B3. Then, the processing module 50 may search for the corresponding prestored
5 information 701 in the storage units 70 to utilize the corresponding first predetermined value range, the second predetermined value range, the first value (V1) 7011 and the second value (V2) 7012 for performing subsequent detection.

As the plurality of detection modules 30 detect the same predetermined
10 position P1 or P2 of the wafer shipping box B, among the plurality of detection values 501 correspondingly generated by the processing module 50, if more than half of the detection values 501 do not fall in the first predetermined value range or the second predetermined value range, the processing module 50 may control the plurality of detection modules 30 to detect again. When the above
15 issue still occurs after the processing module 50 repeatedly controls the plurality of detection modules 30 to detect, the processing module 50 controls related alert units (such as a warning light or a warning sound emitter) to remind the user that the detection module 30 may be damaged or the settings of the first predetermined value range, the second predetermined value range, the
20 first value (V1) 7011 and the second value (V2) 7012 may be erroneous (for example, the wrong prestored information 701 is stored in the storage unit 70 and the wrong prestored information B41 is stored in the information storage unit B4 of the wafer shipping box B). The manner of cooperation between the processing module 50 and the plurality of auxiliary detection modules 40 is the
25 same as that between the aforementioned processing module 50 and the detection module 30, namely that the processing module 50 is electrically connected to the plurality of auxiliary detection modules 40 to receive the detection signals 401 correspondingly generated from each of the auxiliary detection modules 40 detecting the top surface predetermined position P3 of the
30 wafer shipping box B, to determine whether the predetermined position P3 of

the wafer shipping box B is provided with the auxiliary member B3.

FIG. 8 is a schematic view of the system for detecting a wafer shipping box according to another embodiment of the present disclosure. Hereinafter, only the main differences between this embodiment and the aforementioned embodiment will be described, while similar features will be omitted herein. Referring to FIG. 8, the main difference between this embodiment and the aforementioned embodiment is that, the three receiving units 31 included in the three detection modules 30 used to detect the right side predetermined position P1 of the wafer shipping box B may be arranged side by side along an X-axis direction and spaced apart from each other, and the three transmitting units 32 included in the three detection modules 30 may be arranged side by side along a Y-axis direction and spaced apart from each other. That is, the three receiving units 31 and three transmitting units 32 may be respectively arranged side by side along two axes substantially perpendicular to each other, thereby allowing the detection modules 30 to have a larger detection range. In different applications, the three receiving units 31 and the three transmitting units 32 may be arranged side by side respectively along the Y-axis direction and the X-axis direction, and is not limited in the embodiment shown in FIG. 8. The number of receiving units 31 and transmitting units 32 is not limited to that shown in FIG. 8, and the numbers of receiving units 31 and transmitting units 32 are not limited to being the same. Only three of the detection modules 30 are shown in FIG. 8 to detect the right side predetermined position P1 of the wafer shipping box B, but is not limited thereto. The receiving unit 31 and the transmitting unit 32 included in the detection module 30 to detect the left side predetermined position P2 of the wafer shipping box B can be arranged in the manner shown in FIG. 8.

FIG. 9 is a flow chart of a method for detecting a wafer shipping box according to the present disclosure. The method for detecting a wafer shipping box is used to detect at least one predetermined position of a wafer shipping box. The predetermined position is used to be provided with an auxiliary

member (such as the aforementioned handle structures or the related buckling structures). The method for detecting a wafer shipping box includes the following steps.

5 A detecting step S1: using a plurality of detection modules to detect a predetermined position, and using a processing module to convert the detection results from the detection modules into a plurality of detection values; wherein, detection ranges of two detection modules disposed adjacent to each other are partially overlapped; and

10 A determining step S2: according to the plurality of detection values, using the processing module to determine whether the predetermined position of the wafer shipping box is provided with the auxiliary member; wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is
15 provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.

20 In practice, in the above determining step S2, when the processing module determines that more than half of the detection values do not fall in the first and second predetermined value ranges, the processing module determines that the detection has failed, and the processing module may control the plurality of detection modules to execute the detecting step S1 again. Otherwise, the processing module does not execute the detecting step S1 again
25 but correspondingly controls an alert unit to notify the user that the detection has failed. When the processing module determines that more than half of the detection values do not fall in the first or second predetermined value range after repeatedly controlling the detection modules to execute the detecting step S1, the processing module may determine that at least one detection module
30 may have malfunctioned, and then correspondingly controls the related alert

unit as needed to warn the user that there may be a problem with the detection modules.

In preferred applications, in the above detecting step S1, during the process of converting the detection results of the plurality of detection modules into the plurality of detection values, the processing module may standardize the plurality of detection results of detection modules to be converted into the plurality of the detection values. The standardization procedure is the same as that in the above embodiment, and will be omitted therein for the sake of brevity.

FIG. 10 is a schematic view of the method for detecting a wafer shipping box according to the present disclosure. In FIG. 10, the difference between the method for detecting a wafer shipping box in this embodiment and the method for detecting a wafer box in the aforementioned embodiment is that, the following step may be further included before the detecting step S1 is executed.

An information acquisition step S10: using an information acquisition module to acquire predetermined information of the wafer shipping box; in the detecting step S2, determining whether the predetermined position of the wafer shipping box is provided with the auxiliary member by the processing module. The manner of processing the related information of the information acquisition module and the processing module is the same as that in the embodiment of the detection system of the aforementioned wafer shipping box, and will be omitted herein for the sake of brevity.

It should be noted that, the embodiments of the detection methods of the two aforementioned wafer shipping boxes may be preferably executed by the detection system of the aforementioned wafer shipping box, but is not limited thereto.

The foregoing description of the exemplary embodiments of the disclosure has been presented only for the purposes of illustration and description and is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Many modifications and variations are possible in

light of the above teaching.

The embodiments were chosen and described in order to explain the principles of the disclosure and their practical application so as to enable others skilled in the art to utilize the disclosure and various embodiments and with
5 various modifications as are suited to the particular use contemplated. Alternative embodiments will become apparent to those skilled in the art to which the present disclosure pertains without departing from its spirit and scope.

CLAIMS

What is claimed is:

1. A method for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box, the predetermined position being used to be disposed with an auxiliary member, the method comprising:
 - a detecting step: using a plurality of detection modules to detect the predetermined position, and using a processing module to convert the detection results from the detection modules into a plurality of detection values; wherein, detection ranges of two detection modules disposed adjacent to each other are partially overlapped; and
 - a determining step: according to the plurality of detection values, using the processing module to determine whether the predetermined position of the wafer shipping box is provided with the auxiliary member; wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.
2. The method according to claim 1, wherein, in the determining step, when the processing module determines that more than half of the detection values do not fall in the first and second predetermined value ranges, the processing module determines that the detection has failed, and the processing module selectively controls the plurality of detection modules to execute the detecting step again.

3. The method according to claim 1, wherein, in the detecting step, after detecting the predetermined position, the plurality of detection modules correspondingly generate a plurality of detection signals; after receiving the plurality of detection signals, the processing module standardizes the plurality of detection signals to convert the plurality of detection signals into the plurality of the detection values.
4. The method according to claim 3, wherein, in the standardization, the processing module converts the plurality of detection signals into a plurality of initial values, and then converts the initial values into the detection values by using a standardization formula according to a first value and a second value, and the standardization formula is as follows:

$$\text{detection value} = \frac{\left(\text{initial value} - \frac{\text{first value} + \text{second value}}{2} \right)}{\frac{(\text{first value} - \text{second value})}{2}}$$

5. The method according to claim 1, wherein, an information acquisition step is further included before the detecting step, and the information acquisition step includes: using an information acquisition module to acquire predetermined information of the wafer shipping box; in the detecting step, determining whether the predetermined position of the wafer shipping box is provided with the auxiliary member by the processing module according to the predetermined information and the plurality of detection values.
6. A system for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box, the predetermined position being used to be disposed with an auxiliary member, the system comprising:

a platform used to carry the wafer shipping box;

a plurality of detection modules separately detecting the predetermined position, wherein detection ranges of two detection modules disposed adjacent to each other are partially overlapped;

a processing module electrically connected to the plurality of the detection modules, converting the detection results from the plurality of detection modules into a plurality of detection values, and determining whether the predetermined position of the wafer shipping box is provided with the auxiliary member according to the plurality of detection values;

wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.

7. The system according to claim 6, wherein when the processing module determines that more than half of the detection values do not fall in the first and second predetermined value ranges, the processing module determines that the detection of at least one detection module has failed, and the processing module selectively controls the plurality of detection modules to detect the predetermined position again.
8. The system according to claim 6, wherein the system further includes a plurality of auxiliary detection modules, each being electrically connected to the processing module and detecting another predetermined position of the wafer shipping box; the

processing module determines whether another predetermined position of the wafer shipping box is provided with the auxiliary member according to the detection results from each of the auxiliary detection modules.

9. The system according to claim 8, wherein the detection system of the wafer shipping box further includes an information acquisition module acquiring predetermined information to correspondingly generate acquisition information, the information acquisition module is electrically connected to the processing module, and the processing module receives the acquisition information and determines whether the predetermined position is provided with the auxiliary member according to the acquisition information and the detection results of predetermined position from the plurality of the detection modules.
10. The system according to claim 9, wherein, according to the acquisition information, the processing module searches for a plurality of prestored information stored in a storage unit, and the processing module determines whether the predetermined position is provided with the auxiliary member according to one of the prestored information and the detection results of the predetermined position from the plurality of detection modules.
11. The system according to claim 6, wherein after the plurality of detection modules detect the predetermined position, a plurality of detection signals are correspondingly generated; after receiving the plurality of detection signals, the processing module standardizes the plurality of detection signals to convert the plurality of detection signals into the plurality of the detection values.
12. The system according to claim 11, wherein in the standardization, the processing module converts the plurality of detection signals into a plurality of initial values, and then converts the initial values

into the detection values by using a standardization formula according to a first value and a second value, and the standardization formula is as follows:

$$\text{detection value} = \frac{\left(\text{initial value} - \frac{\text{first value} + \text{second value}}{2} \right)}{\frac{(\text{first value} - \text{second value})}{2}}$$

13. The system according to claim 6, wherein each of the detection modules includes a plurality of transmitting units and a plurality of receiving units, the plurality of transmitting units are disposed on the platform, and the plurality of receiving units are correspondingly located above the predetermined position, the plurality of receiving units are used to receive light beams emitted from the transmitting units; wherein, the plurality of transmitting units are arranged side by side along an axis and spaced apart from each other, and the plurality of receiving units are arranged side by side along another axis and spaced apart from each other.
14. A method for detecting a wafer shipping box, used to detect at least one predetermined position of a wafer shipping box, the predetermined position being used to be disposed with an auxiliary member, the method comprising:

providing a system for detecting the wafer shipping box of claim 7;

using the processing module to control the plurality of detection modules to detect the predetermined position, and using the processing module to convert the detection results from the detection modules into a plurality of detection values; and

according to the plurality of detection values, using the processing module to determine whether the predetermined position of the wafer shipping box is provided with the auxiliary

member; wherein, when the processing module determines that more than half of the detection values fall in a first predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is provided with the auxiliary member; when the processing module determines that more than half of the detection values fall in a second predetermined value range, the processing module determines that the predetermined position of the wafer shipping box is not provided with the auxiliary member.