

1. The seven types of robots discussed in class are:

- **Manipulators:** These are generally stationary and have linked arms which can move and access different positions, at different angles depending on the degree of freedom. The following link shows a manipulator with 6 degrees of freedom.  
▶ [KUKA 6-Axis Robot Arm Capabilities](#)
- **Mobile Robots:** As the name suggests, these robots are capable of locomotion and not just stationary movement. Generally refers to robots that are on the ground and use tracks or wheels. One common example is the Roomba vacuum cleaner shown below:  
▶ [Introducing the new Roomba Combo™ j7+ Robot Vacuum and Mop.](#)
- **Limbed Robots:** Like mobile robots, these too move but they possess jointed limbs. A famous example is Spot by Boston Dynamics.  
▶ [Spot Launch](#)
- **UAVs:** UAV is short for Unmanned Aerial Vehicle and they are autonomous robots that fly through the air. One such example is given below:  
▶ [The MQ-9 Reaper Drone: US Most Feared Drone Ever Made](#)
- **AUVs:** These are Autonomous Underwater Vehicles. They are autonomous mobile robots that operate underwater. The following is an example of an AUV made in IIT Bombay  
▶ [Matsya \(Autonomous Underwater Vehicle\)](#)
- **Humanoid Robots:** These are robots that have an upright orientation and have human-like limbs attached to a torso. An example of a humanoid robot is Honda's Asimo.  
▶ [ASIMO Humanoid Robot Honda - Future of robotics from the Asimo period \(ASIM...](#)
- **Microbots:** As the name suggests, these are very small autonomous machines. They can be small enough to operate at a cellular level and are hence of great interest in the medical field. The video linked below illustrates an example of one such robot.  
▶ [Shape-Morphing Microrobots Deliver Drugs to Cancer Cells | Headline Science](#)

2. The types of motors are:

### **AC Motors**

These are motors that are powered by alternating current. They are often used for industrial applications since they are often cheaper than their DC counterparts. They also do not require heavy permanent magnets like DC motors since AC can be used to power electromagnets.

- **Asynchronous Motor (Induction motor):** The speed of rotation of the stator magnetic field and rotor are different. Only the stator windings are excited by AC and this magnetically induces force in the rotor which makes it rotate.

- Synchronous Motors: The speed of rotation of the stator magnetic field and rotor are the same. This is achieved by a magnetically polarized rotor which makes sure that the rotor is always rotating in sync with the stator magnetic field. The rotor can be polarized by a permanent magnet or electromagnet depending on the scale.

## **DC Motors**

Powered by direct current. Use permanent magnets for electromagnetic induction. DC motors are synchronous motors.

They are of the following types

- Brushed DC motor: Commonly used in but not limited to small electronic appliances and are available in a wide range of sizes and power ratings. They have copper or carbon brushes that maintain contact between the stator and the rotor. Their speed is controlled by changing the voltage applied to them and is usually done by a motor driver.
- Brushless DC motor (BLDC): Unlike their brushed counterparts, the rotor and stator are not in contact. This is achieved by magnetic repulsion between stator magnets that are electrically controlled and permanent rotor magnets.
- Stepper Motor: These too are brushless motors. However we can control the movement in steps, hence the name. By controlling the steps, we can precisely control the angle of rotation of the motor.
- Servo Motor: These motors too can be set to a specific angle. These motors have a controller inside that makes sure that the angle specified by an input PWM signal is maintained by controlling the motor torque.