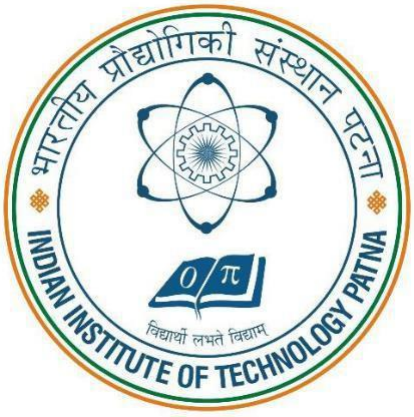
Indian Institute of Technology Patna



Mechatronics, Instrumentation And Controls Laboratory

Lab 11 Report

Topic:

CoppeliaSim

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1. Aim of the Experiments.

1) Differential Drive robot
2) Simple Car robot
3) LOS guidance for differential drive robots
4) Now use a proximity sensor and implement the simplest bug algorithm along with task 4
5) Legged Platform (I will send the help file in the group)

2. Pre-Requisites/Components Required

Software Used:-

- CoppeliaSim Edu
  Version 4.0.0

3. Model Description:-

1. **Differential Drive robot**

- The model is designed using the STL files of various entity included like wheel, motor, servo, power bank, Arduino and others, to make the model look real.
- A proximity sensor is used at front ,to detect the obstacles(*not used in this model)
- Using the simUI.create, various button and pushbutton is designed and also slider to control the joint velocity in real time.
- Using simple kinematics equations, I controlled the robot to move either forward, backward, left and right, by providing the respective corresponding velocity to both the wheels and caster wheel is freely moving.
- Two optional slider is given to control the robot smoothly, varying the linear V and turn rate used in kinematics equation.
- The two wheel joint were used under velocity control.

- Various function made for robot control ,written in Lua language.

2. **Simple Car robot**

- The model is designed using the STL files of various entity included like wheel, motor, servo, power bank, Arduino and others, to make the model look real.
- A proximity sensor is used at front ,to detect the obstacles(*not used in this model)
- Using the simUI.create, various button and pushbutton is designed and also slider to control the joint velocity in real time.(*only Slider used)
- Using simple kinematics equations, I used caster wheel joint and caster joint under velocity and position mode, to control the angular velocity and turning angle respectively.
- For this Two slider is given to control the robot smoothly, varying the angular velocity and turn rate used in kinematics equation.
- The two-wheel joint were free.
- Various function made for robot control, written in Lua language.

3. LOS guidance for differential drive robots

- Using the basic kinematics equation, the robot is controlled.
- The basic philosophy used are: -
    - The robot current position is measured at every instant and a P controller is used which control the motor used .As it get closer to goal position, the speed gets reduced, until the final position and goal position are withing tolerance as defined in code.
    - At every instant the robot pose is read and it is compared with desired pose and this error of the two is used to give corresponding angular velocity to both joint.A tolerance is used for desired pose and actual pose of robot for consideration ,for getting smooth movement.
    - The wheel joint were used under velocity mode and caster joint were free as support.

4. Bug algorithm: -

- In this various are function are defined,to implement the Bug algorithm, like follow wall, check wall in front and in side and various others .
- The basic philosophy is defined as follows: -
  - It make turn and orient toward Goal and move in that direction.
  - It does so until it gets encountered with a wall.
  - Then a random direction is chosed for rotation.
  - Then it follows that wall, until it reaches the shortest path again , i.e, until it reaches a position where it gets to opposite of a line joining the init and goal position, then again it begin from step-1 i.e. orienting itself toward goal and moving toward it and if it coincides with another obstacles, it follow the same technique until it reached the goal under tolerance defined.
  - For obstacles detection sensor are used at front and two side.

5. Legged Platform: -

- The formulation that is being used for walking follows the Trot Gait
- For a leg, there are two joints, which are position controlled, using a cosine and rectified sine wave respectively.
- For each leg there is phase shift for proper waking.
- The same has been implemented.

For Demonstration click on following link: -
Demonstration