What is an end effector?

- An end effector is the device that is at the end of a robotic arm.
- There are two main types of end effectors: Grippers and tools.
- We can think of an end effector like a human hand. Even though a human hand is very versatile, an end effector has one great advantage that humans do not have and that is the interchangeability of end effectors. If the end effector is not suitable than it can be changed unlike the human hand.

Grippers

- Grippers are the end effectors used for holding the parts or objects
- Grippers are devices which can be used for holding or gripping an object.
- They include what you might call mechanical hands and also anything like hooks, magnets and suction devices which can be used for holding or gripping.
- Grippers take advantage of point-to-point control (exact path that the robot takes between what it is picking up and where it is placing it.
- Grippers should be designed so that it requires the minimum amount of manoeuvring in order to grip the work piece
- Applications of grippers :- Machine Loading and unloading, picking and placing of parts on conveyor, material handling, bottle handling, arranging parts onto pallets, etc

Types of Grippers

1. Mechanical Grippers
2. Hooks and Scoops
3. Magnetics Grippers
4. Vacuum Grippers
5. Expandable Bladder Type Grippers
6. Adhesive Grippers

3) Magnetic Grippers

- Magnetic grippers obviously only work on magnetic objects and therefore are limited in working with certain metals.
- For maximum effect the magnet needs to have complete contact with the surface of the metal to be gripped. Any air gaps will reduce the strength of the magnetic force, therefore flat sheets of metal are best suited to magnetic grippers.
- If the magnet is strong enough, a magnetic gripper can pick up an irregular shaped object. In some cases the shape of the magnet matches the shape of the object
- A disadvantage of using magnetic grippers is the temperature. Permanent magnets tend to become demagnetized when heated and so there is the danger that prolonged contact with a hot work piece will weaken them to the point where they can no longer be used. The effect of heat will depend on the time the magnet spends in contact with the hot part. Most magnetic materials are relatively unaffected by temperatures up to around 100 degrees.
- Electromagnets can be used instead and are operated by a DC electric current and lose nearly all of their magnetism when the power is turned off.
- Permanent magnets are also used in situations where there is an explosive atmosphere and sparks from electrical equipment would cause a hazard

Magnetic Grippers design

4) Suction Grippers

- There are two types of suction grippers:

1. Devices operated by a vacuum – the vacuum may be provided by a vacuum pump or by compressed air
2. Devices with a flexible suction cup – this cup presses on the work piece. Compressed air is blown into the suction cup to release the work piece. The advantage of the suction cup is that if there is a power failure it will still work as the work piece will not fall down. The disadvantage of the suction cup is that they only work on clean, smooth surfaces.

- There are many more advantages for using a suction cup rather than a mechanical grip including: there is no danger of crushing fragile objects, the exact shape and size does not matter and the suction cup does not have to be precisely positioned on the object
- The downfalls of suction cups as an end effector include: the robot system must include a form of pump for air and the level of noise can cause annoyance in some circumstances

Vacuum gripper design