

## Industrial Applications

What types of **SENSORS** are used with robots?

- Pressure sensors
- Heat sensors
- Light sensors
- Sound sensors

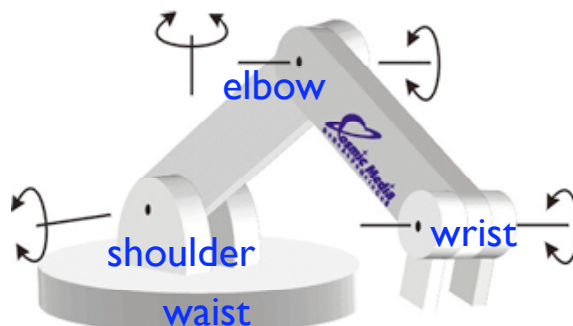
What is **FEEDBACK**?

- Having a sensor is useless unless, the sensor sends a signal to the program controlling the robot detailing the reading on the sensor.
- This is **FEEDBACK**, allowing the robot, via the control program, to change what it does.

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What parts make up a robot's arm?

- Waist, shoulder, elbow, wrist.
- Not all of these parts need be included, but the more there are, the more adaptable the robot will be.



What **TOOLS** does a robot use?

- The tools are the part on the end of the arm, i.e the 'hand', allowing the robot to do various tasks.
- An adaptable robot has different end effectors allowing it to do different tasks.
- Examples are a suction cup, gripper, welding torch, paint sprayer etc.

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How are robots given instructions to carry out a task?

- Using a program written in any high level language or perhaps a special control language.
- Or using LEAD THROUGH PROGRAMMING where a human operator guides the robot through the task to be performed, say, painting a car door.
- Sensors on the arm are activated and the specific actions are stored on the controlling computer which allows the robot to do the painting on its own in the future.

Why might a special purpose control language be used to program a robot?

- Specific robotic commands like GRASP, MOVE can be used.
- One such command could take many lines of code in another high level language slowing down the running of the program and the speed at which the robot works.

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What advantages are there in ROM based software controlling a robot?

- Program does not take time to be loaded, i.e quicker.
- Software cannot be changed or lost.

What disadvantages are there in ROM based software controlling a robot?

- Programs cannot be amended for different purposes.
- More expensive way of storing software.

What is an EMBEDDED SYSTEM?

- A tiny computer inside another larger piece of equipment such as a car or a mobile phone.
- All software for such systems is stored on ROM.
- Data is processed in REAL-TIME.

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What advantages are there in RAM based software controlling a robot?

Programs can be updated and changed to allow robot to perform a different task.

What disadvantages are there in RAM based software controlling a robot?

Programs can be accidentally erased meaning robot will not be able to operate.

Program has to be re-loaded to robot whenever the program is changed.

RAM chips must contain a constant charge to ensure vital programs are not erased.

What makes an automated system ADAPTABLE ?

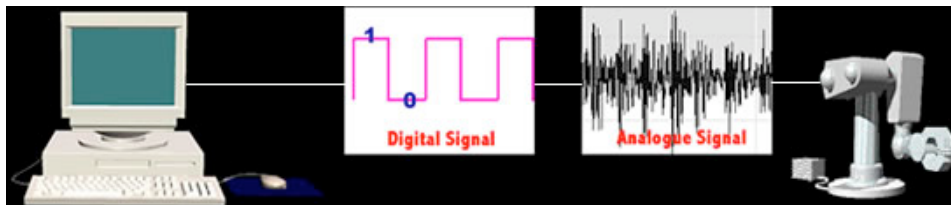
When it is re-programmed to do many different tasks.

## Industrial Applications

Why are ANALOGUE TO DIGITAL CONVERTORS (and vice versa) needed in automated systems?

Many sensors use analogue signals which cannot be understood by the computer which uses digital (binary) signal. Therefore, the signal must be converted.

The same applies when a signal is sent from the computer to the sensor, where a digital to analogue convertor is required.



Why should a SYSTEMS ANALYSIS be carried out before automating a system?

To see if it is financially wise to automate the system.

To discover what tasks should be automated.

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### ✓ What is a SIMULATION?

✓ An imitation of a real life situation using another method such as a computer program or a custom built machine.

### ✓ What are the advantages of using a SIMULATION?

✓ Dangerous scenarios can be tested without the possibility of anyone being harmed.

✓ Simulations can cut down on the costs of using real machines such as cars when testing.

### What is a STATIONARY Robot?

✓ One which performs its task without moving its position on the floor or area it works in.

### What is a MOBILE Robot?

✓ A mobile robot moves around to perform its tasks using wheels etc.

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### What advantages are there to automated systems over manual systems?

✓ Robots can maintain a high level of work constantly. They don't get tired, hungry or need breaks.

✓ They can work in adverse conditions such as under the sea, in space, in radioactive areas, in fires.

✓ Robots are programmed to be very precise, e.g. Mixing highly explosive chemicals can be very dangerous unless measurements are highly accurate.

### What disadvantages are there to automated systems over manual systems?

✓ People will lose their jobs and may struggle to find another.

✓ Automated systems can cost many millions of pounds to implement.

✓ Maintenance budgets are very costly.

✓ If robots break down, the whole system may grind to a halt, again costing money.

# Industrial Applications

## Why do automated systems require REAL TIME OPERATING SYSTEMS?

- Real time operating systems react to input immediately, without any kind of delay.
- This is needed with automated systems and simulations where any delay makes the system unrealistic and unable to work correctly.

## What are the advantages of Computer Aided Design and Computer Aided manufacture (CAD/CAM)?

- Allows detailed animations to be studied without the need to build a model.
- Allows for very highly detailed and precise diagrams to be produced.