Automatic Robot System for Indoor High Rise Spray Painting

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PROJECT DESCRIPTION:

Motivation & Objectives

High ceiling painting is inevitable & common in building construction, especially in industrial workshop. Its painting takes a lot of effort for details and is no doubt time consuming. Traditional high ceiling painting is manually done by means of ladders or hydraulic lifts and often results in unreliable painting quality. Moreover, the high-place operation (up to 10 meters) will create lethal danger to painting workers. This project aims to develop a mobile robot system equipped with a novel long reach mechanism for high ceiling and wall painting applications.

Methodology

Modular design, 3D scanning imaging technology & airless spray painting technology.

Using an optical camera and laser scanner, the robot can automatically scan its surroundings and navigate walls up to 10m high with its automated jack-up platform and paint the wall surfaces with its six-axis robotic arm.

Modular design is considered in this work process to reduce the design complexity at conceptual and technical levels and to accelerate the manufacturing cycle as well as to increase the flexibility of system integration and upgrade. By considering a modular system, the robot is designed with five primary subsystems: a 3-DOF mobile robot, a long 1-DOF reach mechanism, a 6-DOF commercial robot arm, a spraying system and a computer-controlled system. Besides, the robot consists of several subsidiary modules such as hydraulic outrigger stabilizers, cable-hose suspension system and diverse types of covers to protect the equipment and sensors against paint pollution.

Results /Progress

The high-rise spray painting robot called PictoBot is realized with integration of all its modules comprising a heavy-duty mobile robot, a jack-up mechanism, UR10 manipulator, spray painting head, cable-tube management system, and computer-aided control system. Several test experiments are conducted to evaluate each module individually, as well as to validate the overall performance of the integrated system. We have also conducted on-site spray painting experiments and public demonstration of the robot at JTC developments.

The experiments indicate the functionality of PictoBot and its potential to improve on quality coating. More importantly, using PictoBot helps to keep human workers away from toxic fumes and mitigate the risks of workers falling from great when painting walls of industrial buildings. The robot can work four

hours on one battery charge, giving walls an even coat of paint that matches industry standards. These features allow the robot to paint continuously day or night, improving efficiency and reducing manpower.

GRANT:
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