Thanks for submitting your entry for the Exploring Hell: Avoiding Obstacles on a Clockwork Rover, we've got it safe and sound.

Good luck!

Submission

Title

VR-OAS (Venus Rover Obstacle Avoidance System)

Short description

VR-OAS is an obstacle avoidance sensor for the Venusian rover. It detects obstacles and actuates links to generate a relevant response.

Note on Supporting Information

Competitors are encouraged to present citations (or other relevant supporting information) to bolster the case for their design's suitability for this application. Citations may be made inline with text or may be included as a piece of supporting documentation.

Note on Schematics/Diagrams

Responses should include a schematic or diagram of their proposed avoidance sensor design. The diagram should be attached as a supporting document. Acceptable file formats include: WORD, PDF or JPEG. Competitors wishing to include CAD files may do so: 2D CAD files can be shared as a PDF, 3D CAD files should be shared as a Parasolid . x_t file.

Please describe, in a non-confidential way, the operation of your sensor.

The proposed design is fully mechanical and can be divided into two modules. These modules are the **Obstacle avoidance module** and **Hole/Valley/slope detection module**. The description for each can be given as follows.

Obstacle Avoidance Module

Construction:

- The obstacle avoidance module consists of three push rods or pins.
- Out of the three pins, two pins (Pl and Pr) are used for the detection of the obstacle to the left and the right of the rover respectively. The third pin (Pc) which is mounted on the center is extended slightly forward in comparison to the two pins (A and B) is used when the obstacle obstructs the path of the rover from the center.
- The other ends of the pins Pl and Pr are connected with a cranks and connecting rods of the toggle mechanism. The connecting rod at the end are connected to racks (Rl and Rr)
- The racks R1 and R2 are in mesh with the gears G1 and G2.
- These gears are in mesh with a compound gear system Ga and Gb which in turn are in mesh with the main rack R.
- The ends of this rack are in mounted with bell crank levers (L1 and L2) the other joints of which are connected with the wheels of the rover.
- Pin Pc is mounted with some eccentricity on the gear Ge which is in mesh with the rack R.

Working:

- When the path of the rover is obstructed from the right, the right pin Pr gets pressed. This push on the pin actuates the toggle mechanism which in turn moves the rack Rr horizontally. Thus making the gears to rotate. The rotation of the gear would move the rack R and thus this would help the wheel to steer because of the moment of the bell crank lever.
- Similar event happens when the path of the rover is obstructed from the left and the left link is pressed.
- When the path of the rover is obstructed from the center. The extended pin Pc gets pressed. This pin Pc rotates the gear Ge and thus the rack R which is in mesh with the gear Ge moves. The motion of the rack moves helps to steer the wheel.
- Now as the obstacle is detected, the rover would move in the reverse direction and the mechanism would help the vehicle to turn. This will generate a combined reverse + turning motion bringing the vehicle away from the obstacles and finding new path forward.

Hole/Valley/ Slope detection module.

Mechanism for the detection of Holes/ valleys,

In order to detect holes and valleys having depths greater than 0.35 meters we are proposing a simple suspended pendulum mechanism. This mechanism consists of an elastic thread at the end of which a pendulum is mounted. The length of the thread is slightly more than 0.35 meters. As a result when the rover moves ahead the pendulum bob would just freely slide with the ground keeping the thread loose. When the hole or valley having a depth more than 0.35 meters is encountered the pendulum would itself move down and the string would get tensed. The other end of the thread is connected with the link which triggers an indication link on the rover.

Mechanism for the detection of the slope greater than 30 degree

In order to indicate the slope greater than thirty degrees a pendulum is used. The pendulum is freely suspended, so when the rover moves uphill or downhill on the slope, the chassis of the rover becomes parallel to the slope and so the rod of the pendulum have a relative motion with respect to the chassis

and as a result angle of the slope can be indicated. When the slope is thirty degree or more a link gets pressed.

Please provide a schematic diagram of your proposed sensor.

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Please provide any additional information you would like included with your submission, citations, additional diagrams, etc.).

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Please indicate the performance criteria your sensor can achieve:

Move a 6cm pin a minimum of 3cm
Detect slopes greater than 30 degrees (up or down)
Detect rocks greater than 0.35m in height
Detect holes deeper than 0.35m

Please describe how your sensor is suitable for the operational environment on Venus. Consider describing how your sensor design will cope with high temperatures, high atmospheric pressure, wind, launch vibrations, etc while in operation

The sensor consists of no electrical parts and only mechanical parts and so the mechanism could easily survive on the surface of venus. The material selected also have fairly high melting point as compared to that found on the surface of the venus.

Please describe the materials you anticipate needing for constructing the sensor.

Space grade Aluminium

Please describe the electrical power requirements of your sensor. Describe what electrical components are included in your sensor and why. If none, please indicate "Not applicable".

Not applicable

Please describe how your proposed sensor will trigger the pin(s).

Not applicable

Please describe how your sensor meets the physical constraints of the current rover design (i.e. assembled of environmentally appropriate materials, mass ≤ 25kg, not more than 1m from rover body, not more than 0.875m off the surface)

Not applicable

Please indicate the current maturity level of your sensor:

Conceptual

Should you be selected as a winner of this challenge, how would you like to describe yourself/your team and your proposed solution?

We are just a team of degenerate thinkers trying to change the world through the tools we have in whatever ways possible. Participating in this challenge allowed us to explore a completely new paradigm. The challenge was tough and very novel and innovative ideas were required to be crystallized. We have somehow managed to come up with the solution to a few problems.

Was this page helpful?

Yes No