ROBOTICS

CONTEXT

Robotics technologies are increasingly capable, varied and deployed in a wide range of sectors and applications. Robots can be found working in manufacturing, logistics, agriculture, healthcare, energy, hospitality and more, from picking fruit to surveying offshore wind turbines.

TECHNOLOGY

Technological advancements such as in artificial intelligence, sensors, materials, batteries and electronics have led to increasingly capable and versatile robotic designs being possible, supporting their use in a wider range of applications. Advanced robots are increasingly able to function autonomously with precision, work together, and be adapted quickly to new tasks or situations.

FUTURE THINKING

For the remainder of this decade, it is highly likely that robotics technologies will continue to expand into new sectors and applications, particularly if costs fall and advances continue in areas like dexterity and autonomy. Artificial intelligence is highly likely to be key to unlocking new and improved robotics capabilities such as autonomy in difficult environments.

UK POSITION

The UK boasts a strong robotics R&D environment and produces globally competitive research. The UK is well placed to benefit from the opportunities of more capable and versatile robotics technologies, particularly where it can draw on existing strengths such as in marine, nuclear, medical, and agricultural robotics. However, the UK faces challenges to translate research strengths into commercial success.
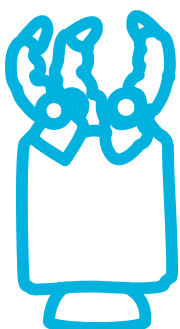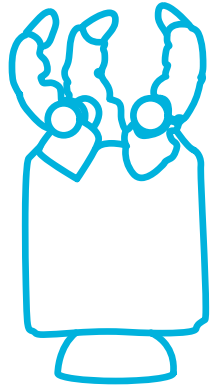
205,000 SALES of professional service robots in 2023, a yearly increase of 30%
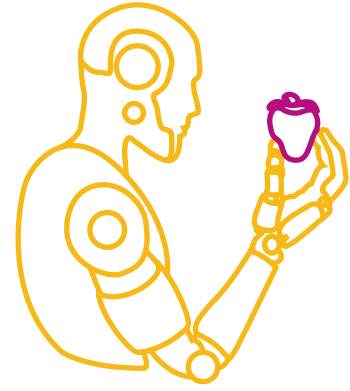
Ref: International Federation of Robotics
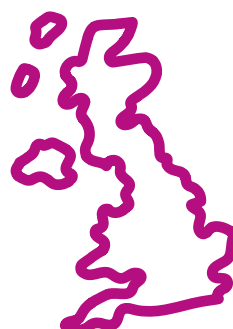
The UK ranks **1st** for **research quality** in Robotics. The UK ranks **3rd globally** for early-stage private **investment** in robotics.

Source: Dimensions & Pitchbook
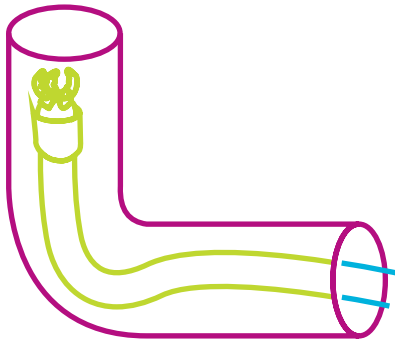
ADVANCES IN ROBOTICS

Dexterity

Manipulation of objects with more care and precision. A continuing challenge to unlock robotics potential.
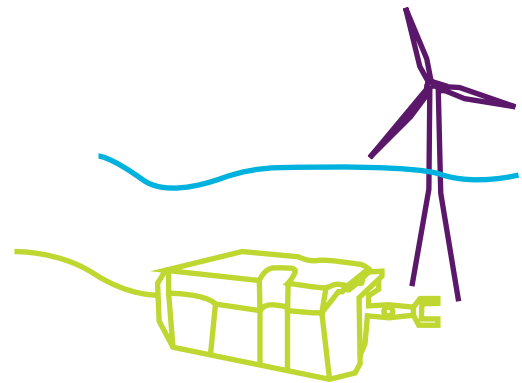
Sensing

Improvements in tactile sensing allow robots to handle delicate goods.
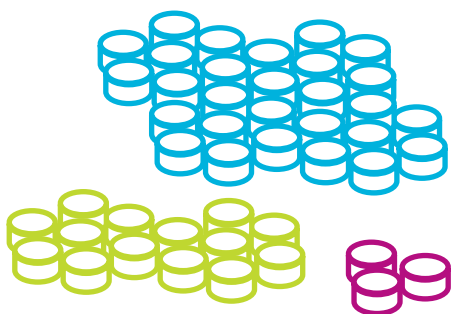
Flexibility

Soft robots allow flexibility to work in new and challenging environments, as well as improving safety for humans around them.

Control/Autonomy

AI is driving advances in autonomy, allowing robots to adapt to new tasks and situations.

Swarm

Multi-agent systems enable tasks that a single robot cannot perform and ensures complex coordination in dynamic environments like logistics.

Size

Additive manufacturing techniques are enabling rapid prototyping and smaller and smaller robot designs.

WHAT COULD AI MEAN FOR ROBOTICS

AI in robotics is not new or essential for every robot. However, researchers are increasingly interested in the potential for recent developments in generative AI and large foundation models, to enhance robotic capability and autonomy.

Sensing & Vision
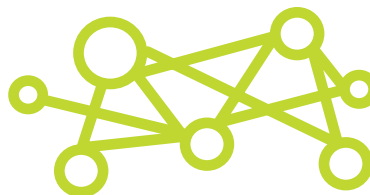
Multi-Agent Control

Learning & Autonomy

System Efficiency

Human-Machine Interaction

OPPORTUNITIES

- **UK Research:** Home to internationally regarded institutions, industry collaborations, and a strong robotics R&D environment, the UK attracts global talent.
- **Hazardous environments:** An area of UK expertise, for example nuclear decommissioning, where the addition of robots can keep people out of harm's way.
- **Agricultural robotics:** Could enhance UK food production, resilience, and mitigate the impact of labour shortages and climate pressures.
- **Health and Social Care:** The number of robot-assisted surgeries in the UK is increasing, alongside developing applications for diagnostics and assistance.

CHALLENGES

- **Commercialisation:** Although the UK has a strong research ecosystem and secures a competitive amount of early-stage private investment, it faces challenges in scaling up innovations.
- **Global and domestic challenges:** The UK faces rising international competition, supply chain reliance, and domestic issues like finance access, skills, and low adoption rates.
- **New risks:** The introduction of robots and other cyber-physical infrastructure into new settings can result in new risks while reducing others, such as increasing vulnerability to cyber-attacks while improving workplace safety.

Please share your views.
Email us at **emtech@go-science.gov.uk**