

SYSTEM FOR SPRAYING A WALL SURFACE OF A BUILDING
AND METHOD THEREFOR

Technical Field

[0001] The present disclosure relates to a robotically-operated painting and
5 cleaning system. More particularly, the present disclosure relates to a robotically-
operated spraying system that can be used for spraying wall surface of a building
for purpose of painting and/or cleaning.

Background

[0002] It is well known in the art to use a moveable carrier suspended by cables
10 from atop a building for painting and cleaning an wall of the building. In some
cases, these moveable carriers may be sized large enough to accommodate painters
and/or cleaner therein who would then set up to manually paint the wall of the
building. With use of such large-sized carriers, structures required to support the
carriers would need to be sturdy enough to withstand the weight of the carrier in
15 operation besides minimizing the tendency of the carrier to sway under the
undesired effect of wind forces. An example of a sturdy mechanism for suspending
such large sized carriers is disclosed in U.S. Patent 3,347,339.

[0003] Nevertheless, in recent times, a size of these moveable carriers has been
reduced with implementation of automated robotic mechanisms that are capable of
20 performing the painting and cleaning operations. However, with incorporation of
such automated robotic mechanisms, it would only be prudent to additionally
render these moveable carriers with enhanced structural and performance
capabilities that would facilitate movement of the carriers and the automated
robotic mechanisms disposed within to traverse the span of the wall surfaces in an
25 optimal or efficient manner and carry out the operations synergistically.

[0004] Hence, there is a need for a simple and compact robotically-operated
painting system that is designed to efficiently perform spray painting or cleaing
over walls surface of a building in a fairly quick and easy manner.

Summary

[0005] In an aspect of the present invention, there is provided an automated system for spraying an wall of a building, the system comprises a carrier; a robotic mechanism mounted on the carrier, the robotic mechanism further having an end effector adapted to support a spray nozzle thereon, a visual monitoring system configured to scan structural characteristics and profiles of the wall, a computing device disposed in communication with the visual monitoring system and the robotic mechanism, wherein the computing device is configured to receive the scanned structural characteristics and profile of the wall from the visual monitoring system; and a controller communicably coupled to the computing device, the controller configured to independently control operation of respective ones of the robotic mechanism, and the spray nozzle according to the scanned structural characteristics and profiles of the wall.

[0006] In one embodiment, the carrier is a aerial work platform.

[0007] In one aspect, the carrier comprises a boom lift.

[0008] In one embodiment, the system may further comprise a linear track located on the carrier and disposed hozizontally with respect to the heigh of the building, wherein the robotic mechanism is slidably mounted on the linear track.

[0009] In another embodiment, the system may comprises a two ways tracks disposed on the carrier, wherein the robotic mechanism is slidably mounted thereon, the two ways tracks comprises at least two axes movements allowing the robotic mechanism to slide over the two axes movements.

[0010] In another aspect, the carrier comprises a sciccor lift.

[0011] In one embodiment, the system may comprise a linear track located on the carrier and disposed hozizontally with respect to the heigh of the building, wherein the robotic mechanism is slidably mounted on the linear track.

[0012] In yet another embodiment, the system may comprising a two ways tracks disposed on the carrier, wherein the robotic mechanism is slidably mounted thereon, the two ways tracks comprises at least two axes movements allowing the robotic mechanism to slide over the two axes movements.

[0013] In yet a further aspect, the automoated system comprises a gondola carrier mounted on a building, wherein the gondola carrier comprises at least

suction cups located at a free end of each linear actuator and disposed in an opposing relation to the wall of the building, wherein the suction cups are configured to selectively adhere with the wall of the building for positioning the gondola carrier.

5 **[0014]** In one embodiment, the system may further comprises a stabilizer platform disposed below the carrier, and moveably connecting to the carrier through a connecting bar, and a drive system adapted to operatively position the stabilizer platform relative to the carrier along the connecting bar; and a secondary suction mechanism installed on the stabilizer platform, wherein the secondary suction mechanism is separately controlled to adheres to the wall of the building. 10 Operationally when the stabilizer platform is moving in relation to the carrier, at least either one of the suction cups or the secondary suction mechanism is adhered to the wall of the building.

15 **[0015]** In another embodiment, the system further comprises a linear track located on the carrier and disposed hozizontally with respect to the heigh of the building, wherein the robotic mechanism is slidably mounted on the linear track.

20 **[0016]** In yet another embodiment, the system may comprise a two ways tracks disposed on the carrier, wherein the robotic mechanism is slidably mounted thereon, the two ways tracks comprises at least two axes movements allowing the robotic mechanism to slide over the two axes movements.

[0017] Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

Brief Description of the Drawings

25 **[0018]** **FIG. 1** is a perspective view of a system for painting an wall of a building, in accordance with embodiments of the present invention;

[0019] **FIG. 2** is a schematic representation of components of the system from **FIG. 1**, in accordance with an embodiment of the present invention;

30 **[0020]** **FIG. 3** is a schematic representation of various modules of a computing device associated with the system of **FIG. 1**, in accordance with an embodiment of the present disclosure;

- [0021] FIG. 4 is a perspective view of the system mounted on a gondola carrier according to another embodiment of the present invention
- [0022] FIG. 5 is a perspective view of the system mounted on a scissor lift according to one embodiment of the present invention;
- 5 [0023] FIG. 6 is a perspective view of the system mounted on a boom lift according to another embodiment of the present invention; and
- [0024] FIG. 7 is a perspective view of a two track system adapted for slidable mounting a robotic mechanism in accordance with an embodiment of the present invention.

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Detailed Description

- [0025] Wherever possible, the same reference numbers will be used throughout the drawings to refer to same or like parts. Moreover, references to various elements described herein are made collectively or individually when there may be more than one element of the same type. However, such references are
- 15 merely exemplary in nature. It may be noted that any reference to elements in the singular may also be construed to relate to the plural and *vice-versa* without limiting the scope of the disclosure to the exact number or type of such elements unless set forth explicitly in the appended claims.

- [0026] FIG. 1 illustrates a system 100 for spraying an wall 202 of a building 200 in accordance with an embodiment of the present invention. The system 100 includes a pair of rails 102, 104 disposed on an upper portion 204 of the building 200. A first one of the rails 102 is configured to slidably support movement of at least one frame member 106 thereon. In an example, two frame members 106 are shown in the illustrated embodiment of FIG. 1. However, it may be noted that
- 25 fewer or more frame members 106 may be implemented depending on specific requirements of an application including, but not limited to, a structural integrity of the frame member that is required to perform functions consistent with the present disclosure.

- [0027] For avoidance of doubt, the system 100 adapts a spraying mean, which
- 30 can be used for spraying paints and/or clean water for cleaning wall surface.

[0028] The frame member **106** has a primary motor **108** mounted thereto for facilitating lateral movement of the frame member **106** along a length **L** of the first one of the rails **102**. The system **100** also includes a carrier **110** suspended from the frame member **106** by cables **112** that are supported on pulleys **114** associated with the frame member **106**. In an embodiment as shown in **FIG. 1**, each frame member **106** includes a free end **116** that is engaged with a second one of the rails **104**. The free end **116** of each frame member **106** is associated with a pre-determined weight **118** to counterbalance a weight of the carrier **110**. Also, the system **100** further includes a tow line **120** connecting the carrier **110** to a ground surface **122**. The tow line **120** is configured to stabilize a position of the carrier **110** in relation to the wall **202**.

[0029] In one embodiment, the carrier **110** can be a gondola carrier.

[0030] In a further embodiment as shown in **FIG. 1**, the system **100** additionally includes at least one wheel **124** disposed on the carrier **110** and located in an opposing relation to the wall **202**. The wheel **124** is configured to assist when the carrier is maneuvering by the wall **202**.

[0031] The carrier **110** is adapted to accommodate a secondary motor **126**, a visual monitoring system **128**, a robotic mechanism **130**, a computing device **132**, and a controller **134** therein. The secondary motor **126** is engaged with the cables **112** to facilitate movement of the carrier **110** in a direction **D** parallel to a height **H** of the wall **202**.

[0032] The visual monitoring system **128** is configured to scan structural characteristics and profiles of the wall **202** through digital imaging techniques. In one embodiment, the visual monitoring system **128** may include a 3-dimensional camera. In another embodiment, the visual monitoring system **128** may include a 3-dimensional laser scanner.

[0033] The robotic mechanism **130** has an end effector **136** that is adapted to support a spray nozzle **138** thereon. In an embodiment of this disclosure, the robotic mechanism **130** has six degrees of freedom in movement for facilitating the spray nozzle **138** in spraying the wall **202** of the building **200**.

[0034] **FIG. 2** illustrates a schematic representation of components of the system **100** from **FIG. 1**. As shown in **FIG. 2**, the computing device **132** is

disposed in communication with the visual monitoring system **128**, the primary motor **108**, the secondary motor **126**, the robotic mechanism **130**, and the spray nozzle **138**. The computing device **132** is configured to receive the scanned structural characteristics of the wall **202** from the visual monitoring system **128**.

5 The controller **134** is communicably coupled to the computing device **132** and is configured to independently control operation of respective ones of the primary motor **108**, the secondary motor **126**, the robotic mechanism **130**, and the spray nozzle **138** in response to the sensed structural characteristics and profile of the wall **202**.

10 **[0035]** In an additional embodiment as shown in **FIG. 1**, the system **100** also includes multiple linear actuators **140**. Each of the linear actuators **140** is slidably engaged with the carrier **110**. The system **100** also includes a suction cup **142** located at a free end **144** of each linear actuator **140** and disposed in an opposing relation to the wall **202** of the building **200**. The suction cups **142** are

15 configured to selectively adhere with the wall **202** of the building **200** for positioning the carrier **110**.

[0036] In an embodiment, at least one of the sensed structural characteristics of the wall **202** includes a distance between each suction cup **142** and the wall **202**. As shown in **FIG. 2**, the system **100** further includes ultrasonic

20 sensors **146**, disposed on the carrier on two sides, associated with each of the linear actuators **140** shown in **FIG. 1**. Each of the ultrasonic sensors **146** is configured to output a distance of the associated suction cup **142** relative to the wall **202**, to the computing device **132** which in turn provides such outputs to the controller **134**. Accordingly, the controller **134** is configured to selectively and

25 independently actuate movement of each of the plurality of linear actuators **140** until respective ones of the suction cups **142** adhere with the wall **202** of the building **200**.

[0037] In the case where the system **100** is adapted for spray painting, in an embodiment, a paint container **148** is disposed within the carrier **110**. Further,

30 as shown in **FIG. 2**, the system **100** includes a sensor **150** that is disposed in communication with the paint container **148** and the computing device **132**. The

sensor **150** is configured to output a level of paint remnant in the paint container **148** to the computing device **132**.

[0038] In the case where the system **100** is adapted for spray cleaning through high speed water jet, the spray nozzle may be connected directly to a water source through water hose. A person skilled in the art would appreciate that the system may require a stronger pump and/or nozzle may be required for cleaning purposes. The carrier can also include a container for loading liquid detergent to aid in the cleaning process.

[0039] Additionally or optionally, as shown in **FIG. 1**, the system **100** further includes a hood **152** be disposed around the spray nozzle **138** as shown in the illustrated embodiment of **FIG. 1**. The hood **152** is configured to contain sprayed liquid that escapes from being sprayed onto the wall **202**.

[0040] In a further embodiment, the hood can be any overhead covering means disposed at on the front end of the spraying tip for assisting in isolate overspray and fumes of the sprayed liquid. It is well understood to a skilled person that there can be many forms of geomatry applicable to the hood. In yet a further embodiment, the hood can be adapted with barn doors.

[0041] In another embodiment, the computing device **132** may be remotely controllable with the help of a remote controller **158** shown in **FIG. 2**. It is envisioned that with use of the remote controller **158**, any function pertaining to individual components of the system **100** can be controlled wirelessly by a remotely located operator via the remote controller **158**. Therefore, it may be noted that although the system **100** of the present disclosure is configured to operate autonomously with the help of data from the ultrasonic sensors **146**, the paint level sensor **150**, and the visual monitoring camera, embodiments of the present disclosure also allow an operator of the system **100** to remotely override any operations and provide alternative commands to the computing device **132** with the help of the remote controller **158** so that the computing device **132** may appropriately control one or more components of the system **100** in accordance with the alternative commands provided by the operator.

[0042] Referring to **FIG. 3** and as disclosed earlier herein, the computing device **132** is communicably coupled to each of the controller **134**, the primary

motor **108**, the secondary motor **126**, the inclinometer device **162**, the visual monitoring system **128**, the ultrasonic sensor **146**, each of the linear actuators **140**, a valve mechanism **154** shown in **FIG. 1** as being associated with the spray nozzle **138**, and the robotic mechanism **130**.

5 **[0043]** Moreover, as shown in **FIG. 3**, the computing device **132** is developed on a robotically-operated software (ROS) platform that is configured to include a carrier positioning module **302**, a spraying module **304**, a vision module **306**, a motion module **308**, and a graphical user interface (GUI) module **310**. Further, the computing device **132** on which the ROS platform resides would also
10 be configured to include a program manager module **312** that is disposed in communication with each of the carrier positioning module **302**, the spraying module **304**, the vision module **306**, the motion module **308**, and the GUI module **310**.

[0044] As such, it may be understood that the carrier positioning module
15 **302** may be disposed in communication with the controller **134**, the primary motor **108**, the secondary motor **126**, and each of the linear actuators **140**. The carrier positioning module **302** may also be disposed in communication with one or more sensors disclosed herein, for example, the inclinometer device **162**, the ultrasonic sensors **146**, and the like, that are associated with operation of one or more of the
20 primary motor **108**, the secondary motor **126**, and each of the linear actuators **140**. The carrier positioning module **302** therefore, may be configured to receive data from such sensors to help the program manager module **312** in accomplishing the positioning of the carrier **110** appropriately with respect to the wall **202** of the building **200**.

25 **[0045]** Further in the case of spray painting, the spraying module **304** may be disposed in communication with the liquid level sensor **150** and the valve mechanism **154** of the spray nozzle **138**. The spraying module **304** may receive data from the liquid level sensor **150** transmit such data and/or feedback to the program manager module **312** for determining the level of paint remnant in the
30 container **148** and for operating the valve mechanism **154** of the spray nozzle **138** to spray on the wall **202** of the building **200**.

[0046] Furthermore, the vision module **306** would be disposed in communication with the visual monitoring system **128**. The vision module **306** can receive data including the sensed structural characteristics of the wall **202** from the visual monitoring system **128** and provide the same to the program manager module **312**. This data could help the program manager module **312** to independently control a movement of each of the linear actuators **140** and adhere the suction cups **142** on the wall **202** of the building **200** for stabilizing a position of the carrier **110**.

[0047] Still further, the motion module **308** may be disposed in communication with the robotic mechanism **130**, and particularly with the end effector **136** of the robotic mechanism **130**. The motion module **308** may receive feedback from the robotic mechanism **130** and send such feedback to the program manager module **312** so that the program manager module **312** can plan a trajectory for movement of the end effector **136** of the robotic mechanism **130** so that spraying can be commenced on the wall **202** of the building **200** upon stabilizing the position of the carrier **110**.

[0048] It is to be noted that the modules **302-312** explained in the foregoing disclosure is non-limiting of this disclosure. Rather, other types of modules may be, additionally or optionally, implemented in addition to or in lieu of the positioning module **302**, the vision module **306**, the spraying module **304**, the motion module **308**, and the GUI module **310** to co-operate with the program manager module **312** without deviating from the spirit of the present disclosure as will be evident from the explanation pertaining to the working of the system **100** which will be made in detail hereinafter.

[0049] In an alternative embodiment to the system **100** depicted in **FIG. 1**, the system **100** may, as shown in **FIG. 4**, additionally, or optionally, include a stabilizer platform **1102** that may be disposed below the carrier **110** and moveably connecting to the carrier **110** through a connecting bar **1111**. The stabilizer platform **164** may include therein, a drive system that is moveably engaged to the connecting bar **1111**, and at least one secondary suction mechanism **1106** that is similar to or different from the suction cup **142** of the carrier **110**. The drive system **1104** may be commanded to operatively position the stabilizer platform **1102**

relative to the carrier **110**. Additionally, the secondary suction mechanism **1106** could also be commanded for adhering with the wall **202** of the building **200**. When the secondary suction mechanism **1106** adheres to the wall **202** of the building **200**, the secondary suction mechanism **1106** provides added resistance to the carrier **110** from swinging into or away from the wall **202** of the building **200**.

[0050] During operation, it is envisioned that if the carrier **110** is to be moved *e.g.*, downward along the height **H** of the building **200**, then the secondary suction mechanism **1106** is first released from adherence with the wall **202** and thereafter, the drive system **1104** is commanded to operably move the stabilizer platform **1102** downward along the height **H** of the building **200**. Once the stabilizer platform **1102** is moved to a predetermined or anticipated position in relation to a position at which the carrier **110** needs to be subsequently moved into, the secondary suction mechanism **1106** would be commanded to adhere with the wall **202** of the building **200** before commanding the secondary motor **126** to move the carrier **110** into its subsequent position. Therefore, in this embodiment, it may be noted that at any given instant of time, either the secondary suction mechanism **1106** associated with the stabilizer platform **1102** or the suction cups **142** from the carrier **110** are in adherence with the wall **202** of the building **200**. As the carrier **110** and the stabilizer platform **1102** connected through the connecting bar **1111** and are also disposed on the same set of cables **112**, forces, for example, undesired forces associated with wind, that could otherwise displace the carrier **110** are mitigated by the adherence of the secondary suction mechanism **1106** and/or the suction cups **142** and in this way, the gondola carrier **110** could be resisted from swinging into or away from the wall **202** of the building **200** while it is “crawling” along the vertical wall **202**.

[0051] Also, as shown in the illustrated alternative embodiment of the system **100** in **FIG. 4**, the system **100** may further include a linear track **1108** located above the carrier **110** and disposed horizontally with respect to the height **H** of the building **200**. A length **L1** of the linear track **1108** may be selected such that the linear track **1108** would be configured to extend at least up to a width **W** of the carrier **110**. The robotic mechanism **130** may be slidably disposed on this linear track **1108**, and in operation, the robotic mechanism **130** may be commanded

to traverse the length **L1** of the linear track **1108** so as to be axially displaceable in position. The linear track **1108** can offer a greater range of movement to the robotic mechanism **130** as it allows the robotic mechanism **130** to be positioned at any desired point along the length **L1** of the linear track **1108**. This way, when spraying operation is in process, a reach of the end effector **136** may be enhanced to cover a greater surface area of the wall **202** in a single pass of the carrier **110**. Also, with greater reach of the end effector **136**, a number of times for which the frame **106** would otherwise need to be moved along the rail **102** can be potentially minimized to reduce an overall cycle time associated with re-positioning the carrier **110** for spraying the wall **202** of the building **200**.

[0052] Referring to other alternative embodiments depicted in **FIGs. 5** and **6**, the carrier **110** may be a scissor lift arrangement **1202** as shown in **FIG. 5** or a boom lift arrangement **1302** as shown in **FIG. 6** respectively. The scissor or boom lift arrangements **1202/1302** can be used in lieu of the cables **112** and the secondary motor arrangement **126** to operably vary a height to which the carrier **110** is moved in relation to the ground surface **122**. In fact, the scissor lift arrangement **1202** and the boom lift arrangement **1302** may allow the gondola carrier **110** to not only be used in accomplishing a spraying of the wall **202** of the building **200** (shown in **FIG. 1**) but also in spraying an interior wall **206** of the building **200**.

[0053] It is understood to a skilled person that the system **100** in accordance with the present invention is adapted for mounting on any aerial device, such aerial work platform, elevating work platform or the like.

[0054] In yet a further embodiment of the present invention as shown in **FIG. 7**, the robotic mechanism **130** is mounted on a two-ways track system **1400** allowing the robotic mechanism **130** be moving in at two axes directions, i.e. both longitudinal and lateral directions. As shown, the two-ways tack system **1400** comprises a lateral track **1402** slidably attached on a longitudinal track **1404**. The robotic mechanism **130** is slidably mounted on the lateral track **1402** allowing the robotic mechanism **130** be moving along the length of the track, while similarly, the lateral track **1402** that mounted on the longitudinal track **1404** allows the robotic mechanism **130** movable along the length of the longitudinal track **1404**.

Accordingly, the two-ways track system **1400** extends the movability of the robotic mechanism **130** on the vehicle (including gondola) on which it is mounted.

[0055] In another embodiment, the two-ways track system **1400** can be adapted as a H shape track having a longitudinal track disposed between two lateral tracks. The two way track system **1400** can be mounted on any vehicles, such as
5 gondola, boom lift, scissor lift or the like.

[0056] With the various configurations offered by the embodiments of the present invention, it is well understood to a skilled person that spray system can be used for external wall as well as internal wall when it is mounted on a suitable
10 vehicle. By replacing the nozzle head with inspection means, the present system can also be used to automate wall inspections.

[0057] Various embodiments disclosed herein are to be taken in the illustrative and explanatory sense, and should in no way be construed as limiting of the present disclosure. All directional references (*e.g.*, top, bottom, above, below, lower) are only used for identification purposes to aid the reader's
15 understanding of the present disclosure, and may not create limitations, particularly as to the position, orientation, or use of the system and/or method disclosed herein. Moreover, all joinder references (*e.g.*, attached, affixed, joined, adhere, associated, connected, and the like) are only used to aid the reader's understanding of the
20 present disclosure, and may not create limitations, particularly as to the position, orientation, or use of the system and/or method disclosed herein. Therefore, joinder references, if any, are to be construed broadly. Moreover, such joinder references do not necessarily infer that two elements are directly connected to each other.

[0058] Additionally, all numerical terms, such as, but not limited to, “primary”, “secondary”, “first”, “second”, “third” or any other ordinary and/or numerical terms, should also be taken only as identifiers, to assist the reader’s understanding of the various elements, embodiments, variations and/ or modifications of the present disclosure, and may not create any limitations,
25 particularly as to the order, or preference, of any element, embodiment, variation and/or modification relative to, or over, another element, embodiment, variation and/or modification.
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[0059] It is to be understood that individual features shown or described for one embodiment may be combined with individual features shown or described for another embodiment. The above described implementation does not in any way limit the scope of the present disclosure. Therefore, it is to be understood although
5 some features are shown or described to illustrate the use of the present disclosure in the context of functional components, such features may be omitted from the scope of the present disclosure without departing from the spirit of the present disclosure as defined in the appended claims.

[0060] Embodiments of the present disclosure have applicability for use
10 and implementation in painting and cleaning walls **202** of a building **200**. As the system **100** of the present disclosure is provided with the robotic mechanism **130**, the robotic mechanism **130** can be advantageously automated with capabilities to perform the required operations on the wall **202** of the building **200**, with minimal or no human interactions. Moreover, with use of the embodiments disclosed
15 herein, it would be easy and quick to shuttle the carrier **110** of the present disclosure in comparison to traditional designs.

[0061] Hence, use of the system **100** disclosed herein for spray painting or cleaning the walls of a building may advantageously save time, costs, labours and effort that were typically incurred with manual painting and cleaning of the walls
20 by personnel disposed within a traditionally designed carrier or vehicles.

[0062] While aspects of the present disclosure have been particularly shown and described with reference to the embodiments above, it will be understood by those skilled in the art that various additional embodiments may be contemplated by the modification of the disclosed machines, systems and methods
25 without departing from the spirit and scope of what is disclosed. Such embodiments should be understood to fall within the scope of the present disclosure as determined based upon the claims and any equivalents thereof.

Claims

What is claimed is:

1. An automated system for spraying an wall of a building, the system
5 comprising:
 - a linear track;
 - a robotic mechanism slidably mounted on the linear track, the
robotic mechanism further having an end effector adapted to support a
spray nozzle thereon, wherein the linear track is disposed horizontally
10 with respect to the height of the building;
 - a visual monitoring system configured to scan structural
characteristics and profiles of the wall;
 - a computing device disposed in communication with the visual
monitoring system and the robotic mechanism, wherein the computing
15 device is configured to receive the scanned structural characteristics and
profile of the wall from the visual monitoring system; and
 - a controller communicably coupled to the computing device, the
controller configured to independently control operation of respective
ones of the robotic mechanism, and the spray nozzle according to the
20 scanned structural characteristics and profiles of the wall.
2. The system of claim 1, wherein the linear track is mounted on a aerial
work platform.
- 25 3. The system of claim 1, wherein the linear track is mounted on a boom lift.
4. The system of claim 1, wherein the linear track is mounted on a scissor
lift.
- 30 5. The system of claim 1, wherein the linear track is a two-way track
comprises at least two axes movements allowing the robotic mechanism
to slide over the two axes movements.

6. The system of claim 1, wherein the two-way track comprises a second linear track slidably mounted on a first linear track, and the robotic mechanism is slidably mounted on the second linear track, such that the robotic mechanism is slidable over the two axes movement.
7. The system of claim 1, wherein the linear track is mounted on a gondola installed on a building, wherein the gondola comprises at least suction cups located at a free end of each linear actuator and disposed in an opposing relation to the wall of the building, wherein the suction cups are configured to selectively adhere with the wall of the building for positioning the gondola.
8. The system of claim 7, further comprises
- a stabilizer platform disposed below the gondola, and moveably connecting to the gondola through a connecting bar, and a drive system adapted to operatively position the stabilizer platform relative to the gondola along the connecting bar; and
- a secondary suction mechanism installed on the stabilizer platform, wherein the secondary suction mechanism is separately controlled to adheres to the wall of the building,
- wherein operationally when the stabilizer platform is moving in relation to the gondola, at least either one of the suction cups or the secondary suction mechanism is adhered to the wall of the building.