Autonomous Window Cleaning Robot for Commercial High Rise Buildings

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Cleaning external windows on commercial high-rise buildings is expensive and potentially very dangerous as it is traditionally labour intensive. There is an increasing awareness of the commercial benefits of regular window cleaning yet the currently available mechanised solutions are limited in their application. To address this I designed and built a prototype of an autonomous window cleaning robot that can manoeuvre around architectural obstacles to clean and dry windows in a safe, cost effective and sustainable way. Through an iterative design approach, I built a small robot with three water dampened disks covered with micro fibre cloth to effectively scrub off bird poo and other contaminates. A windscreen wiper blade follows above the disks to dry the window. The robot is suspended and tethered from a driven track secured above the building. It uses horizontally mounted drone motors and propellers for propulsion onto and off the window. It autonomously senses the window geometry, cleans the entire pain, then crosses the mullions to the next pain as well as compensating for cross-winds. The robot is controlled by an open source microprocessor programmed in C++, this interfaces numerous components including: ultrasonic sensors for positional tracking; anemometer and custom circuitry to measure crosswinds and servos to tilt the propellers to compensate; PWM motor controllers for brushed DC motors; a H bridge relay controller to drive the winch motor; PWM controlled ESCs for the brushless DC thrust motors; a custom acceleration routine for the stepper motor that accurately movement along the track.

Awards Won:

Intel ISEF Best of Category Award of $5,000

First Award of $5,000

Gordon E. Moore Award

International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention

IEEE Foundation: IEEE Foundation Second Place Award $600

NASA: Second Award of $750