Group 4

Systematization of fundamental technologies in industrial robots for manufacturing use 1)Sensor Technologies


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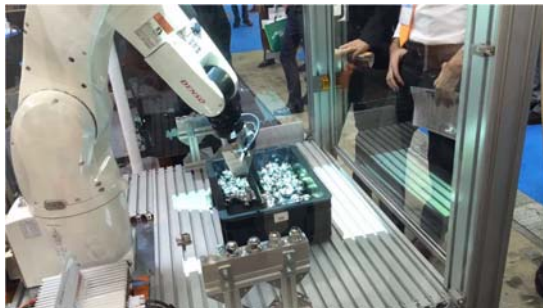Jacky Wong
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Introduction

Nowadays, sensors are an important part in our life. There are sensors everywhere, for example in an elevator, a door lock, or even in your phone!

In this study report, we will introduce five different kinds of sensors which can have various uses in the industrial area.
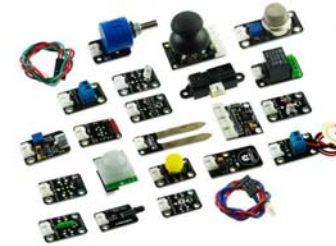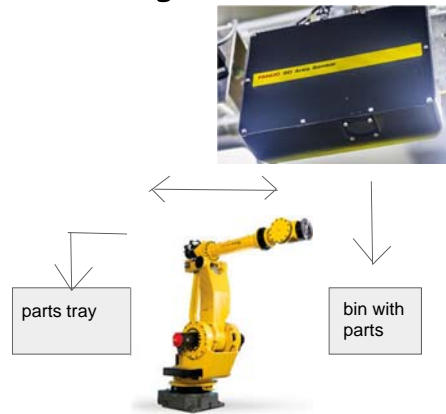

3D Vision

3D vision is an extraction of 3D data from digital images. This technology can calculate out an object's coordinates by capturing a photo of it. Mechanical arms often works with a 3D vision system, especially when it needs to pick parts from a bin to a parts tray.

Use of this technology -- Bin Picking

One way to apply the 3D vision onto Bin Picking is through the 3D area sensor. I found some of the companies creating Bin Picking projects that pick up parts, parcels and even lining up dices! Although it only gets a two-dimensional picture, it can calculate out the angle of the part and cooperate with the mechanical arm to pick it up, turning it into a tri-dimensional action.

parts tray

bin with parts

As the quality and speed of manufacturing things increases, high-speed producing is becoming more essential. The combination of mechanical arm and 3D vision can seperate different kinds of parts precisely in a speedy time. Besides, Fanuc also develops a self-learning system that involves 3D area sensor. It can improve its accuracy every time it scans the bin. With these two improvements, the speed of manufacturing can be reduced.

Force Torque Sensors

A force torque sensor is a 6-Axis sensor designed for force and position control. A torque is the tendency of a force to rotate an object about an axis. Using this, the robot can know how much pressure is between it and another object and use that data to calculate. Here is a video where Robotiq show how their Force Torque Sensor works.
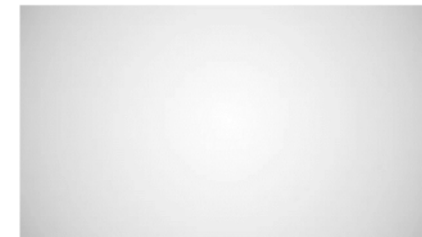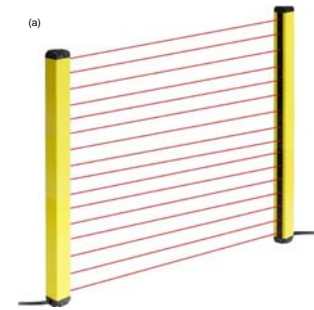
Where can we use this type of sensor?

With the help of the force torque sensor, the robot can precisely assemble every small part. It does this through :

1. Roughly positioning the parts with vision technology

2. Slowly "wiggling" the part

3. Force torque sensor detects force feedback that means the part is in place

4. Putting the part in

Safety Sensors

(a)

Nowadays, many factories use the robotic arms to produce products. It is fast and accurate but it may harm the workers, so we use the safety sensor to help the robotic arms to detect is someone near it. If there is a person , the robotic arms will be more careful to not harm the workers. Instead of it, we can make some ways to stop the robotic arms if they go wrong or will harm someone.

It can make the process of producing more safety and reliable, also protect the workers not to be injured.

(b)

A safety sensor is a kind of sensor that uses laser to detect if there is anyone near the robotic arms. If there is, the robot will slow down.It is usually used in factories where there are a lot of robots. It can help the workers work with the robots more comfortably and safely.

(c)
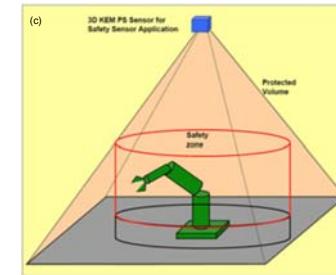
There is an other kind of safety sensor in robotic arms. It can also protect the workers not to be injured but it use another way to do it.

The robotic arm is made out of a special material which is like a touch sensor. When there is a worker near the robotic arm, the workers can push it and make it stops. It can make the process of producing faster and also protect the workers.


Infrared thermal imager

The Infrared thermal imager have two different types of detect ways. The first type, the photon detection uses the electric effect on the semiconductor material of photons to generate the image and it has high sensitivity. But the temperature of the detector will affect them,so we need to cool the detector down.

The second type, the thermal detection turn the heat which were caused by the rays into electrical signals, the sensitivity is worse than the first type but we do not need to cool it.

People use the infrared thermal imager into many places such as military uses, it can discover the engine of the tank and the soldiers at night.

People combine the infrared thermal imager with different sensors such as the ultrasonic sensors to invent a robot to save lives in many disasters. The robots do their rescue job to perform to the tourist in iREX.
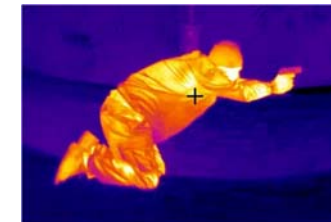
Tactile sensors
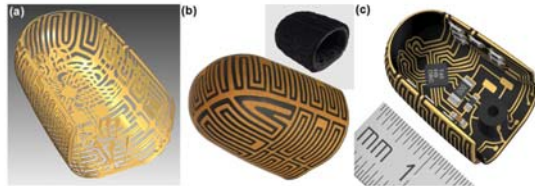
A popular sensor

Tactile sensors are becoming more popular these days. This kind of sensor is, most of the time, fitted on a gripper to detect and feel what is in it.

## Here is a video about tactile sensors

My research in iREX

This is Dual COBOTTA Co-Painting. It uses tactile sensor to control the pressure of the pen. If the pressure is too high, the paper will break. If the pressure is too low, you cannot draw anything on the paper.

How a tactile sensor works

The tactile sensors are usually able to detect forces and draw an array of vectors with the force distribution. That can show the exact position and shape of an object and allows you to control the position and the grasping force of the end effector. Some tactile sensors can also detect heat variation.
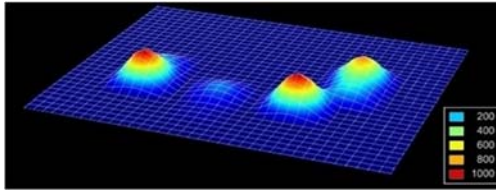
This is a tactile sensor vetor. It can detect the force distribution.

Conclusion

Nowadays, the development of the industrial robots have become more and more important as the decreasing of the labor force in the developed countries. In order to keep the quality of manufacturing precise, safe and convenient machines are required. Sensor technologies plays a vital role in machines. As we mentioned before, sensor technologies can be applied in various fields. Robots will gradually become our great cooperator in our life.

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~THE END~
Thank You