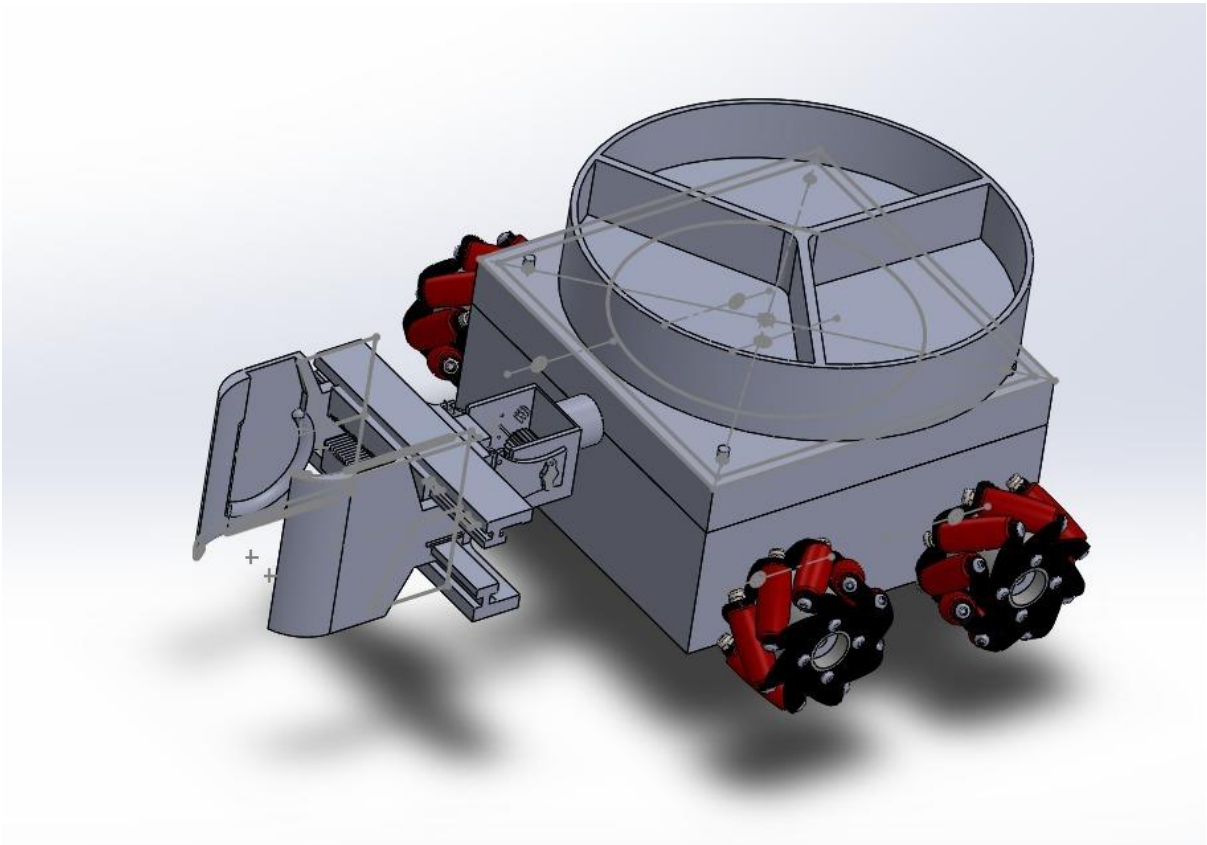
Pick and Place Robot

Task:

The task is to build a robot that can traverse through a grid having black colored boundaries and white surface, and collect the balls placed in different cells, and sort them on the basis of their color.

Specification of Robot:

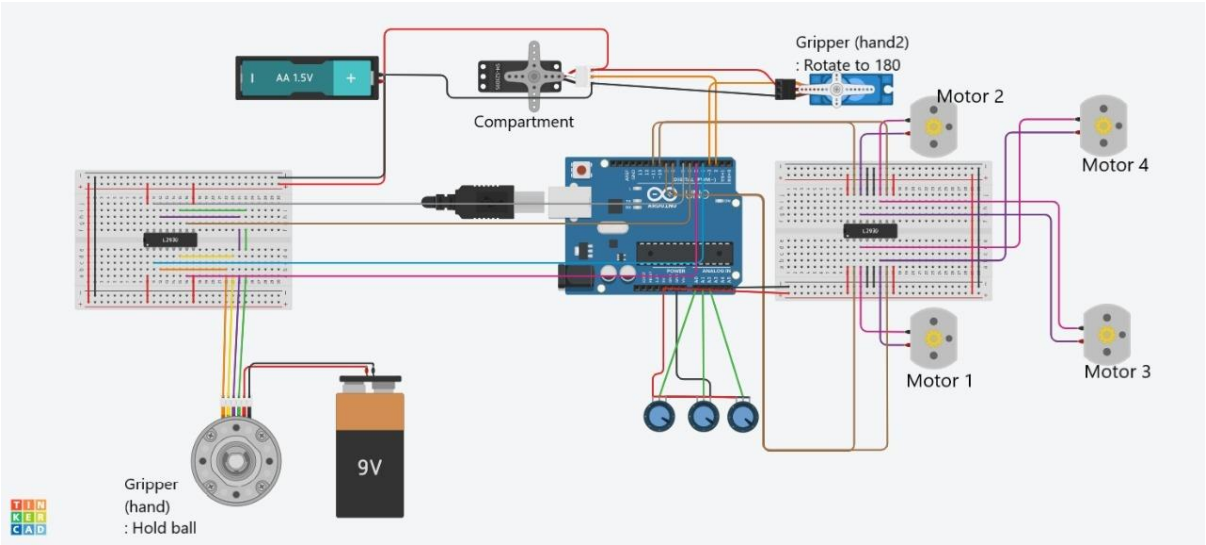
The robot is autonomous and will perform all the tasks by its own once placed in perfect orientation. The robot will follow the black line using infrared sensors, and will keep looking for the balls with the help of its camera. When it finds the ball, it picks up the ball through gripper and place it in the respective compartment of the bot.



Functionalities of the Robot:

➢ Electrical division:

- The electronic deals with the navigation, controls and vision of the Robot. It comprises of the Raspberry pi which is the mind of the Robot and give commands to Arduino after receiving the input from the camera.
- There are 3 IR sensor which help us to decide whether we are on a cell or not.
- The raspberry pi will run the python code and do the image processing using OpenCV library to detect the shape and color of the ball. Then the information is sent to Arduino using pyserial.
- If no ball detected, then the Bot will continue to traverse and search.
- If ball is detected, a signal is sent to Arduino through Pyserial.
    - It will stop for 1 min (can be change according to physical constraint), compartment will rotate in either direction according to the color of the ball & gripper will hold the ball rotate about 100 degree to place the ball in compartment.
    - After picking up the ball the Robot will move on to searching for the ball in the untraversed cells.
- Here is the link of the Arduino code.



Note – There is assumption assumed that the Robot is placed at the Right most backward corner of the Grid Pattern with all 3 IR sensors over the black line.

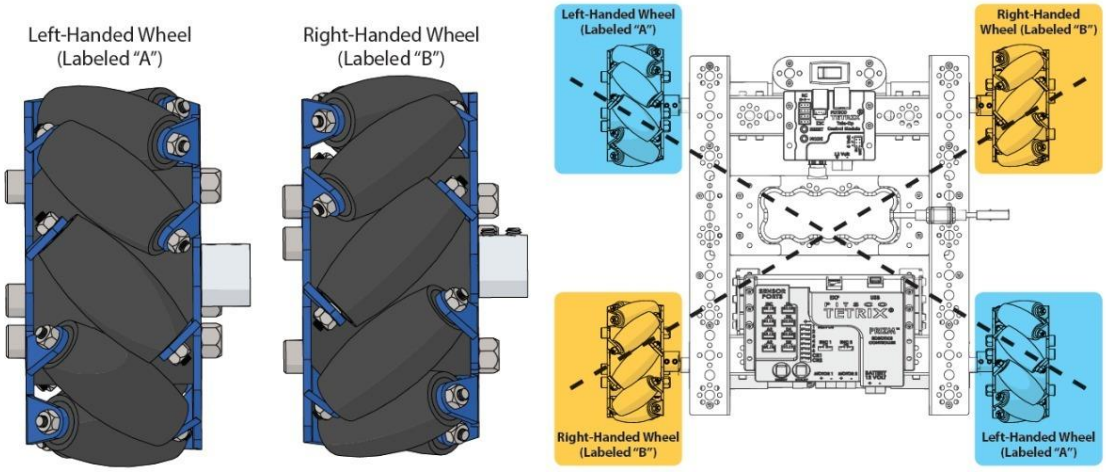
Tinker Cad Arduino Code :-
https://www.tinkercad.com/things/354Y1Ip9LxX-latest-bot-code/editel

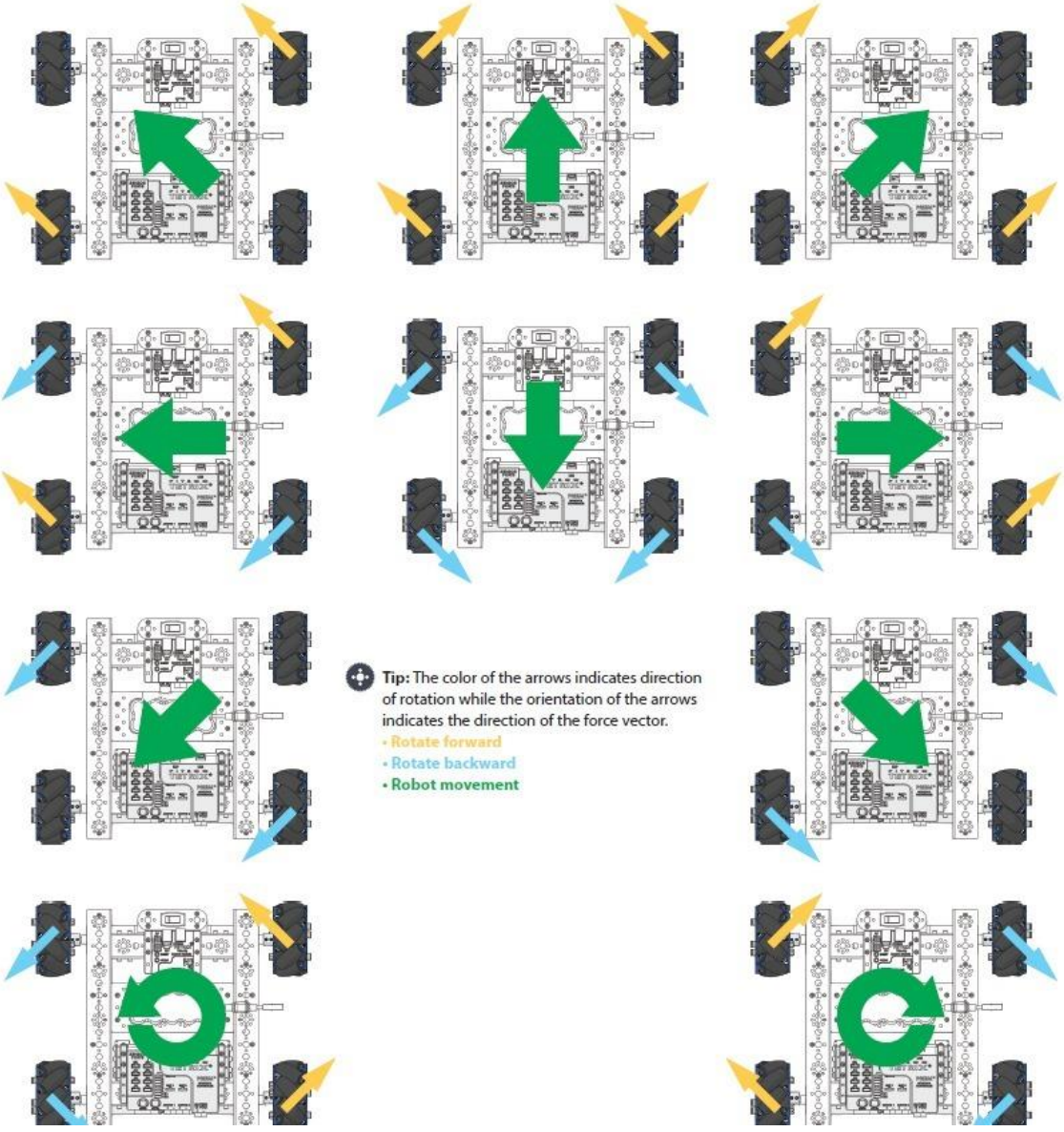
➢ Mechanical Division:

The base of our robot is 15*15 cm^2.

The different main parts used in it are:

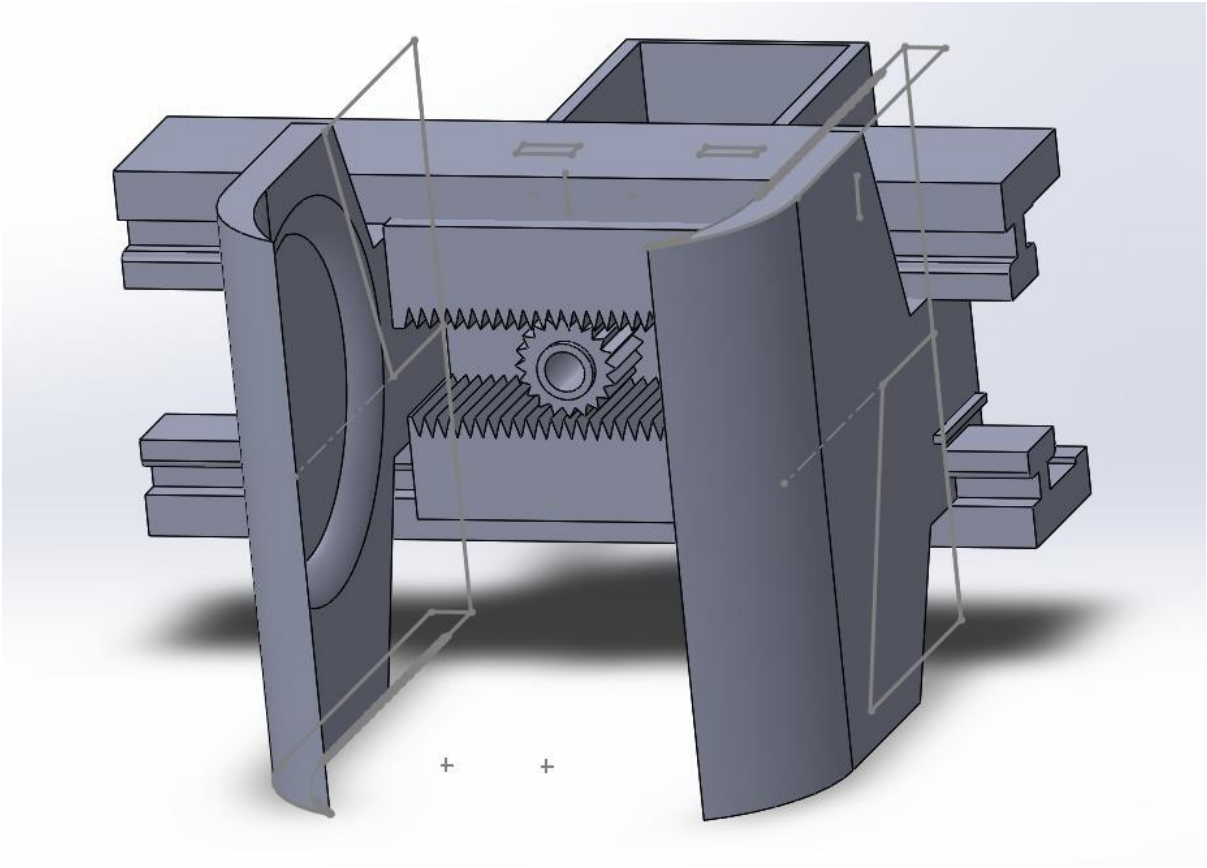
- Mecanum wheels
- Rack and pinion
- Jaws
- Cylindrical compartment
- Rippets…etc.

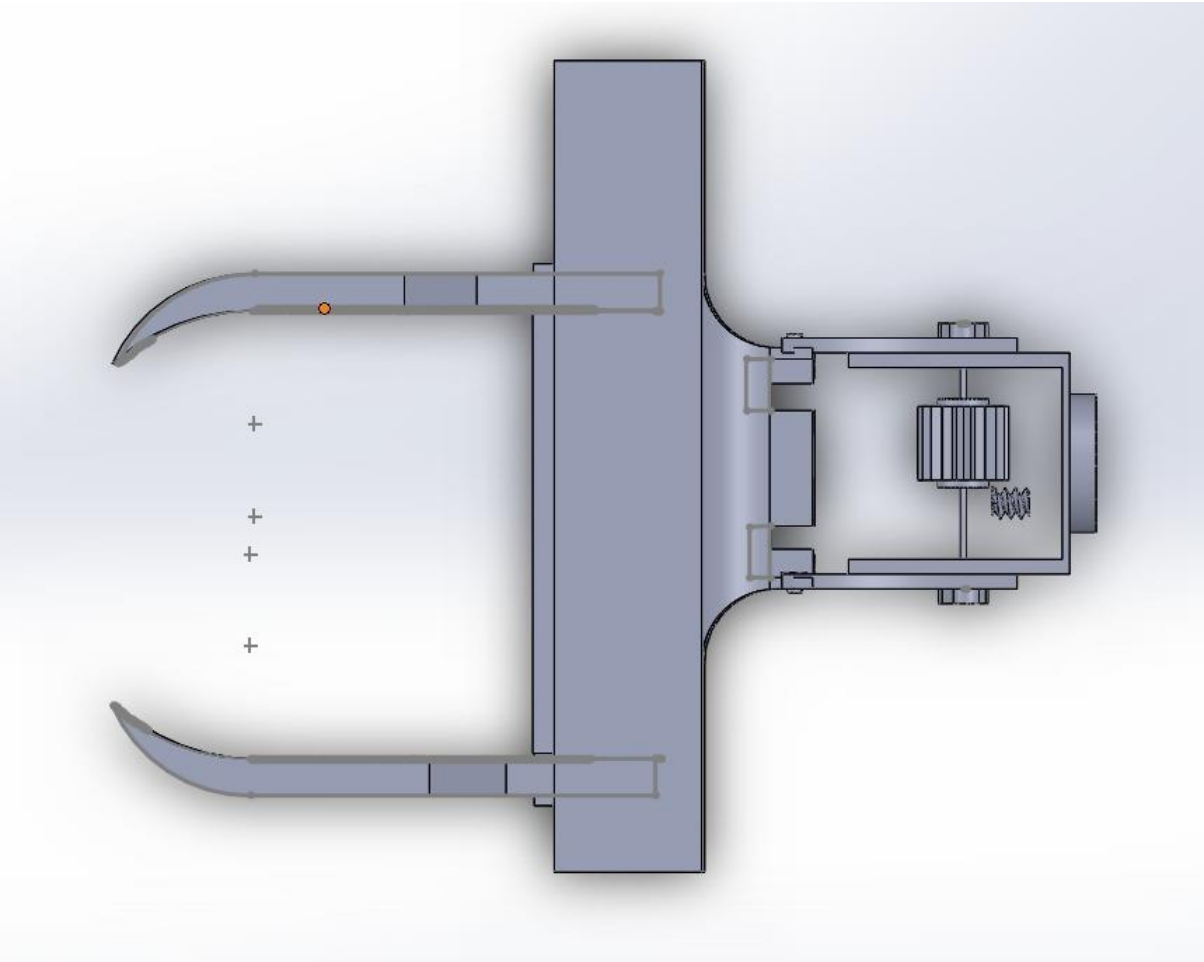




Tip: The color of the arrows indicates direction of rotation while the orientation of the arrows indicates the direction of the force vector.

- Rotate forward
- Rotate backward
- Robot movement

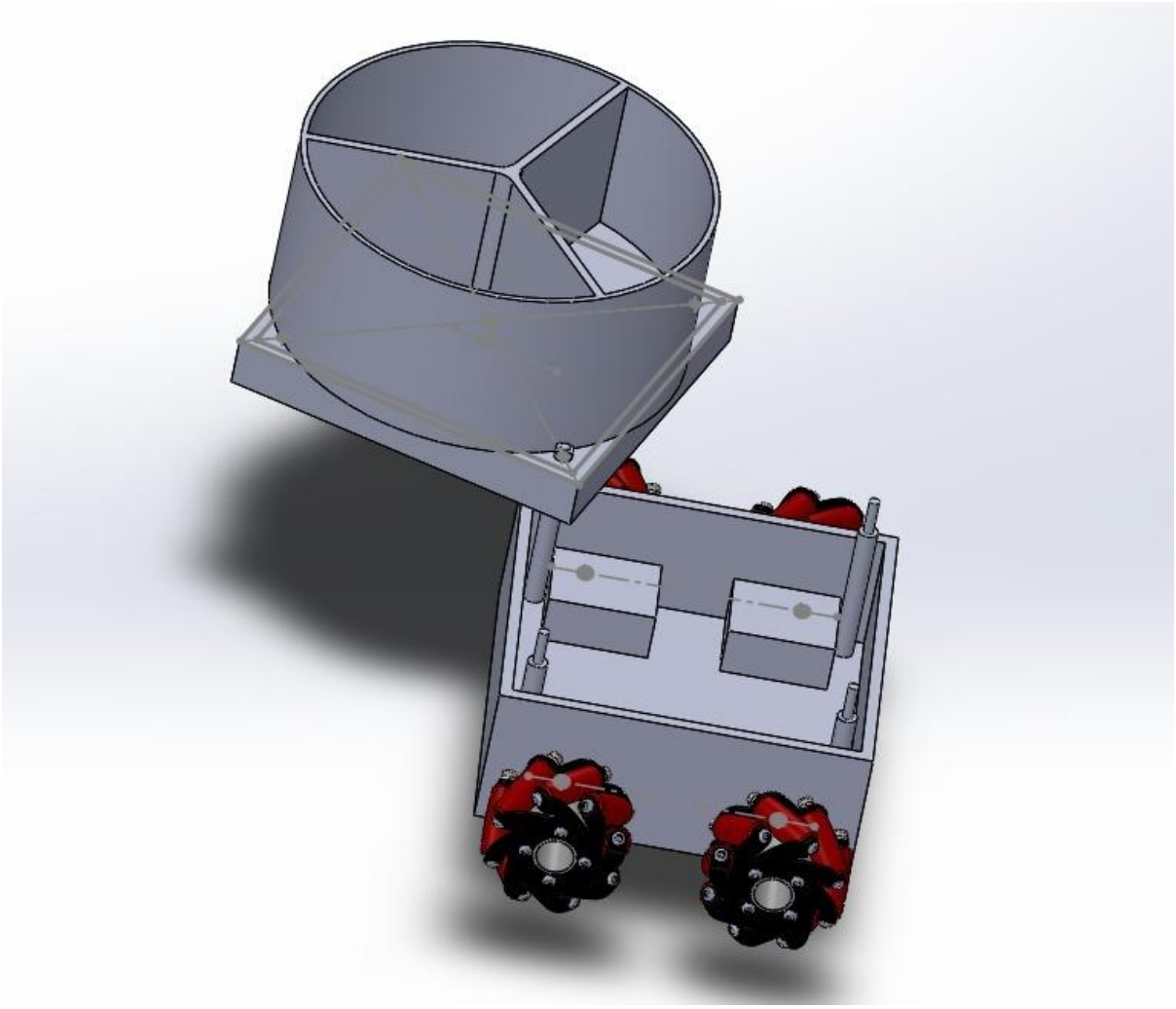




GRIPPER'S MECHANISM: - The gripper consists of two motor drivers. First one is to capture

and release the ball, while the second one is for placing the ball into the compartment.

The gripper will pick the ball of approx. diameter of 7.8cm from slightly below its center. So that the ball get better pick easily without dropping the ball.



About COMPARTMENT specs: -- The compartment is cylindrical and having the equal space at an angle of 120 deg for the ball to fit into. The compartment is having a rotor at the bottom of the base which will get rotated after the ball get dropped into it. There is a disk consist of the small rings which is used to reduce the friction sharply. Inside the base there is space for other stuffs to fit into like battery, Arduino, motors driver…etc.

Height of the cylindrical compartment from base is 68mm.

THE DOF: -

- GRIPPPER (1)
- WHEELS (3)
- COMPARTMENT COVER (1)

Challenges:

- Electrical –
  - Communication between Arduino and python code is the challenge.
  - Getting used to raspberry pi environment and designing a power distribution system.
- MECHANICAL –
  1. Cad assembly and fixation among parts.
  2. MAKING PARTS WITH SMALL DIMENSIONS
  3. EASE IN ROTATION.

Solutions:

- Electrical –

  1. Pyserial is the library with act as a medium between Arduino and python code.
  2. AA batteries will be used to power the motors.

- MECHANICAL :--

  Redrawing and taking again everything with proper dimensions
  And MENTOR guidance helped us a lot.

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- Hemant Sadawana
- Srushti Borate
- Uday Gupta
- Aditya Sen

Mentor:

- Aditya Raj Singh Gour
- Bhavna M.