Gliese 667 CB

Contact:
Kishan Tiwari
+91-8726140062
Aniket Kumar
+91-9532361335

Robotics.society.mnnit@gmail.com

Problem Statement

Introduction: The year is 2045, and SpaceX has devised a mission to explore the nearest exoplanet, **Gliese 667Cc**, which appears to be habitable and could contain possibly sustain life. You are onboard the space-ship with other mission crew. The captain of the ship decided to send a probe to explore the planet in first place and sample it while the space ship along with its crew members will orbit the planet, but alas! the principal probe is not working and you have to make a new one fit for the job, which can be manually operated (remotely) using the equipment available onboard. You and your team is also responsible to pilot it remotely using its camera vision. You are aware of the terrain from the satellite feed which is highly uncertain, and there is a high possibility of some liquid on the surface.
Depending on the live feed from your camera on the bot, you have to explore the planet and load the boxes with samples from the planet.
Explore the deep reaches of control and maneuverability in the presence of all medium in the event of manual robotics.

Problem Statement:

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

Round 1: Testing of the robustness, flexibility, strength and power of your bot
Tasks:

A) **Stones:** Initiating the race from start point of the line, you will have to cover track obstructed with stones in the form pebbles.
B) **Roughness:**The next obstruction is in the form of rough muddy surface. It may be sandy and solid both. Crossing it you will reach the bottom of an inclination.
C) **Uneven Stairs:** Inclination is somewhat in the form of stairs with max inclination of 40 degrees.
D) **Water body:** At the top, you will have to cross a water body, by either swimming on it or in it.
E) **Sand turn:** After crossing water, you have to turn on a platform full of sand.
F) **COM Balance:** The you have to take your bot over a platform hinged at center (in direction of track) and is free to roll sidewards. It is to test for COM (Center of Mass) balance.
G) **Loose mat:** Following it will be track with two carpet sidewards. The carpet will be in the form of a loose mat.
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 kept on some other platform at a distance from there. This you have to do with 4 cubical boxes of dimension 50 mm × 50 mm × 50 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.

Arena:

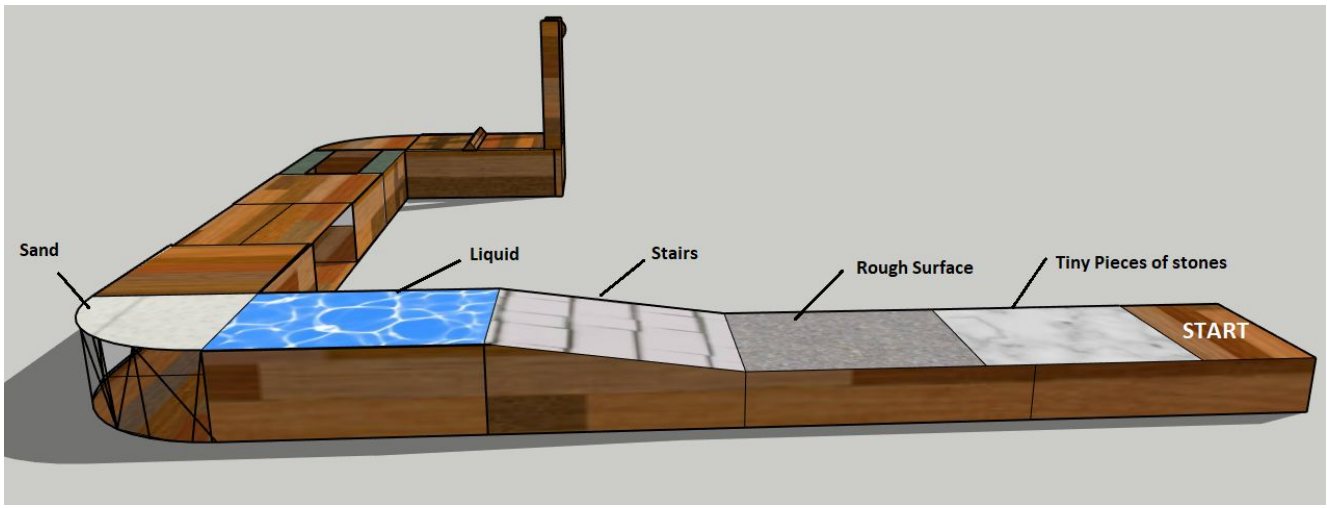

Fig 1: Isometric view 1 of round 1

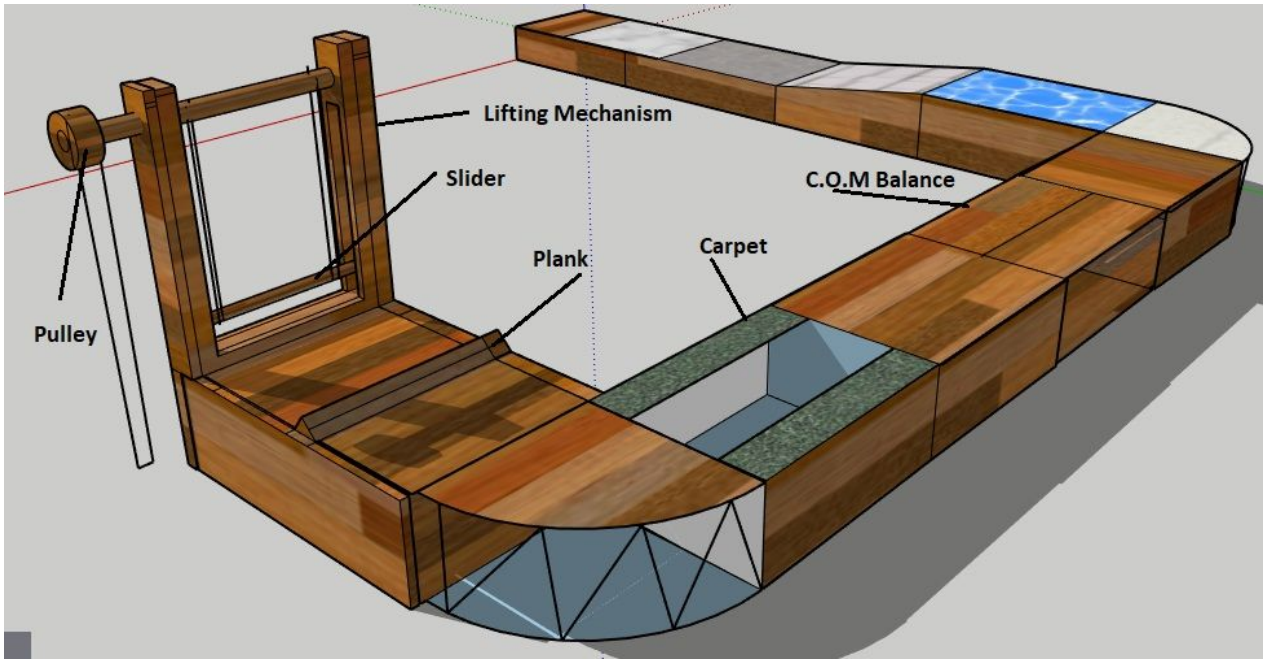

Fig 2: Isometric view 2 of round 1

Note: A more clear idea of the track can be seen here.

Protocols

1) The team should have max of 6 members.
2) The bot can fit in a box of 500 mm × 360 mm × 500 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.**

Note :

- Game field dimensions are subject to a tolerance of ±5 %. No tolerances will be given in case of maximum bot dimensions.
- The authenticity of any action not provided in this problem statement shall be subject to discretion of Coordinators.

Marking Schemes:

➔ A single arm with different functionality will be preferred.
➔ The rover with less mechanical complexity and cheaper cost will be preferred.

Total marks,
Round 1= 1(10✕1A + 20✕1B + 50✕1C + 100✕1D + 20✕1E + 30✕1F + 20✕1G + 50✕1H + 80✕1I) - time (in seconds) - {total cost (in Rupees) / 10}

Round 2 = 2(50✕Weight of Sand + 30✕number of piled sandboxes) - 2✕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

Contacts:

1) Kishan Tiwari (+91- 8726140062)
Email id: me153006@mnnit.ac.in

2) Aniket Kumar (+91- 9532361335)
Email id: me153007@mnnit.ac.in

3) Piyush Kumar Gupta(+91- 9455396226)
Email id: piyushkg1997@gmail.com

Robotics Club Email Id: robotics.society.mnnit@gmail.com