



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

200
1822 - 2022

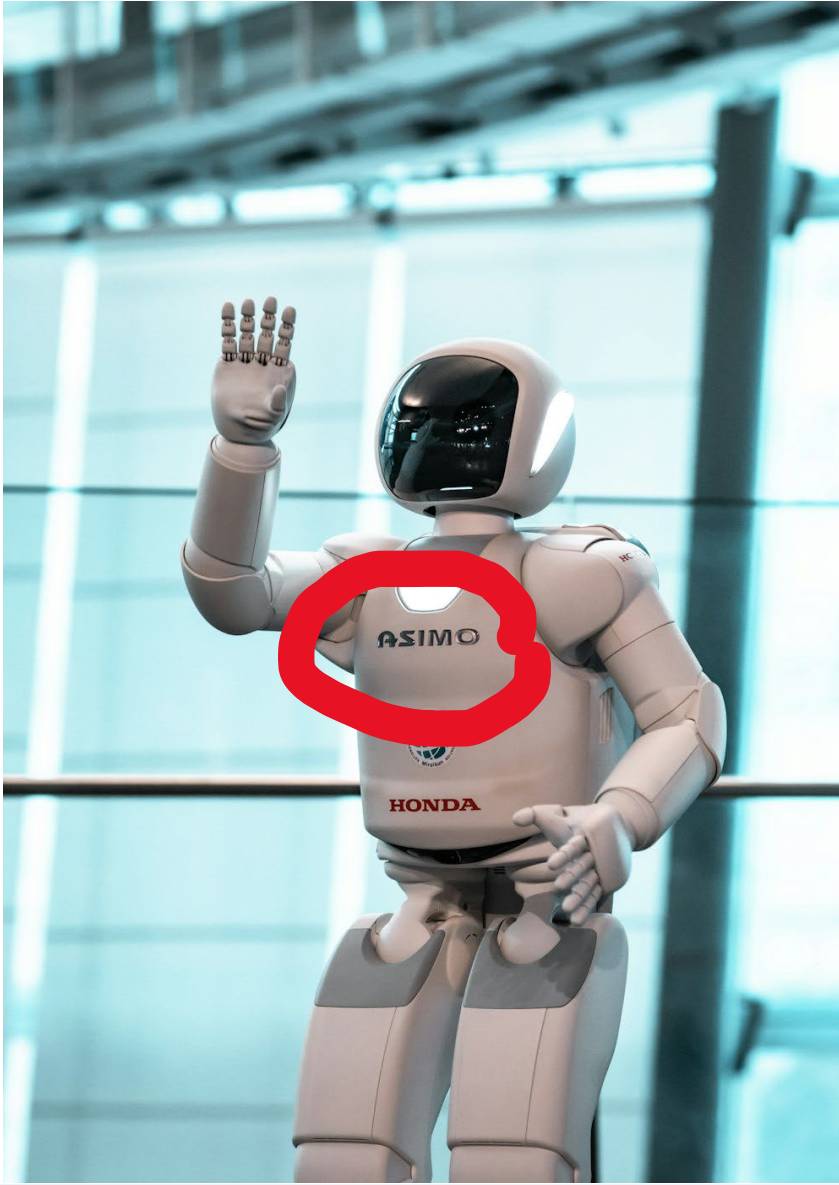
PRIME LESSONS

Introduction to Robots

Man Geni Addysg Uwch yng Nghymru
Where Higher Education Began in Wales



What is a Robot?



What is a Robot?

Ans:

A goal oriented machine that generally can sense, plan and act autonomously

3 Laws of Issac Asimo



- A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
- A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Quiz

What is robotics?

- a. The study of insects
- b. The study of robots and their applications
- c. The study of rocks and minerals
- d. The study of rocket propulsion

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What is robotics?

- a. The study of insects
- b. **The study of robots and their applications**
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Robotics is the interdisciplinary study and practice of the design, construction, operation, and use of robots.



Quiz

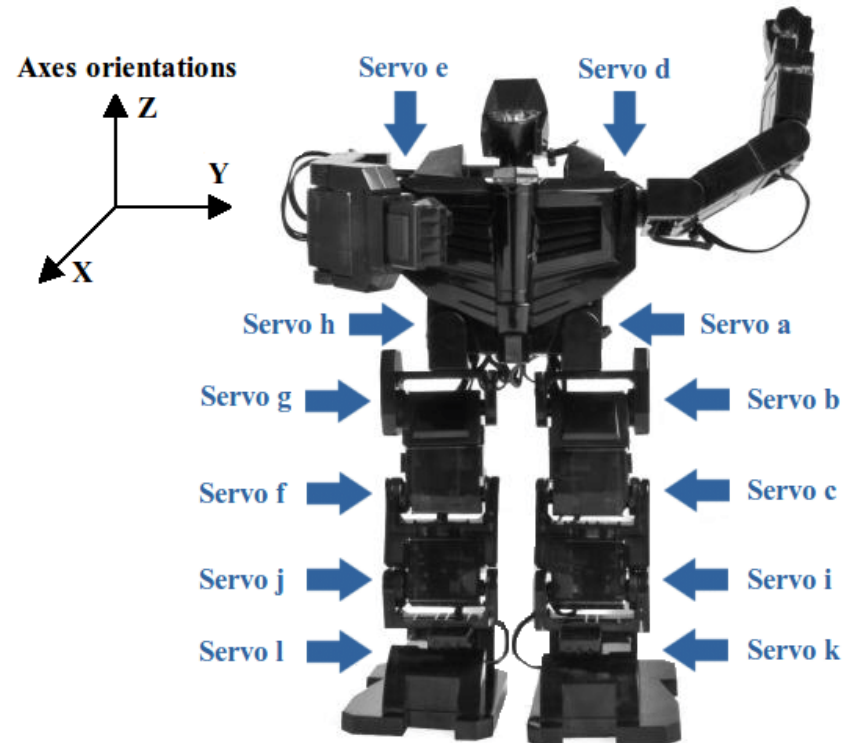
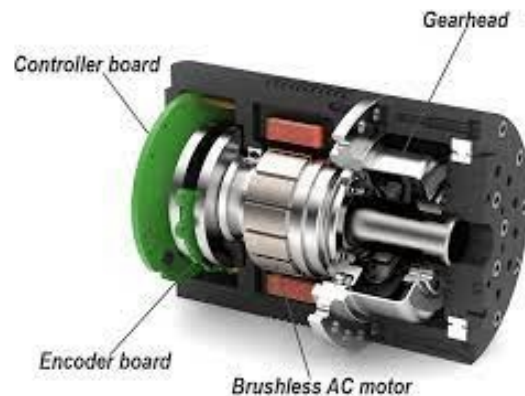
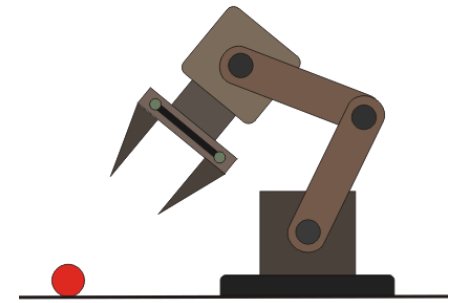
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- a. Microscope
- b. Servo motor
- c. Telescope
- d. Piano

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3. What is a microcontroller in the context of robotics?

- a. A tiny computer that controls the robot's movements
- b. A small animal trained to perform tasks
- c. A type of musical instrument used in robotics
- d. A telescope for viewing microscopic robots

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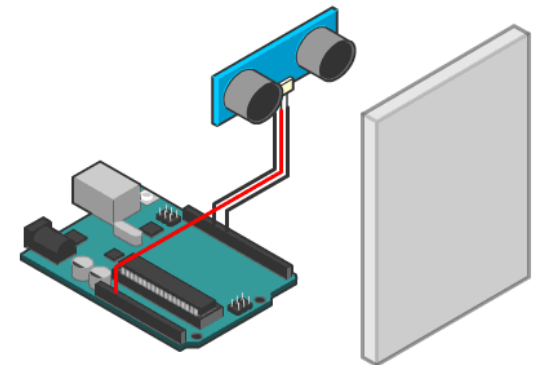
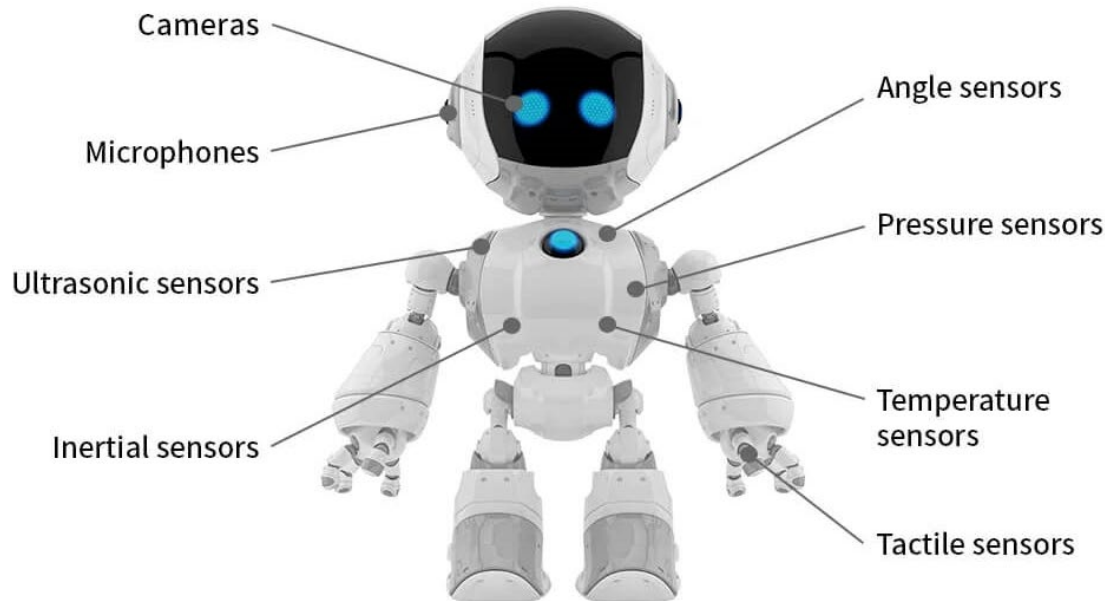
5. What is the purpose of sensors in robotics?

- a. To make the robot look more appealing
- b. To detect and respond to changes in the environment
- c. To play music
- d. To help the robot speak

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Quiz

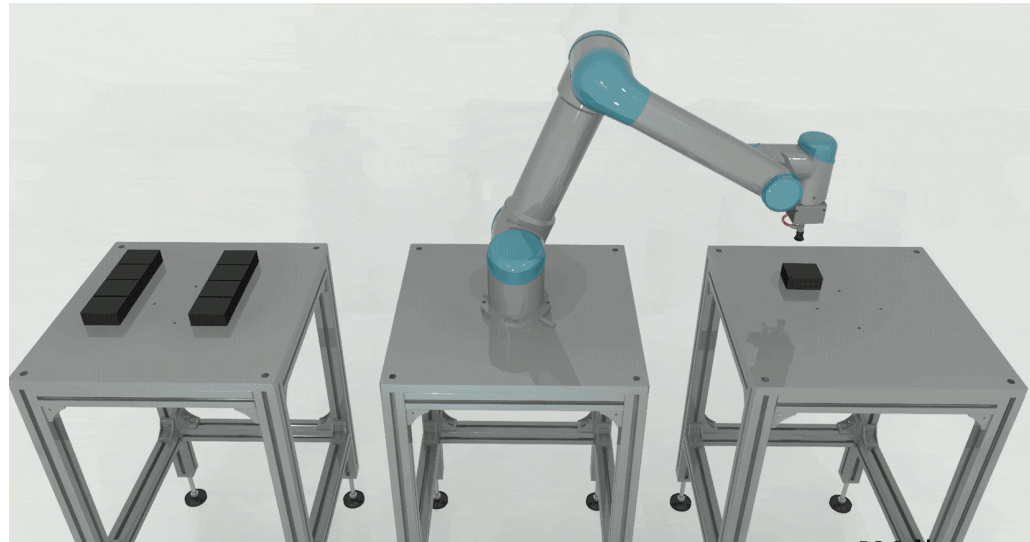
6. Which term refers to the ability of a robot to perform tasks without human intervention?

- a. Artificial intelligence
- b. Automation
- c. Robotics surgery
- d. Cyborg

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Quiz

7. What does the acronym "AI" stand for in the context of robotics?

- a. Alien Intelligence
- b. Artificial Invention
- c. Artificial Intelligence
- d. Advanced Interaction

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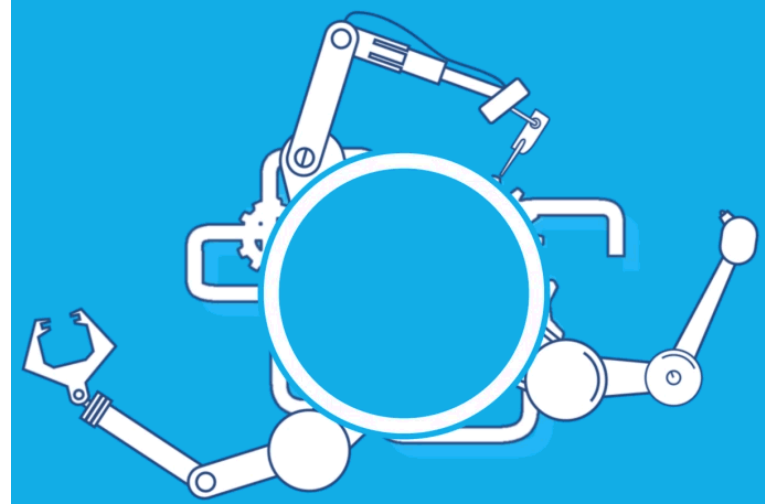
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- c. Screw
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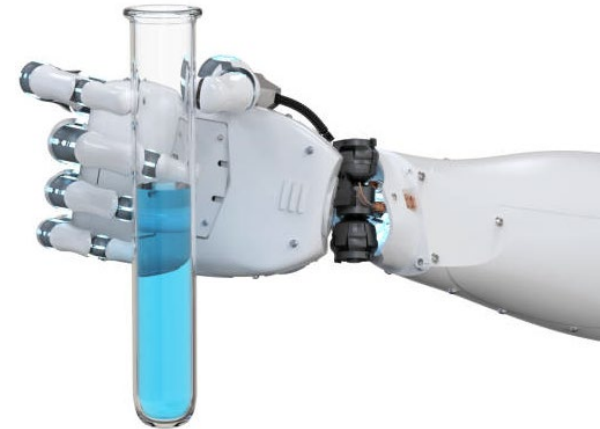
9. In the context of robotics, what does "End Effector" refer to?

- a. The robot's brain
- b. The robot's hand or tool at the end of its arm
- c. The robot's power source
- d. The robot's eyes

Quiz

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Quiz

10. Which of the following is NOT a type of robot?

- a) Surgical robot
- b) Vacuum cleaning robot
- c) Smart toaster
- d) Humanoid robot

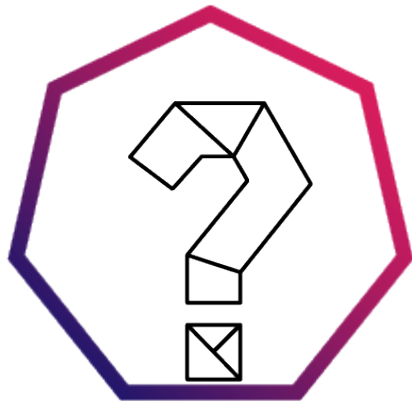
Quiz

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What is a robot?

When you think of a robot, what do you imagine, and why?



Sketch and label how you imagine a robot.

Share and explain your sketch.

Discuss why you chose this type of robot.

Then, share a definition of a robot - try to think like an engineer.

Robots replace human effort

A robot is a **programmable** machine that can carry out **complex actions** with **speed and precision** and **without the need for human intervention**.

What **complex actions** might this robot carry out?

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Why do **speed** and **precision** matter in industry?

----->



What **programming** might this robot require?

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How might this robot avoid the need for **human intervention**?

-----<

What do robots need to work?

Robots can replace human effort through, for example:

Complex actions:

- Lift, move and manipulate an object or tool.
- Mill a shape from a block of material.

Programming:

- Sequence of movements.
- Decisions depending on inputs.
- Safety responses.

Speed is important for productivity.

Precision is important for quality and functionality.

Human intervention can be limited by effective programming and use of input sensors that enable the robot to respond to 'most likely' scenarios, for example to sense that the object to be worked on is in the correct position, that the tool is correct and calibrated, that the machine is safe etc.



Industrial robots **move**, **manipulate** and **process** pieces of work. They need to obtain and process **information** about their position, state and environment.

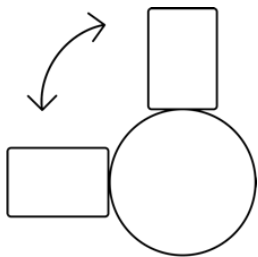


What features would allow the robot to move, manipulate, process an object and obtain information about its position, state and environment?

What do robots need to work?

Robots can replace human effort through, for example:

Actuators for movement



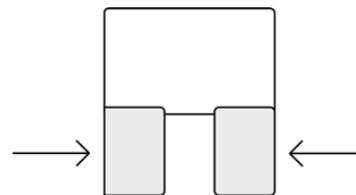
Examples:
Linear
Rotational

Sensors for information



Examples:
Position
Angle
Proximity or touch
Force
Vision

End effectors for manipulation and processing



Examples:
Tool holder (gripper, paint, weld, drill, mill)
Gripper
Pin
Suction



Imagine you are a production engineer considering robotic automation. List some **advantages** and **limitations** you might identify.

Advantages and limitations of robotics

Advantages

Fast
Tireless
Accurate
Consistent
Can work in hazardous environments

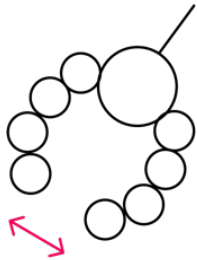
Limitations

Expensive
Complex
Employee safety
Limited decision-making
Limited dexterity



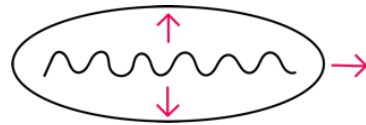
- In terms of human abilities, what weaknesses can robotics successfully replace or improve, and what strengths do robotics currently fail to replace?
- Discuss what innovations you think will help robotics to replace or improve these human strengths.

Emerging technologies, innovations and impacts



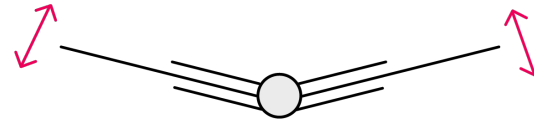
Soft robot

Inflatable silicone pouches expand with air then contract so soft 'limbs' move and grip.



Swimming robot

Sequential actuators 'undulate' wings, like how a cuttlefish swims and can move on land.



Flying robot

Electrostatic 'muscles' contract and relax when stimulated. A high-frequency signal enables rapid 'flapping'.



Discuss how each of these innovations might have a useful industrial application.

Careers and robotics

Design engineer

Creates the overall design solution for a robotics task.

Electromechanical engineer

Designs how the robot will use sensors, actuators and end effectors.

Mechanical engineer

Designs the moving parts of the robot.

Software engineer

Writes the software and algorithms for the control systems.

Automation engineer

Plans, implements and monitors factory automation.

Sales engineer

Helps clients choose the right robotics product for their needs.

Introducing robotics

Design a future robot

We can only engineer what we imagine. When we reimagine what a robot can look like, we create new possibilities.



- Design a future robot that overcomes one limitation you identified.
- Identify what your robot needs to do, how it might sense its environment and how it will move and manipulate things.
- Include one of the innovations you've seen, or ideas of your own.
- How does this reimagine what an industrial robot can be?
- How might your robot incorporate AI?



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