



CURIOSITY

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PROBLEM STATEMENT

INTRODUCTION: Finally the extensive mind boggling studies of human for their working of wormholes have proven successful. Kepler-452b, also known as Earth's Cousin by NASA, is an exoplanet orbiting the Sun-like Star Kepler-452 about 1,402 light-years from Earth. The crew travelled through the wormhole and is now on the orbiting planet! Their camera results, coincides with that of Kepler Space Telescope, shows the planet to be habitable with rocky surface, big mountains with active volcanoes and also having a major portion covered with water. Before risking the lives of the crew, the leader sends a rover that would check if the planet is worth surviving. The rover, camera fitted and manually controlled, would travel through the rocky terrains, swim the oceans, speed through the volcanoes and load the boxes with samples from the planet.

Explore and survive the topology of the planet with mastering the controls of the rover through in the presence of all the mediums.

PROBLEM STATEMENT:

The teams have to design an ATV rover with arms over it, to perform the different task of gripping and sampling on the surface of exoplanet.

ROUND 1: A test of flexibility, speed, strength, power and robustness of your bot.

TASKS:

- A. Hemispherical Curvature:** Starting from the beginning, your rover should be able to descend and then ascend a hemispherical bowl.
- B. Stones:** Next there will be a surface of varying sizes of stones, which must be crossed by the rover.
- C. Control:** In this obstruction would be a very smooth surface with oil spilled. The rover's controls are tested at this stage.
- D. Sand Turn:** the rover has to make a turn on a surface full of sand. The reduced friction on tires because of oil will be brought to normal at this stage.
- E. Water body:** At this stage, rover should be capable of crossing the water body either by swimming in it or on it.
- F. Uneven stairs:** Inclination is somewhat in the form of stairs with max inclination of 40 degrees.
- G. Bridge:** A bridge on some height, consisting of 2 thin parallel strips for the tires of rovers with empty space in between and volcanoes beneath.
- H. Arm test:** When reaching plank, it is basically a vertical obstruction of about 4.3 inches, you have to grip the slider with your arm and then using it you have to lift off your front tyres balancing the bot on arm and rear tyres. This is to test for the strength and flexibility of your bot arms and gripper.
- I. Suspension Test:** In final stage, your bot will be hanged with the help of the slider for 50 seconds to test the grip strength and that of arms.

ROUND 2: You have to collect sand from a pile kept over a platform and collect it in a box kept on your bot. Then you have to grip the sand box with your gripper and keep it on some other platform at a distance from there. This you have to do with 4 cubical boxes of dimension $50\text{ mm} \times 50\text{ mm} \times 50\text{ mm}$ each. A) Collecting Sand to box B) Carrying it to the truck to unload C) Unloading sand boxes. D) Piling them up 2×2 . Finally we will weight up total weight of sand collected.

PROTOCOLS-

- 1) The team should have max of 6 members.
- 2) The bot can fit in a box of $500\text{ mm} \times 360\text{ mm} \times 500\text{ mm}$ before the start of the match, fully assembled.
- 3) The bot to perform for round 1 and 2 have to be same.
- 4) The teams should have two grippers, one for round 1 to grip something and other for round 2 to collect sand.
- 5) The potential difference between any two points of both the robots should not exceed 12V.
- 6) Use of pneumatics, hydraulics or any other mechanical mechanisms are allowed.
- 7) Any power source including Li-Po battery or AC source can be used but the safety has to be guaranteed by the teams. Only then they will be allowed.
- 8) The bot tyres will be max of 70 mm in diameter.
- 9) The water source is 70 mm deep.
- 10) The ground clearance of the bot should be minimum of 100 mm.
- 11) Wheel Track should be minimum of 200 mm and max of 330 mm.
- 12) Damage to the arena or any part of the arena will not be tolerated. Violation of any of the rules will lead to disqualification. Coordinator's decision is final and binding in case of any discrepancy.

Rules can be modified or changed without any prior notice, but it will be such that to accommodate the current bot design constraints.

MARKING SCHEMES:

- Stable and Controlled rover would be preferred.
- Unique mechanism for movement and arms would be preferred.

TOTAL MARKS:

Round 1: $1(10 \times 1A + 20 \times 1B + 50 \times 1C + 100 \times 1D + 20 \times 1E + 30 \times 1F + 20 \times 1G + 50 \times 1H + 80 \times 1I) - \text{time (in seconds)} - \{\text{total cost (in Rupees)} / 10\}$

Round 2: $2(50 \times \text{Weight of Sand} + 30 \times \text{number of piled sandboxes}) - 2 \times \text{time (in seconds)}$

SUGGESTIONS:

- Rocker Bogie mechanism is recommended for the bot to facilitate ATV.
- You can go refer to Curiosity and other related rovers design.
- Wireless control of the bot is suggested for greater robustness and control.

REFERENCE MATERIALS:

1. [Rocker Bogie Mechanism](#)
2. [Curiosity driving mechanism](#)
3. [Curiosity tests](#)
4. [Rocker Bogie Mechanism Rover](#)
5. [RC Car Tires: Driving on water](#)

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