

Assignment-1

Introduction to robotics

(Pradeep saini, 18110120)

Common classification of robots-

1. Manipulators(Robotic arms):

- UR robotic arms:

These are 6 DOF robotic arms. All the joints are revolute joints. As it has a high degree of freedom, it can flexibly go to any point in its workspace. Frameless servo motors are used to actuate the joints. UR3, UR5, UR10 are its types varying in length.

<https://youtu.be/JqHkeq-7WHE>

- Scara robot:

It is a 4 DOF of freedom manipulator. It has three revolute joints and one prismatic joint perpendicular to the plane of revolute joints. It is a very fast and robust manipulator and is thus used in a large number of industries.

<https://youtu.be/qD6hm3xbbzo>

2. Mobile robots(ground):

- Dingo:

They are small, lightweight and cost-effective and modular. They can autonomously go to any location and can move in multi-directions without any rotation of the frame. This robot is highly used for mapping and navigation. They are also used by researchers to investigate multi-robot systems.

<https://youtu.be/NnXYX3Y2KIk>

3. Aerial robots(UAV):

- Drones -

Drones fly in the air by the propulsion created by the rotors present in the drone body. The yaw, pitch and roll motion can be controlled by controlling the angular velocity of the motors connected to the rotors.

https://youtu.be/N_XneaFmOmU

4. Underwater robots(AUV):

- Aquanaut-

This is a transforming robot. The manipulators can come out of the body of the robot whenever required. This robot is used for underwater inspection, maintenance work of ships, submarines etc.

<https://youtu.be/shimvNXyVtw>

- Microbe eddy bots-

These bots can swim very flexibly and faster underwater. They have an appearance like fish. They can collect underwater samples at a very fast rate.

<https://youtu.be/SvdBgrCatAo>

5. Soft robots:

- DIY soft robotic gripper-

This robot adapts like a human hand. They are highly flexible robots. These grippers can be very useful in picking up fruits and vegetables from plants as rigid grippers can damage them easily.

<https://youtu.be/uPx8xwRpfFk>

- Soft robotic fish-

The soft material of these robotic fishes allows them to perform very fast and agile manoeuvres. Its appearance and movement in water is similar to an actual fish.

https://youtu.be/BSA_zb1ajes

6. Microrobots:

- Micro scallop-

This robot is smaller than 1 mm. This robot is capable of swiping. The scallop opens and closes continuously to perform swimming. This robot can not swim in water as it can only swim in non-newtonian fluids.

https://youtu.be/5d_CNu5_z_c

- Magnetic microrobots-

They are only a few millimetres in size. They are capable of performing various tasks by the application of magnetic fields like bending, moving, rotating grasping, jumping etc.

<https://youtu.be/N7IXymxsdhw>

7. Hybrid:

- Cassie robot-

This robot consists of two human-leg like legs. It can walk and run in any terrain without the perfect knowledge of the surface. It is able to avoid obstacles in its path while walking/running.

<https://youtu.be/Is4JZqhAy-M>

- Humanoid robot Lola-

This robot is inspired by the flexibility of movements in the human body. It looks like a human and can perform different movements like a human body. This robot has 26 electrically actuated joints to perform different movements.

<https://youtu.be/cNkQT2SUegE>

Motor types-

1. Brushed DC:

In this type, the plastic side of the stator has copper/carbon brushes that touch the copper pads of the shaft of the rotor. These brushes are good conductors of electricity. They help in the rotor spin continuously by changing the polarity of its winding. The stator of the motor contains two permanent magnets of opposite polarity.

2. BLDC(brushless DC):

In this type of motor, brushes are absent and the component having the permanent magnets acts as the rotor. An ESC(electronic speed controller) is used to supply three-phase current to the windings of the stator. They are of two typer- outrunner and inrunner.

3. Stepper motors:

A stepper motor is also a bldc motor. However, there is a difference between their internal structures and only a two-phase current input is needed in the stepper motors. The rotation in these motors is divided into an equal number of steps. The motor can be controlled to move to these steps and hold its position there. A position sensor for feedback is not needed to control these motors.

4. Servo motors:

Servo motors can be controlled to go to any angular position or to achieve a desired speed or acceleration. A good closed-loop controller and a position sensor for feedback are needed for this motor.

5. AC synchronous motors:

The coil of the stator is supplied with a three-phase AC current which produces a rotating magnetic field. The coil of the rotor is supplied with the DC current producing a static magnetic field. The rotor acts as a permanent magnet and rotates by the interaction of the two magnetic fields. The rotor speed is the same as the speed of the rotating magnetic field, thus called synchronous motors.

6. AC induction(asynchronous) motors:

In induction motors, the rotating magnetic field of the stator induces a current(electromagnetic induction) in the rotor which allows it to rotate. As the rotating magnetic field speed and rotor speed are not equal, it is called the asynchronous motor.