Method for cleaning the external walls of a building with a lightweight six axis robotic arm coupled with a 3D camera, and a spray nozzle on its red effector; and mounted on a mini-gondola with the mini-gondola hoisted by a motor-drive pulley system traversing along a set of of twin-rails located on the roof-top of the building

DESCRIPTION

A lightweight six-axis robotic arm (2 in Figure 1) is adopted to wash and clean the external walls of a building with a high pressure water spray nozzle (1 in Figure 1) mounted on the robotic arm's end-effector to spray the water onto the wall. The robotic arm is mounted on a mini-gondola (10 in Diagram) and hoisted by a pulley system with the controlling motor (9 in Figure 1) located within the mini-gondola, while another set of motor located on the pulley system (11 in Figure 1) at the roof-top end drives the mini-gondola to traverse laterally on a set of twin-rails on the roof-top of the building. The pulley system raises and lowers the mini-gondola in parallel to the external wall of the building to be cleaned, spraying water onto the wall in a vertical manner from top to bottom, column by column.

1. The lightweight six-axis robotic arm (2 in Figure 1)

The six-axis robotic arm is to be lightweight, and is coupled with a 3D camera and a spray nozzle (high pressure water spray) on its end effector. The 3D camera mounted on the robotic arm scans the wall area (approximately 1.2m by 1.2m) to be cleaned; a software program will then calculate the trajectory of the water spraying motion for the robotic-arm to carrying out the water spraying action.

The robotic arm is controlled (through a RS422 cable, TCP/IP) by an industrial PC (personal computer) (5 in Figure 1) mounted within the mini-gondola.

2. Adoption of mini-gondola (10 in Figure 1)

A specially designed mini-gondola, hoisted by a motor-driven pulley system with the controlling motor of the pulley system within the mini-gondola, is used to seat/house the robotic arm to carry out the cleaning of the external wall of a building. Four vacuum suction cups (7 in Figure 1) mounted on the mini-gondola helps to secure the mini-gondola to the wall when the mini-gondola/robotic arm makes a 'stop' for the cleaning process to be conducted. To have further securing of the mini-gondola - prevention of swaying motion - a tow line attached to the mini-gondola is used to secure the mini-gondola to the ground.

An onboard controller (4 in Figure 1) mounted on the mini-gondola manages and controls the distance between the mini-gondola and the wall to be cleaned. The measured distance is fed from the onboard controller to the Industrial PC (personal computer located within the mini-gondola), which then activates the robotic arm to start the cleaning process.