

## Components of a robot

Study the following essay

*Robots and humans share a common feature. Humans and mechanical robots—as opposite as they may seem, they, in fact, share the same underlying structure of links (bones) and joints. The basic skeleton of industrial robots, of which is made up of mainly robotic arms, is a combination of links and joints. Relating it to a human body, parts that can freely bend and move about, such as the elbow and shoulder, are the joints, and the bones connecting those joints are equivalent to a robot's links.*

What are the 2 main mechanical components of a robotic arm mentioned in the essay?

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Examine the **DOBOT Magician** and label the diagram using the 2 keywords



Compare your answer with the diagram displayed on the screen.

## Type of joints

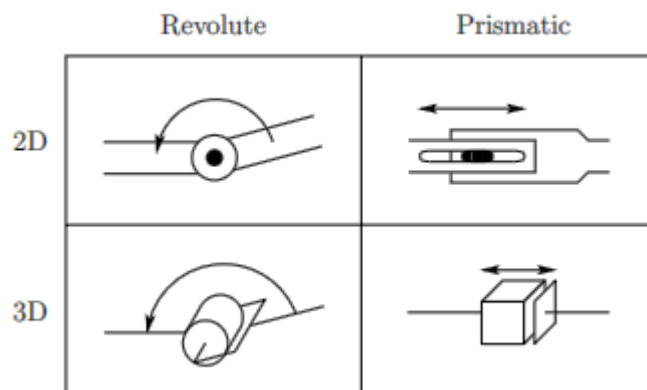
There are various ways to classify robots, for instance, by operation, industry or size. However, here we will focus on the type of joint.

2 joint types commonly used in robotic arm:

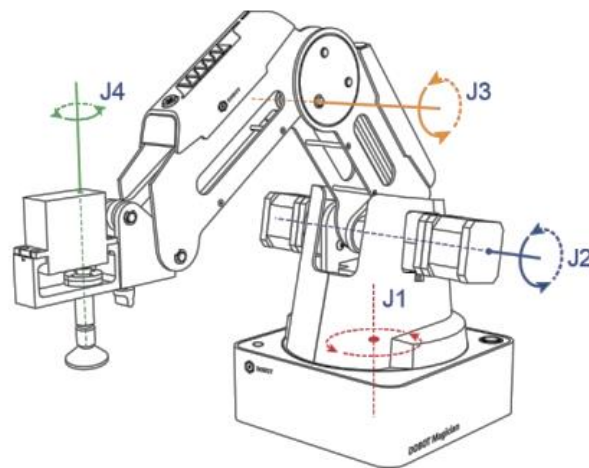
- **Revolute Joint:** Revolute joint can be indicated by the letter R. This type will allow the joints to move in a rotary motion about the axis, which is vertical to the arm axes.
- **Prismatic Joint:** prismatic joint can be represented as P. This type of joints can perform translational (sliding) movement. The two links should be in parallel axes for achieving the linear movement.

Drawing

Robot engineers like to use the following symbols to outline their robots



Suppose you are a robotics engineer, examine DOBOT Magician and use the above 3D symbols to draw a sketch diagram for it.



Your sketch of DOBOT Magician:

Compare your answer with the diagram displayed on the screen.

Do you know why DOBOT Magician is classified as an RRR robot?

*[Hints: what does the letter R mean?]*

## Articulated robots

Fill in the blanks using the following words

- repeat
- precision
- motors
- human arm
- articulated robots

The most common type of industrial robots today is \_\_\_\_\_.  
 They have a similar mechanical structure to that of a \_\_\_\_\_.  
 What really makes articulated arm robots attractive for industrial applications is the \_\_\_\_\_ and strength with which these \_\_\_\_\_ operate, allowing a computer to \_\_\_\_\_ a series of movements over and over in exactly the same manner.

### Video watching

Articulated robots are used in welding car bodies' frames.

[https://www.youtube.com/watch?v=c\\_kTwUisyp4](https://www.youtube.com/watch?v=c_kTwUisyp4)

## Degrees of freedom

The number of joints is described using the “degrees of freedom (DOF)”. For a robot with three joints, we can say it has three degrees of freedom (3DoF). The number of joints is one of the key points when assessing robots. It is also important in manipulating the robotic arm.

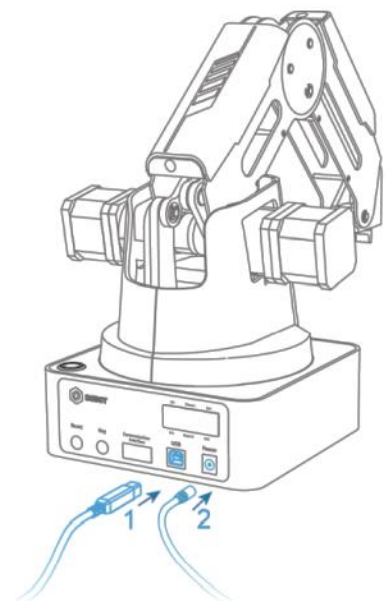
### Practical Session

Connect your DOBOT Magician as shown with the computer and the power supply.

- Cable 1: USB cable to the computer
- Cable 2: power cable to the power supply

### Precaution:

Please make the DOBOT Magician in the workspace with a 45° angle between the forearm and the rear arm before starting up.



Launch the controlling software **DobotStudio**.

Connect using COM3 (or higher) and set the robotic arm to HOME position.

**Precaution:**

*During homing, DOBOT Magician will rotate clockwise to the limited position and then return to the homing position. After homing, if there is a beep sound, it indicates that the homing is successful.*

## Familiar with the operation panel

Complete the following table

| Joint variable | value |
|----------------|-------|
| Joint1         |       |
| Joint2         |       |
| Joint3         |       |

You have the “freedom” to change the value of the joint variable to change the physical position of the robotic arm. You may use the buttons J1+/J1-, J2+/J2- or J3+/J3- to change the value of the joint variables



Draw a line on the paper provided

Mark 2 points on the line A and B

Try to find the combination of joint values corresponding to positions A and B

| Joint variable | Position A | Position B |
|----------------|------------|------------|
| Joint1         |            |            |
| Joint2         |            |            |
| Joint3         |            |            |

In order to change the physical position of the robotic arm, how many "degrees of freedom" (the number of joint variables) can you select from the operation panel?

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What does three degrees of freedom (3DoF) mean when using the software interface to manipulate the robotic arm?

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