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Exercise 2

- Extend exercise 1 and implement odometry for Youbot
- Details on the Youbot movement [https://seeeddoc.github.io/4WD_Mecanum_Wheel_Robot_Kit_Series/]
- Details on the Youbot Dimensions [http://www.youbot-store.com/wiki/index.php/YouBot_Detailed_Specifications](Alternative files [https://www.generationrobots.com/img/Kuka-YouBot-Technical-Specs.pdf])
- Navigate Youbot to follow the path in a shape of a square with side length 7.0m (Robot should rotate and translate)
- To check if you are calculating the correct odometry you can use:

```
res,base=vrep.simxGetObjectHandle(clientID,'youBot_center',vrep.simx_opmode_oneshot_wait)
base_pos=vrep.simxGetObjectPosition(clientID, base, -1, vrep.simx_opmode_oneshot_wait)
base_orient= vrep.simxGetObjectOrientation(clientID, base, -1, vrep.simx_opmode_oneshot_wait)
vrep.simxGetPingTime(clientID) # make sure that all streaming data has reached the client at least once
```

- Maximum speed per joint of Youbot is 16 rad/s

Calculate robot velocity from the wheel speeds

```
def wheelVel(forwBackVel, leftRightVel, rotVel):
    return np.array([-forwBackVel-leftRightVel+rotVel, -forwBackVel+leftRightVel+rotVel,
                     -forwBackVel-leftRightVel-rotVel, -forwBackVel+leftRightVel-rotVel])
```

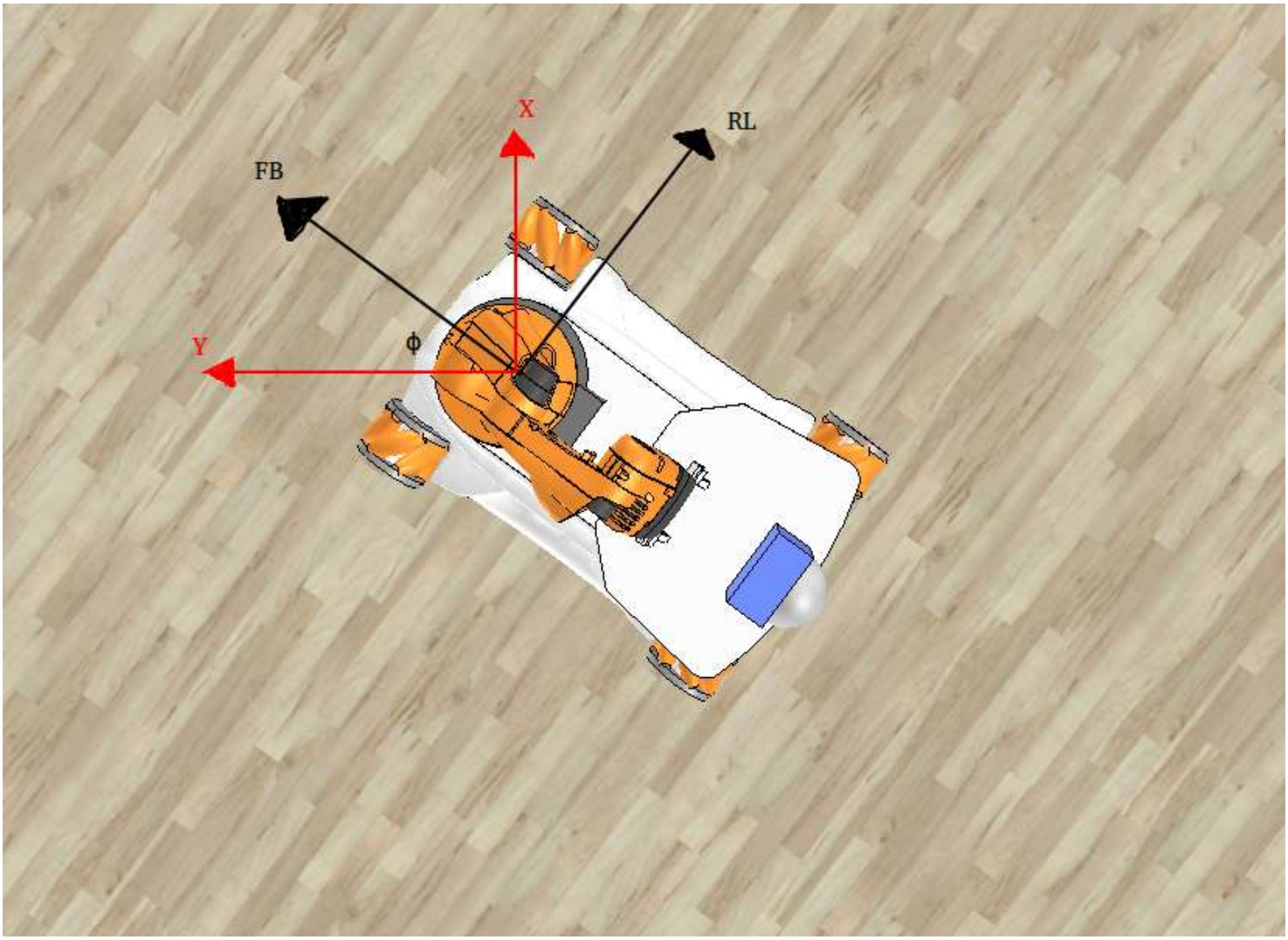
Simplify: $\dot{\theta}_f$ is forwBackVel, $\dot{\theta}_r$ is leftRightVel, $\dot{\theta}_\omega$ is rotVel, assuming the robot only move in one dimension

$$\begin{bmatrix} v_f \\ v_r \\ \omega \end{bmatrix} = \begin{bmatrix} \dot{\theta}_f \cdot \frac{B}{2} \\ \dot{\theta}_r \cdot \frac{B}{2} \\ \frac{2}{C+D} \cdot \dot{\theta}_\omega \cdot \frac{B}{2} \end{bmatrix}$$

B, C, D is the specifications of robot size and can be found in "Details on the Youbot Dimensions" [http://www.youbot-store.com/wiki/index.php/YouBot_Detailed_Specifications]

Calculate the position increments from the robot velocity

The figure for calculating the change of position:



$$d\phi = \omega \cdot dt$$
$$dx = -v_f \cdot dt \cdot \sin\phi + v_r \cdot dt \cdot \cos\phi$$
$$dy = v_f \cdot dt \cdot \cos\phi + v_r \cdot dt \cdot \sin\phi$$
