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FEATURE ARTICLE

Choosing the Right Robot: collaborative heralds a new age

Collaborative robots are heralding a new age in robotics. With significant, rapid growth predicted, cobots will undoubtedly play a major role in the future of manufacturing. There is now a huge range of robots on the market. Applied Automation looks at how to choose the right one for your application and what collaborative robots can offer.

A new robot revolution is upon us. In a digital age where the industrial landscape is constantly changing, the emergence of collaborative robots is stimulating development in robotics and driving innovation in the market. Cobots are also a key part of Industry 4.0 and are opening up new areas for automation.

The future of the whole robotics industry looks bright. As suppliers adapt to changing demands there are many variants of robots on the market and customers are spoilt for choice. Selecting the right robot could now seem quite daunting.

There are six primary types of industrial robots:

1. Articulated: the unit is fitted with rotary joints.
2. Cartesian or Gantry: the robot is constructed from linear axis.
3. Cylindrical: the robot has one rotary joint at the base and one prismatic joint.
4. Polar or Spherical: the arm is connected to the base with a twisting joint and a combination of two rotary joints and one linear joint.
5. SCARA: the robot is similar to a cylindrical type but has two parallel joints that provide compliance in one selected plane.
6. Delta: where the robot is spider like with three or four arms or parallelograms connected to a common base.

Each type of robot has variations subject to the number of axis fitted or required, or where the robot design has been tailored to suit a specific application.

Applied Automation is a robot integrator and supplier of the Universal Robots cobots. We help manufacturers who want to introduce a robot and work through these seven steps with them:

1. Consider the process:
   There are robots available on the market that have been specifically designed to suit certain applications: welding robots, paint spraying robots and palletising robots for example. In this instance, you can be confident that the robot type is suited to the application.

2. Mass of the product:
   Consider the mass of the product or products to be handled and add to that mass the allowance for the end effector which is generally some form of gripper unit. Also allow for any process loads i.e. if the robot is going to be used to press fit a component into another, you need to add on the insertion

force. Obviously this is one of the most important factors, small robots typically have a load carrying capacity of 2kg or 3kg but some of the big articulated handling robots can carry loads of 2000kg or more.

1. Field of operation
   Determine the field or zone within which the robot needs to operate, the robot reach. Subject to the robot type, the shape of the operating field changes. A Cartesian robot constructed from three linear axis, two horizontal and one vertical, can operate in a simple box or cube shaped zone whereas a SCARA operates in a heart or kidney shaped prism with a circular hole passing through the middle. Some robots can be mounted inverted. It is quite common to see an articulated robot suspended from the ceiling in order to gain the best use of its working envelope.

2. Dexterity
   Decide on the dexterity required. For example, does the robot only need to operate in two planes for a pick and place operation or are the movements required much more complex?

3. Accuracy
   What accuracy/repeatability is required at the end effector? If you need to pick up a part and insert it into a tight tolerance hole, the robot needs to provide sufficient accuracy for the fit to be achieved. The most accurate robots will quote repeatability figures of +/- 0.01mm. For something like a spraying operation you can use a robot with far less precision.

4. Speed
   Determine the speed of the operation or cycle time and be aware of the likely path of movement or any objects within the field of the robot that it may need to avoid.

5. Environment
   What is the nature of the environment within which the robot will operate? There are robots designed specifically for clean room applications where the robot must not shed debris and other robots designed to work in Atex rated environments.

As different types of robot have different features, they obviously lend themselves to certain applications. The articulated robot is the most dextrous. They are frequently used for handling or assembly work, spray painting, spot welding, arc welding and machine loading. Articulated robots are available with load carrying capabilities from a couple of kilogram to more than 2000kg and have a reach of up to four metres. They can be very accurate/repeatable and pretty fast, particularly where a lighter load is carried.

SCARA robots are commonly used for assembly applications or high speed handling of parts. The SCARA robots tend to be quicker than articulated robots but are less dextrous and generally are not able to provide a great reach or the ability to handle large masses.

Cartesian or Gantry robots are relatively simple, usually offering two or three axis of movement in a simple straight line format. They are generally used for simple pick and place applications, palletising or perhaps the unloading of a mould machine. A small scale Cartesian can be relatively low cost, simple to integrate and to programme whereas a large scale Cartesian can be designed to take extremely high loads and have very long axis of travel. However, they tend not to be used for very high speed applications.

Delta are the highest speed robots available on the market with the ability to operate at 10m/s and undertake a standard reciprocal goal post move of 25mm lift, 305mm travel and 25mm lower with a mass of 1kg in 0.36 seconds. Generally though, this robot type is not able to carry very high loads (up to a maximum of 6kg) so they tend to be used for high speed pick and place applications, perhaps picking parts from a moving conveyor and placing them into a container.

Then we come to collaborative robots. They are a game changer. In effect, they are an articulated arm type robot but can safely limit the force generated and set safety limits on the fields of movement. They can work alongside human employees without the need for safety guarding and are used to automate repetitive or potentially unsafe processes. They tend not to handle heavy payloads or operate at high speeds so that is a consideration when deciding whether to go down this route.

Collaborative robots are undeniably the hottest topic in robotics at the moment. It is now the fastest growing segment of industrial robotics. According to ABI Research, it is expected to increase roughly tenfold to $1 billion by 2020, aided by on-going technological innovations and decreasing prices.

Market leader, Universal Robots, has developed a family of three lightweight robots that are sold in 55 countries around the world. Easy to programme and deploy, they are cost effective with a rapid ROI. The company boasts that with their cobots, you can automate virtually anything in almost any environment and industry.

It has been reported that 30% of the collaborative robots sold are being used in applications where a traditional articulated robot would operate. That means a staggering 70% are being used in new applications. As they are easy to use, flexible and relatively cheap, they are bringing value to areas where automation was previously impractical. They are making it accessible to smaller companies and improving productivity. For sectors such as medical assembly, cobots are an attractive proposition. They cause little disruption, being easily deployed to work alongside humans on the production line and do not require a large capital outlay.

The whole robotics industry is evolving and the pace of change is accelerating. Global sales are expected to gain significant momentum in the next few years and robotics technologies will play a major role in the future digitisation of factories and Industry 4.0.