Vertigo

a Wall-Climbing Robot including Ground-Wall Transition

Team name- **Tarantula**

Introduction

Vertigo is a robot that can move with significant speed on ground as well as on walls. The most important part is its smooth ground to wall transition. The robot will have two propellers that will provide enough normal force so that the bot would be able to move smoothly on walls.

Motivation

Vertigo extends the ability of robots to travel through urban and indoor environments.
We have been motivated by a past attempt of a similar project, made by disney, zurich.
Here is the link to vertigo made by disney:
https://www.disneyresearch.com/publication/vertigo/

Demonstration

There were some efforts to make a wall climbing robot last year but they were based on suction. We are making a propeller based WC robot. This provides a fast motion to it on both ground and the wall unlike the earlier suction bot. **https://youtu.be/KRYT2kYbgo4**

Implementation

VertiGo - a Wall-Climbing Robot including Ground-Wall Transition. The robot has two tiltable propellers that provide thrust onto the wall, and four wheels. One pair of wheels is steerable, and each propeller has two degrees of freedom for adjusting the direction of thrust. By transitioning from the ground to a wall and back again, VertiGo extends the ability of robots to travel through urban and indoor environments. The robot is able to move on a wall quickly and with agility. The use of propellers to provide thrust onto the wall ensures that the robot is able to traverse over indentations such as masonry. The choice of two propellers rather than one enables a floor-to-wall transition - thrust is applied both towards the wall using the rear propeller, and in an upward direction using the front propeller, resulting in a flip onto the wall.

Technical Background -

- A key research problem in the design of VertiGo robot was to maximize the ratio between thrust output and vehicle weight. Weight is minimized by using a carbon fibre baseplate, while 3D-printed parts in conjunction with carbon fibre are used for more complex three dimensional structures like the wheel suspension or the wheels themselves.
- The base plate provides mounting points for two thruster modules and the wheel suspensions. It also serves as carrier for all the electronic parts and wires.
- The thrusters are mounted using a two-ringed Cardan Suspension. Integrated servo motors allow the inner and outer ring to be moved independently from one another. This supports the generation of all the forces required to drive on the floor, on walls and theoretically even on the ceiling.

- The wheels are mounted with a double wishbone suspension based on model car oil dampers, but they are not propelled in any way.
- The full design has eight individually controlled actuators. To enable a human operator to conveniently drive the vehicle in a way similar to common RC-cars, an onboard computer is incorporated as a controller.
- It uses data from a 6-axis IMU in the centre of the robot to estimate its orientation in space. Based on this attitude information, the controller then devises the best positions for all actuators to achieve a desired user input.

Timeline

Week 1: Plan the exact design of the car and study and purchase all the hardware.
Week 2: Make the base structure of the skeleton and simultaneously work on on the programming for the arduino.
Week 3: Work on mechanical and electronic components must be started.
Week 4: Completion of mechanical and electronic components.
Week 5: Integration of all 3 components.
Week 6: Buffer Week.

Cost estimate-
IMU (GY-85) : 1500
Chasis (Poly-carbonate and carbon-rods): 1500-2500
servo motors:1100
BLDC+ESC: 2400 (already owned)
arduino + rest of electronics:1000
total 7500-8500 if BLDC included

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