

HOVERPOD

Build a manually controlled, wireless, hovercraft that has the capacity to move through a predefined path

Introduction

It's the year 2270, star date 6000. Starfleet can no longer use Warp-Drives, as all the reservoirs of Di-lithium Crystals on any of the known republic planets have depleted. But captain Kirk, of the USS Enterprise has located a planet in a very far off location, emitting X-ray signature similar to that of Di-lithium Crystal planet, and hence, a surveyor mission has to be sent to the planet for close observation. But there is a problem. DI-lithium Crystals are usually extracted from the semi-solid/liquid DI-lithium Crystal ore, which would be present in oceans and shallow regions of this otherwise terrestrial planet, and hence, for close inspection, conventional 6-wheel rovers are not a good choice. Also, Di-lithium Crystal ore easily reacts with minimal changes in temperature, so rocket propelled rovers can also can't be used. But since the planet has a mass close enough to support an atmosphere, Spock has come up with an old but genuine idea, using which the surface mapping of the planet can be done easily. This in genuine Idea is not to use a conventional rover, or rocket propelled rovers which do not touch the ground, but to use a 'Hovercraft' and then survey the planet.

Problem Statement

The team has to build a manually controlled, wireless, hovercraft that has the capacity to move through a predefined path. The path will have varied terrain, having potholes, water and other kinds of terrains as specified in the sample arena below. The aim of the participant is to rake up the maximum points to win the task.

How to Approach

1. First of all, we will learn how to make a simple hovercraft (without rc).
2. After that understanding the physics behind it.
3. Applying it to the Problem Statement.

How to Make a Hovercraft?

MATEIALS REQUIRED

- Piece of Plywood
- Tarp or plastic shower curtain
- Leaf Blower
- Duct Tape
- Staples/ Staple Gun
- Plastic Cofee Can Lid

- Jigsaw
- Drills/ Screw
- Measuring Tape
- String/ Pencil
- Sandpaper

Directions for Making a Hovercraft

1. Take the plywood and locate its center of gravity.
2. Draw a Circle taking this point as the center of appropriate radius
3. Inside the leaf Blower, draw a circle of radius equal to that of leaf blower.
4. Use the jigsaw to cut the circle and the hole for the leaf blower using the pencil lines as the guidelines.
5. After completing the previous step you are going to place the tarp or the plastic shower curtain (smoother side down) underneath the circle (platform) that you created. Make sure that the tarp or curtain can completely cover the underside of the platform with about 8 inches of excess or so in order to attach it to the platform. Trim any excess that is not needed.
6. With the 8 inches of excess you are going to use the staple gun and staple the tarp or curtain to the platform. Don't make the tarp tight around the circle. You want it to be loose that way when the air blows into the tarp it will be able to puff outward. Be sure not to cover the top of the hole meant for the leaf blower.
7. Once you have stapled the tarp or curtain all the way around the platform use duct tape and go over the edges of the tarp, where the staples are. This will help prevent the air from leaking out.
8. Flip the platform over so that way you are viewing the underside, the side where the tarp is covering the board entirely. Once again you are going to use the measuring tape and find the center of the platform and mark it.
9. Take the plastic, circular lid and place it directly in the center. You are then going to drill a hole in the center of both the lid and the platform. Secure the two together by screwing in a screw in the hole you just created. Screw in a total of five screws. It is ideal if the screws don't stick up through the top side.
10. Once the lid is secure to the platform with the tarp in between you are going to create a total of six holes in the tarp on the underside (side you are currently looking at). The holes should be 5 inches from the outer edge of the lid and should be evenly spaced among each other. The holes should have a diameter of inches or so.
11. If you decided to use a plastic shower curtain you might want to secure the holes so that way they won't rip even further. You can do this by securing them with duct tape by placing it around all the holes on the underside of the plastic curtain.

12. After finishing the previous step you can flip it over, place the leaf blower's nozzle in the hole designated for it, turn the leaf blower on, and ride.

Physics behind the Working of Hovercraft

First there is the concept of pressure, air pressure to be more exact. Air pressure played a huge role, along with the skirt. As the leaf blower continued to blow, air pressure inside the skirt would build up and when under pressure, the molecules would try to spread out. However, the skirt prevents that from happening so the end result is the air bursting out of the holes made at the bottom side of the skirt. If the air pressure inside the skirt rises to the point where the air molecules exert more force than gravity would on the hovercraft and for whoever is riding it, the hovercraft is lifted.

Second there is the concept of friction. Friction is the resistance to sliding motion between two surfaces that come into contact with each other. In our case with the hovercraft, there needs to be as little friction as possible between the skirt and the ground to avoid potential damage and to allow the rider to glide faster.

Another physics concept would include torque. Torque is the amount of force acting on an object that causes the object to rotate. The object then rotates about its axis. So in our case if the rider places more force on one side of the object after being pushed or while being pulled on the hovercraft the hovercraft will then spin.

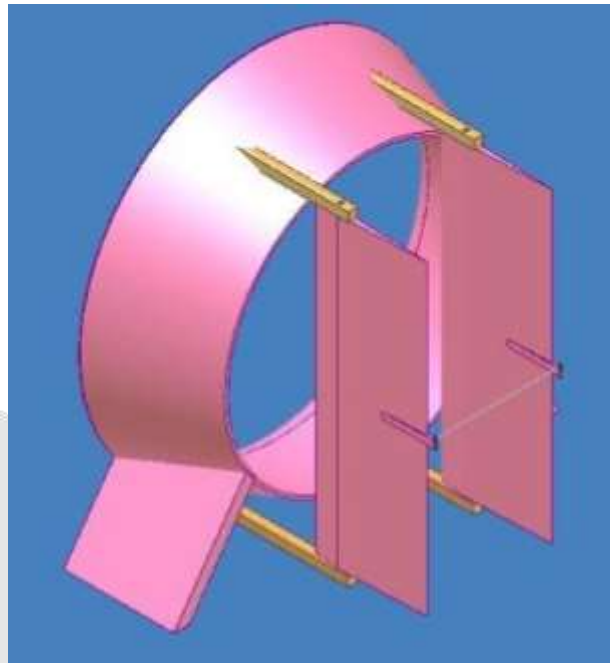
Application of the Above Problem Statement



Now that we have learnt how to make a simple hovercraft, it's time to move on to a more advanced version. According to the problem statement, we are required to build a manually controlled hovercraft that is capable of moving on predefined path. For this, we will do the following changes.

Rudder Assembly

We have achieved providing lift to the robot. However, we will need to provide thrust for the successful motion of the bot. Note that for providing the thrust, we can attach a propeller facing back. With the help of this we are successful in providing thrust. But what about it's direction? For that we need something called as the rudder assembly.(See figure below)



This rudder assembly can be made of any strong material like perforated plastic, etc. The end part of the rudder contains a crease from which it can bend to provide a direction. The bending of the rudders can be controlled by servo motors which can be controlled RC.

Few Important Terms

There are few important points that will be necessary for creating a successful hovercraft.

1. Firstly, heavy materials should be avoided because they add extra payload.
2. Leaf Blowers can be replaced by simple propellers mounted on a stand to provide both lift and stand.
3. Position of both holes in the skirt and the propeller has an important role.
4. Propeller for lift should be at centre of gravity to provide lift equally in all directions.
5. Weight on the hull of the robot should be balanced. 6. Skirt should not be affected by water.

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