

21AIE201-INTRODUCTION TO ROBOTICS

Lecture 4



When and where to use Robots?

- Traditional 3Ds of Robotics
 - Dull, Dirty and Dangerous
- Conventional 4Ds of Robotics
 - Dull, Dirty, Dangerous and Difficult
- Modern 4Ds of Robotics
 - Dull, Dirty, Dangerous and Dear
- Current trend of 5Ds of Robotics
 - Dull, Dirty, Dangerous, Domestic and Dexterous



COMMONLY USED INDUSTRIAL ROBOTIC CONFIGURATIONS

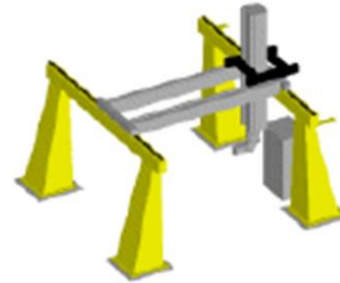
1. Articulated (industrial) robots (the original and most common)
2. SCARA robots (Selective Compliance Assembly Robot Arm)
3. Gantry robots



Articulated robot



SCARA robot



Gantry robot



LESS COMMON CONFIGURATIONS

1. Linear units (articulated robot on a slider)
2. Parallel arm robots (E.g. Tricept, Flexpicker, f200ib)



Tricept

Fanuc f-200ib



Flexpicker

Fig : Parallel arm robots

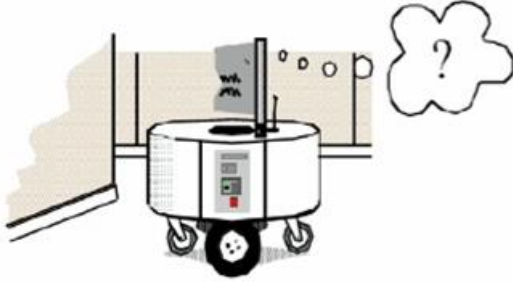


Mobile Robots

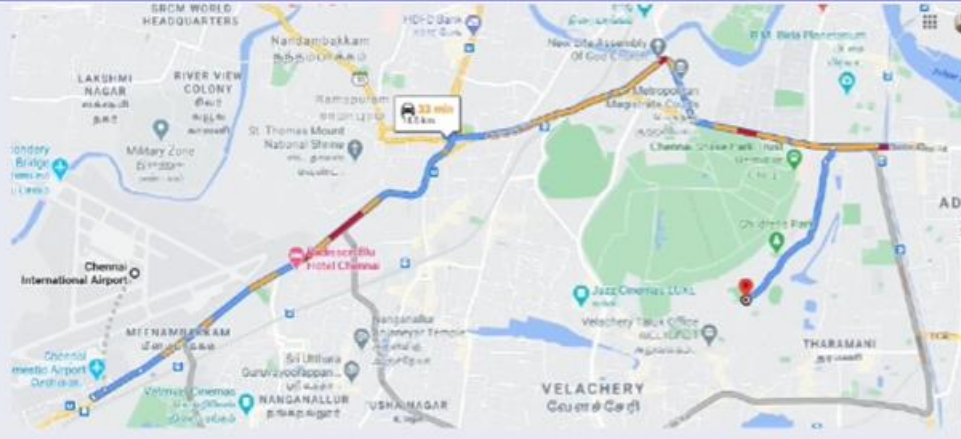
- A **mobile robot** is an automatic machine that is capable of locomotion.
 - Mobile robots have the **capability to move around** in their environment and are not fixed to one physical location.
 - Mobile robotics cover robots that **roll, walk, fly or swim**.
-
- They may travel on the ground, on the surface of bodies of water, underwater, and in the air.
 - This is in contrast with fixed - base robotic manipulators that are typically programmed to perform repetitive tasks with perhaps limited use of sensors, whereas **mobile robots are typically less structured** in their operation and **likely to use more sensors**.



Mobile Robots



Directions from Chennai Airport to IIT Madras

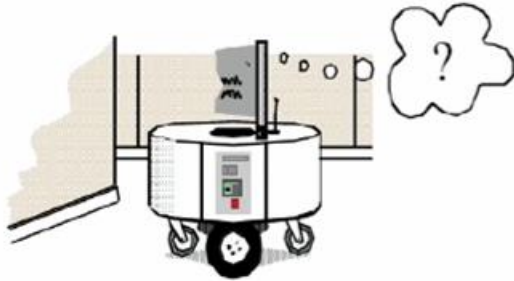


Landmarks

- 1 Airport metro station
- 2 Radisson blu hotel
- 3 Kathipara Junction
- 4 Gunidy Junction
- 5 Metropolitan Magistrate Court
- 6 Anna University
- 7 Cancer Institute



Mobile Robots



Mobile robots need to answer three fundamental questions

- 1 Where am I?
- 2 Where am I going?
- 3 How do I get there?

To answer these questions the robot must first

- 1 Make measurements and Model the environment
- 2 Localize itself
- 3 Plan a path to its goal and control its motion



Effector

An **effector** is any robot or robotic device that has an effect on the environment.



- **Locomotion:** if the effect on the environment causes motion of the effector itself.
Mobile robot
- **Manipulation:** if the effect on the environment causes motion of the objects around.



The role of the controller is to get the effectors to produce the desired effect on the environment, based on the robot's task.



Manipulator



Mobile Robot



Mobile Manipulator

Our perspective

A robotic manipulator is a software controlled mechanical device that uses sensors to guide one or more of end effectors through programmed motions in a given workspace in order to manipulate physical objects.



Manipulators vs Mobile Robot



- Operate in a constrained workspace
- Have absolute measurements of position
- May or may not need to perceive the world around them



- Can operate in unconstrained environments
- Need external sensing to determine position
- Need external sensing to avoid obstacles



Manipulation:

If the effect on the environment causes motion of the objects around.

- Robotic manipulator



Manipulator

Manipulator is a system of set of **bodies (links)** arranged or connected as a chain with the help of **joints (constraints)**

Description

It is used to describe or specify attributes of various objects with which a manipulator system deals.

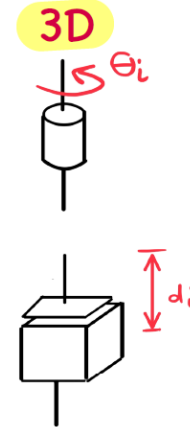
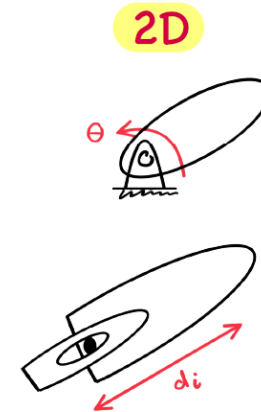
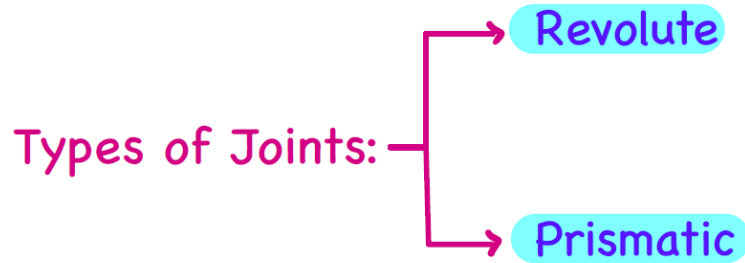
Configuration

Is a complete specification of location of every point on the manipulator



JOINTS

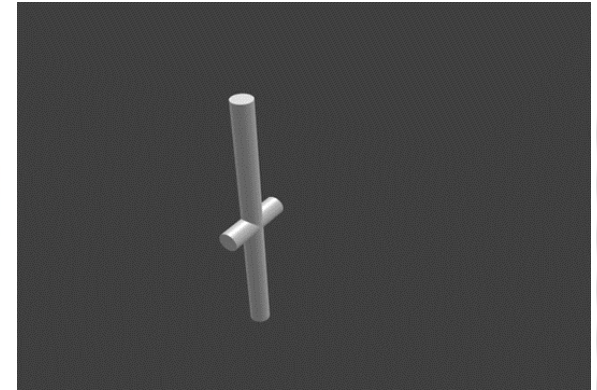
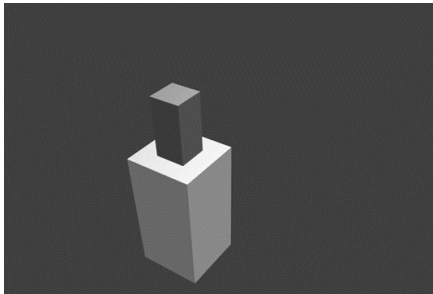
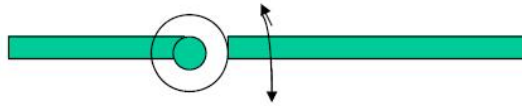
- Joints are used to connect links, being key components to motion realization
- Joints are classified into revolute joints and prismatic joints

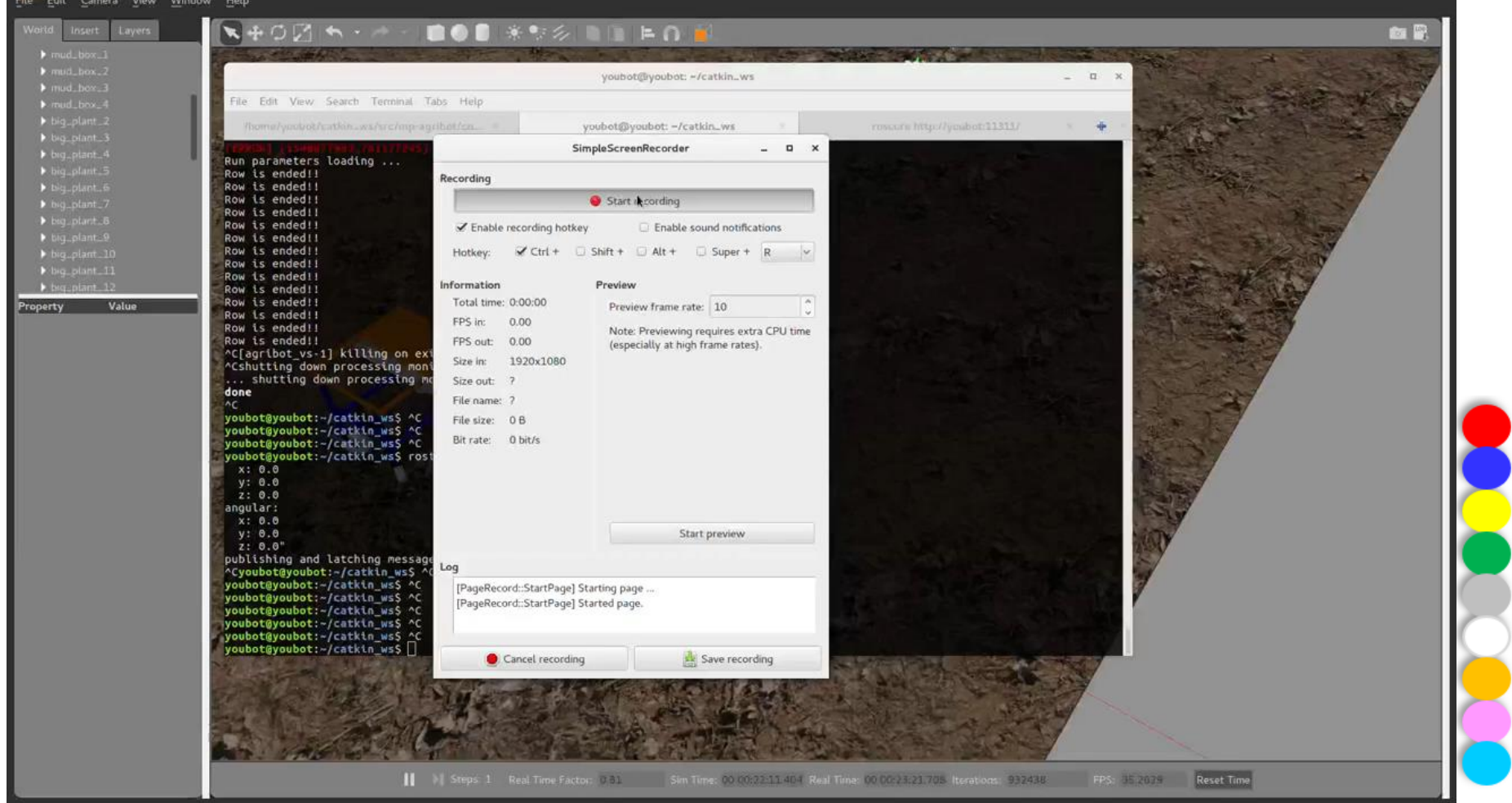


- Prismatic joints: relative linear motion



- Revolute joints: relative rotation





ActivitiesTerminal

Feb 10 10:00

superadmin@01HW2013872: ~/axalta_ws/src

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```
[ INFO] [1644984847.482654374]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
[ INFO] [1644984969.84277506]: Loading robot model 'axalta_robot'...
[ INFO] [1644984971.153223485]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
[ INFO] [1644985257.705491790]: Loading robot model 'axalta_robot'...
[ INFO] [1644985259.113103403]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
[ INFO] [1644985419.292446441]: Loading robot model 'axalta_robot'...
[ INFO] [1644985420.562278610]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
[ INFO] [1644985998.683003529]: Loading robot model 'axalta_robot'...
[ INFO] [1644986000.072628421]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
[ INFO] [1644986105.068349918]: Loading robot model 'axalta_robot'...
[ INFO] [1644986106.514304601]: Ready to take commands for planning group manipulator.
superadmin@01HW2013872:~/axalta_ws/src$ roslaunch move_ur10e kin.py
```

Executed

Goal State:

Clear all maps

<current>

Path Constraints

None

Use Cartesian Path

Collision-aware IK

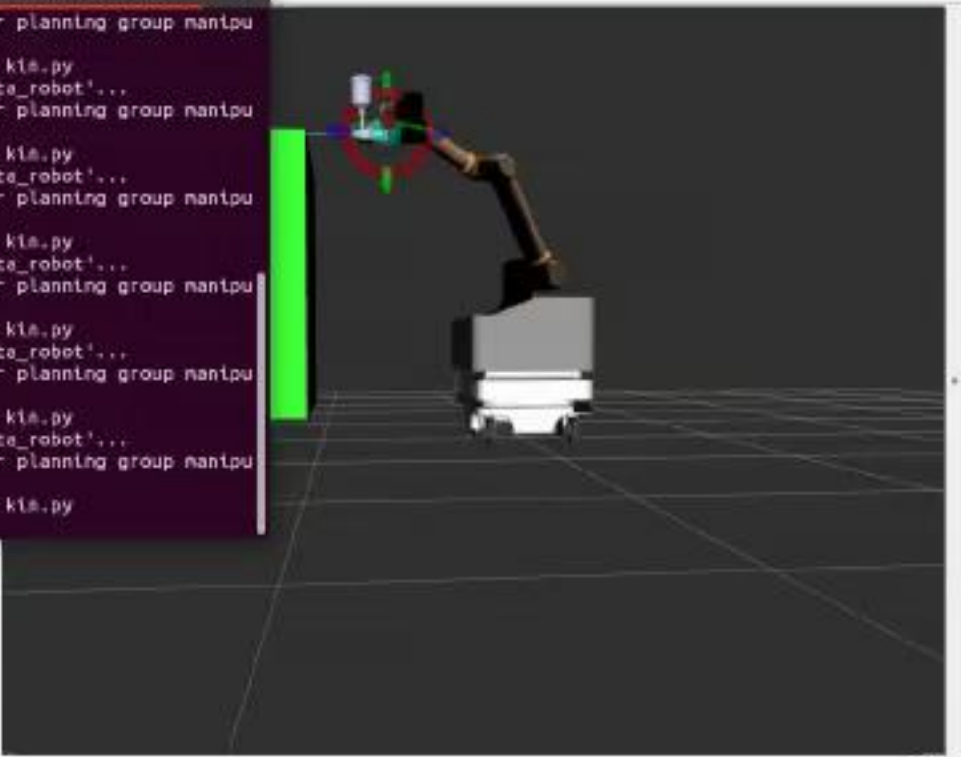
Approx IK Solutions

External Comm.

Replanning

Sensor Positioning

Reset



31 fps





Time for Discussions



Thank You!

