

Robotics in Construction

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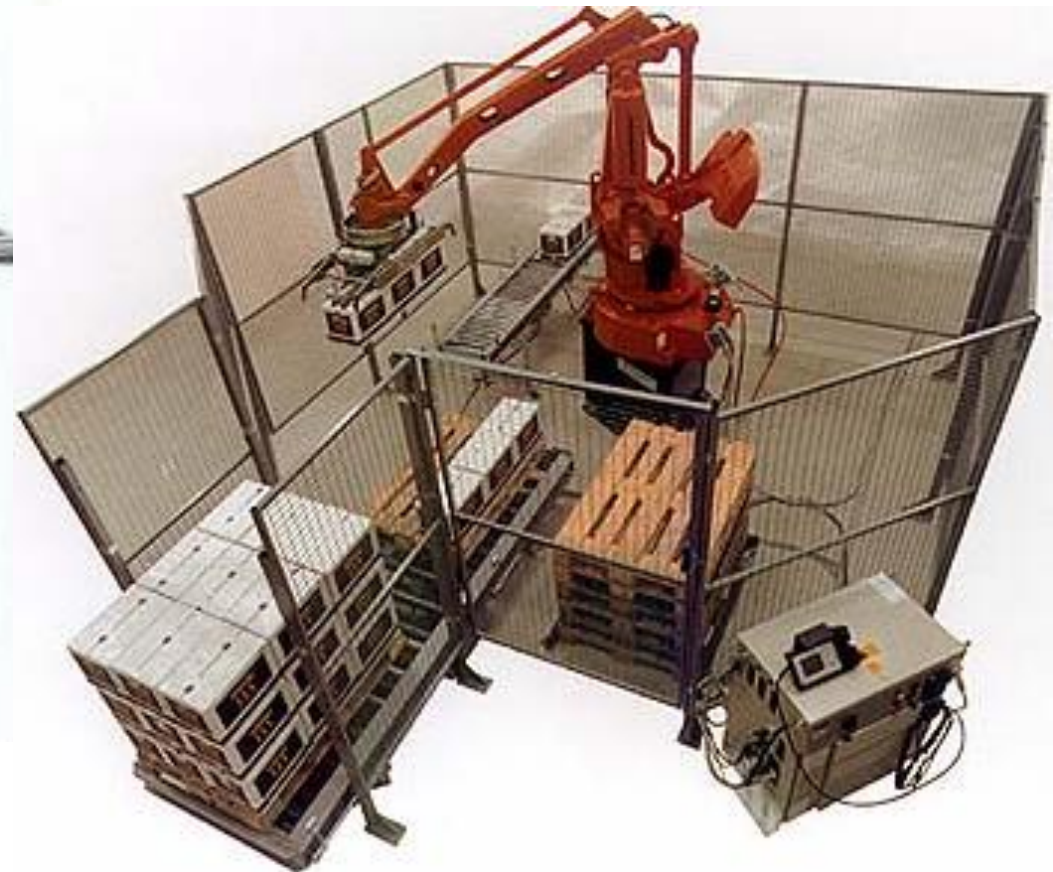
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Learning Objectives

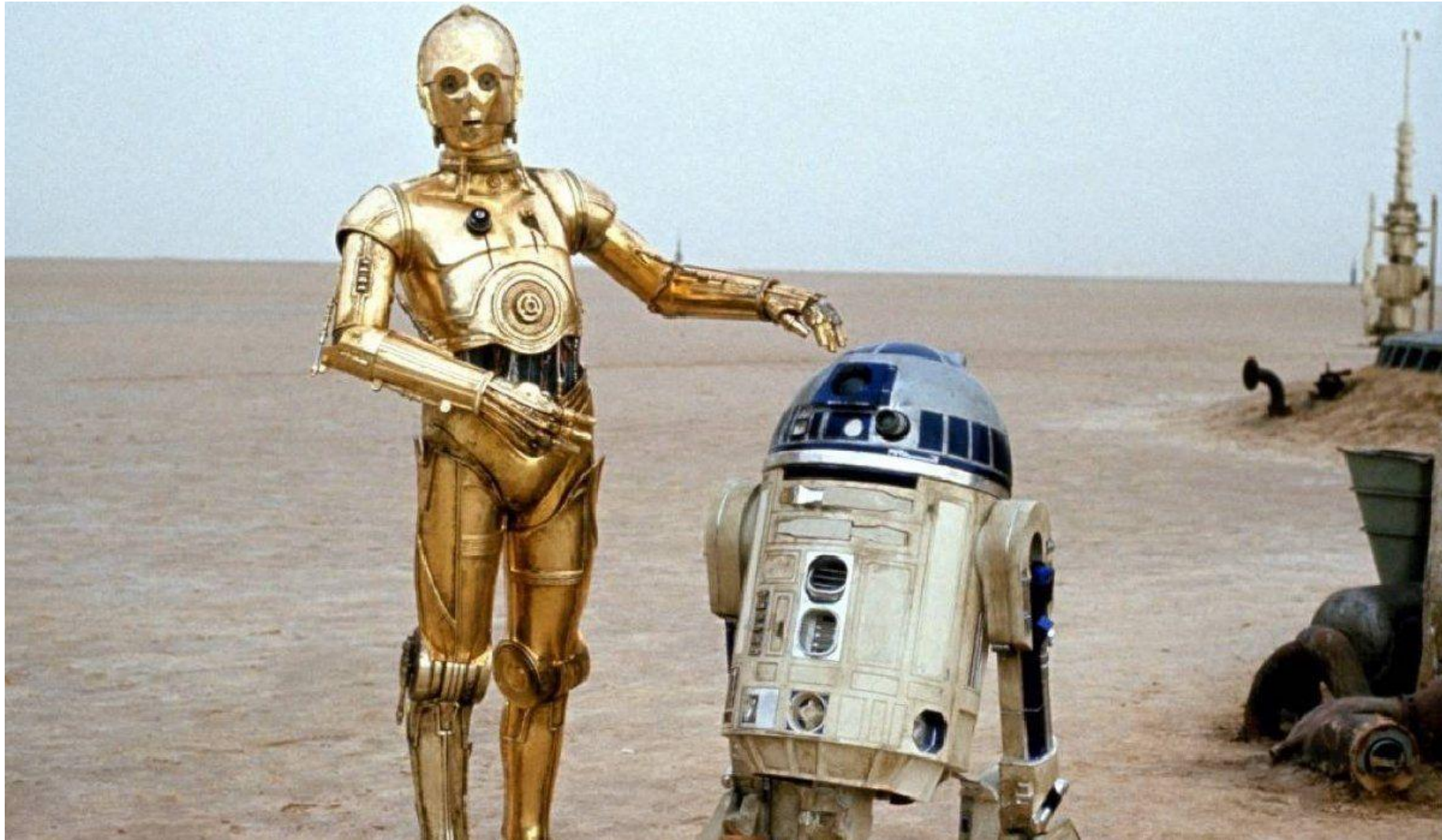
- Understand what robotics means
- Discover how robots are used in construction
- Learn about basic robot components and functions
- Explore real-world examples and think about future possibilities

Robots



Slides Courtesy of
Benjamin Kuipers

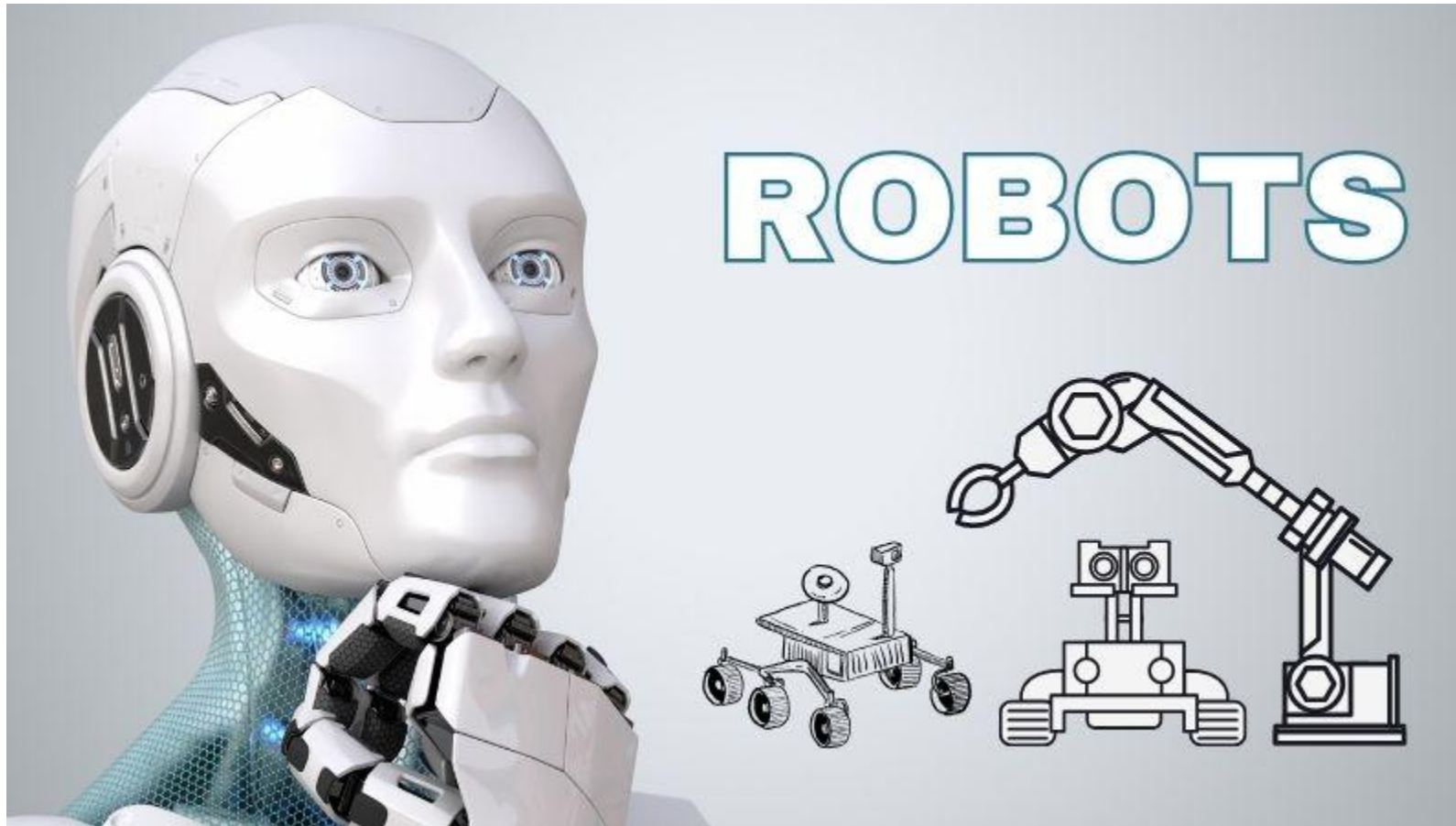
Robots



Robots

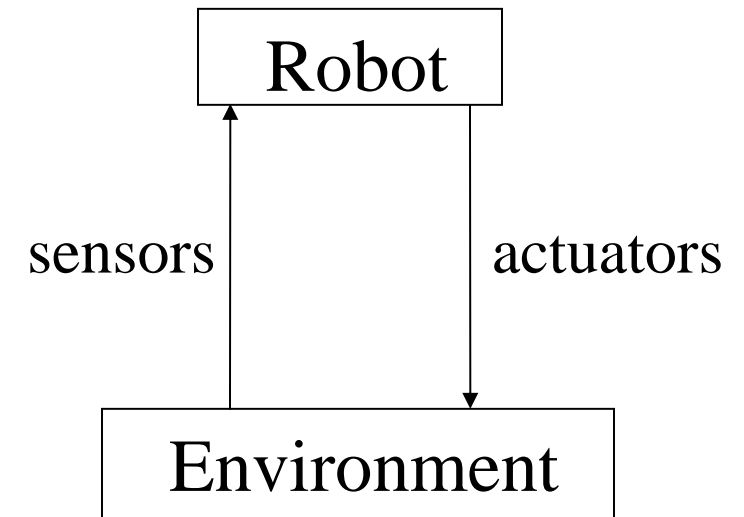


What is a robot?

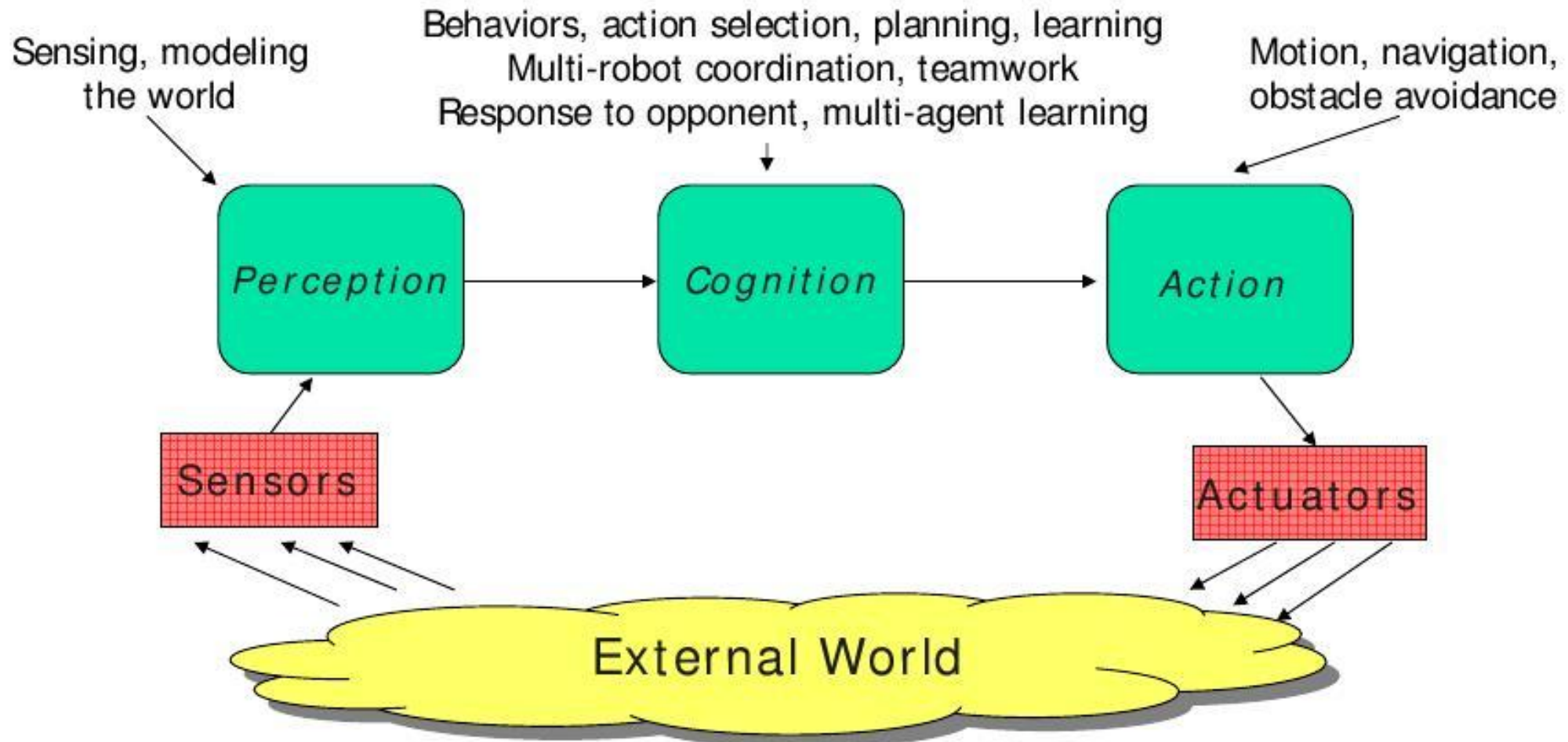


What is a robot?

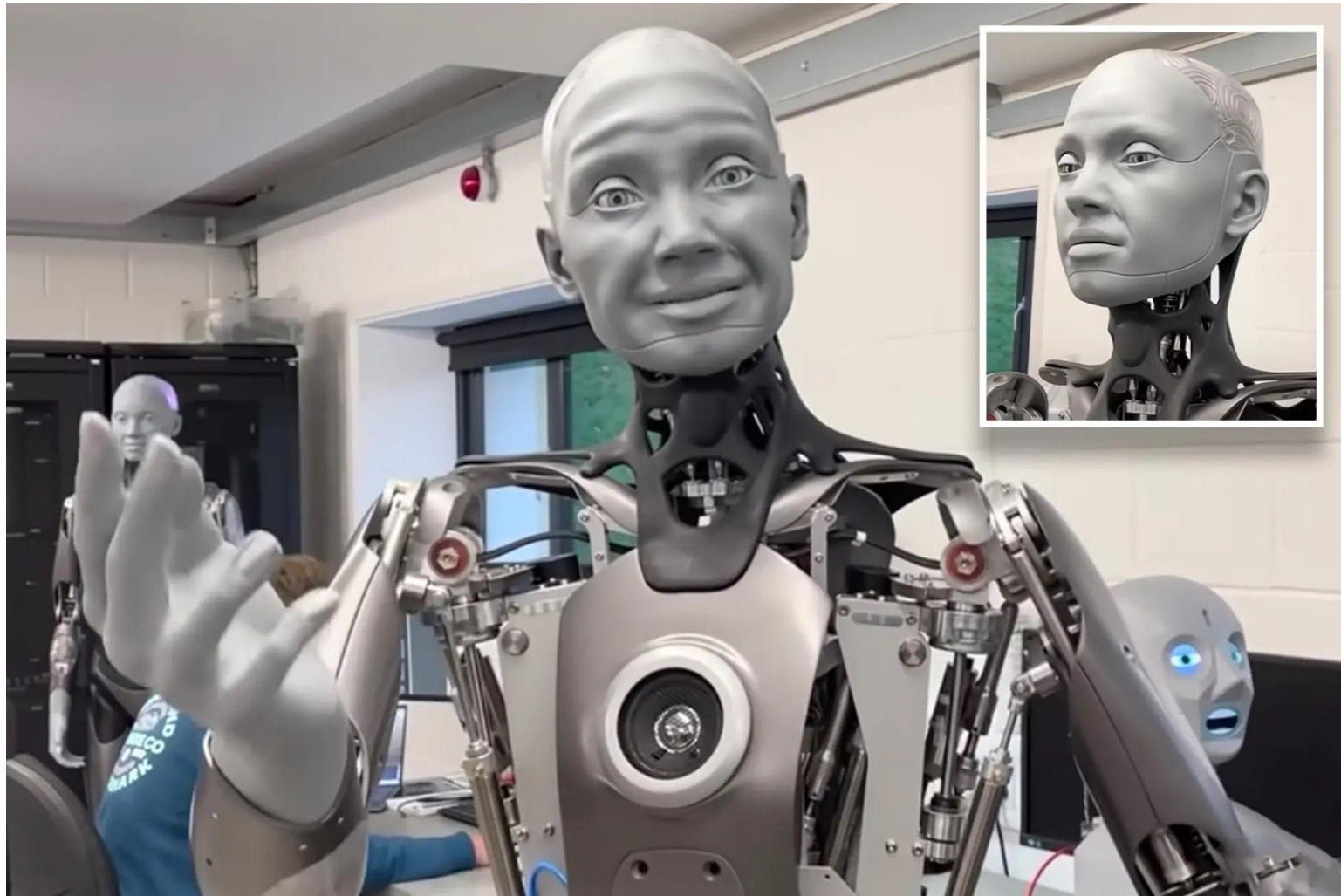
- A robot is an intelligent system that **interacts with the physical environment through sensors and actuators**
 - Program module?
 - Web crawling 'bot?



Intelligent Complete Robot



Is a human a robot?



Is a human a robot?

- **By our definition, yes.**
 - Humans interact with a complex physical environment via sensors and effectors.
 - We are not artificially manufactured, of course!
- **Does this diminish humans? No!**
 - Understanding the difficulties of robotics helps us appreciate how amazing humans are.

Advanced Construction Robotics



Why We Need Robots in AEC?



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Construction Tasks

- Dirty – Dust, mud, etc
- Dull – not creative and tedious work operations
- Dangerous – accidents and likely injuries
- Difficult – physically demanding



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-
- **Aging workforce**
 - **Rising construction costs**
 - **Productivity**
 - **Robotics Free Humans Up**



POTENTIALS OF ROBOTS

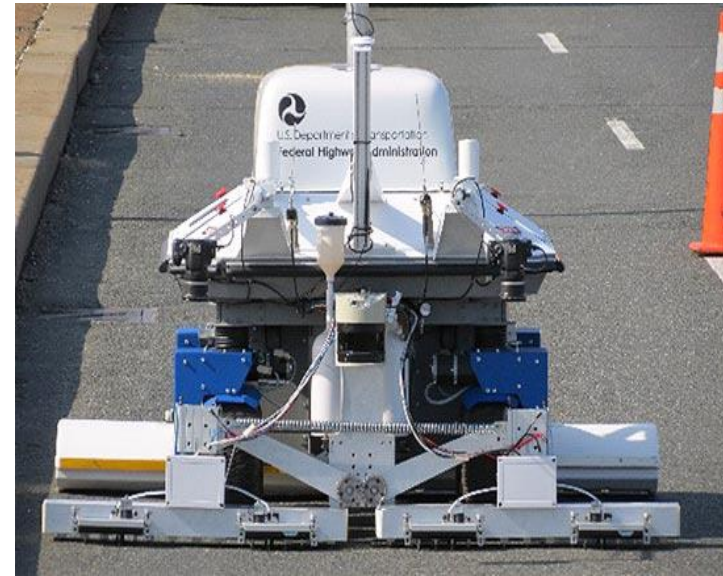
1. **Productivity**
2. **Precision**
3. **Materials, Noise, Dust reduction**
4. **Safer work, ageing Workforce**

Robotics Utilization in Industry

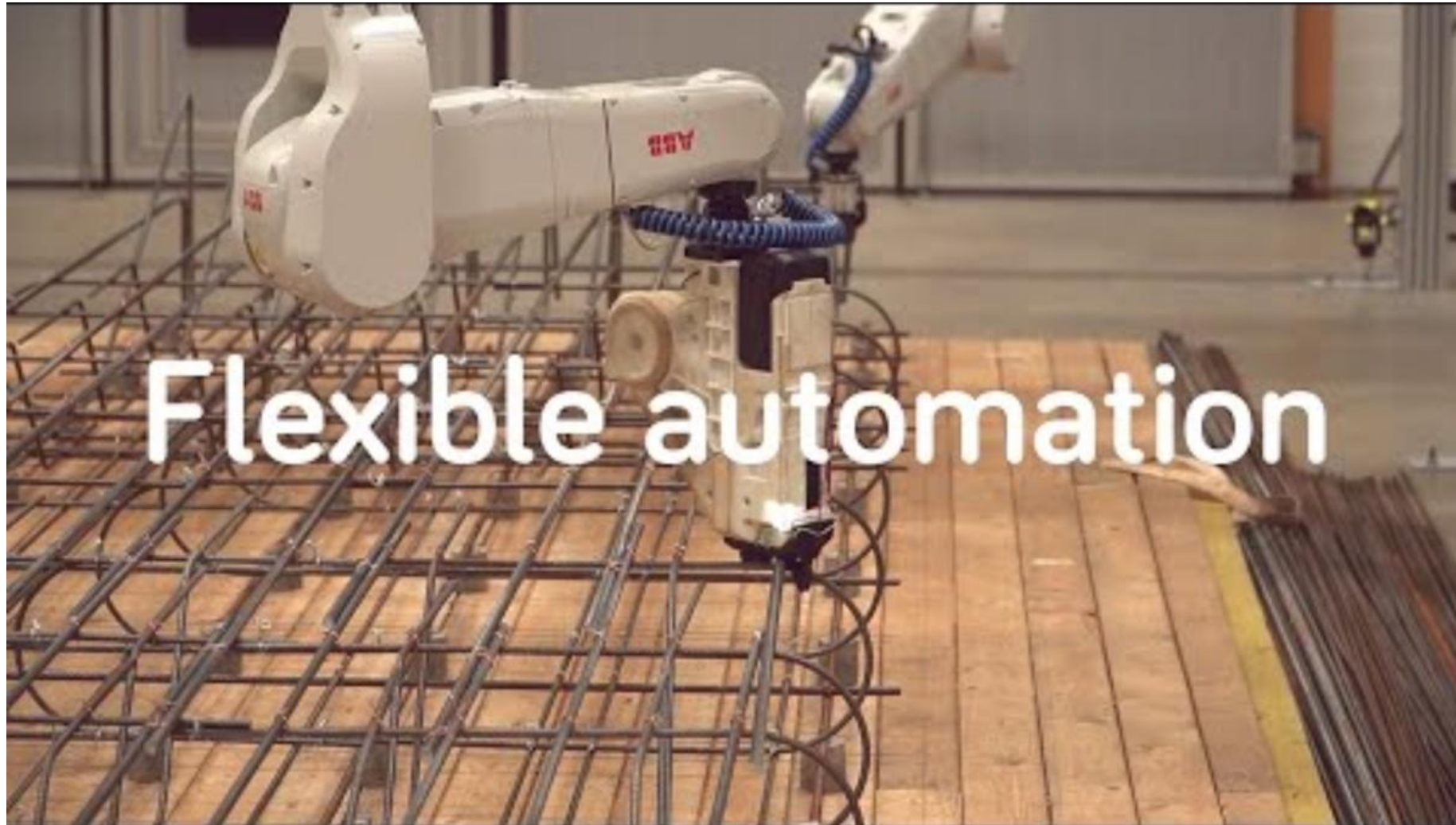
Construction Operations



Data capture / inspection (progress/safety/quality/productivity)



Reinforcement installation



Demolition

Remote controlled demolition robots.

- Concrete Sawing
- Demolition
- Water based concrete demolition and recycling



BROKK[®]



Husqvarna



ERO[®]
CONCRETE RECYCLING ROBOT

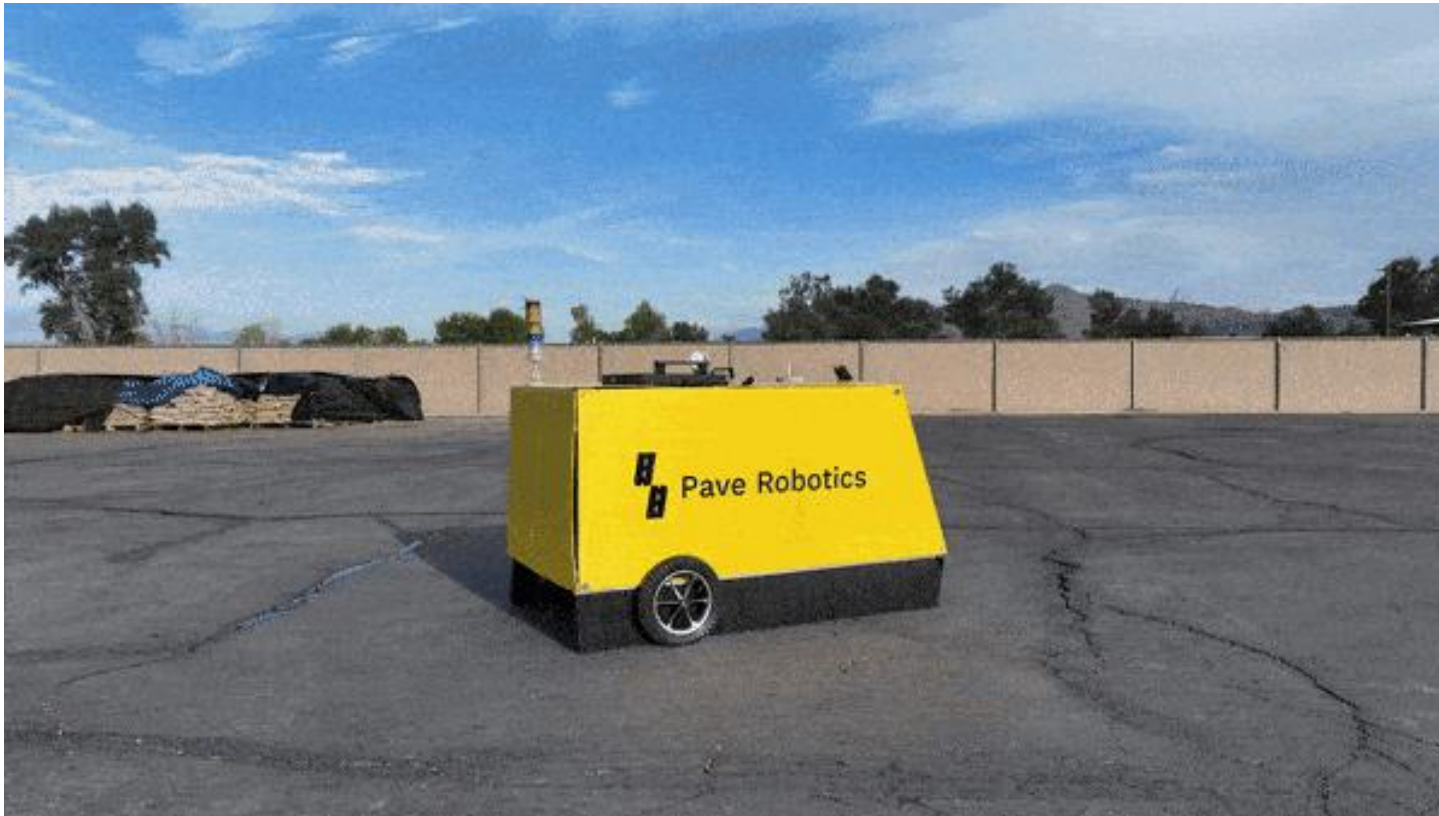
Surveying

- Drones for aerial mapping and surveying construction sites.
- Allow for real-time surveying, improve logistics and collaboration across construction teams.



Paving

- Robots pave roads with bricks or concrete.
- Relieve workers from physically straining work, improve efficiency.



Concrete finishing

- Automatic concrete trowelling and paving.
- Automates task that is repetitive and hard for humans to do well.



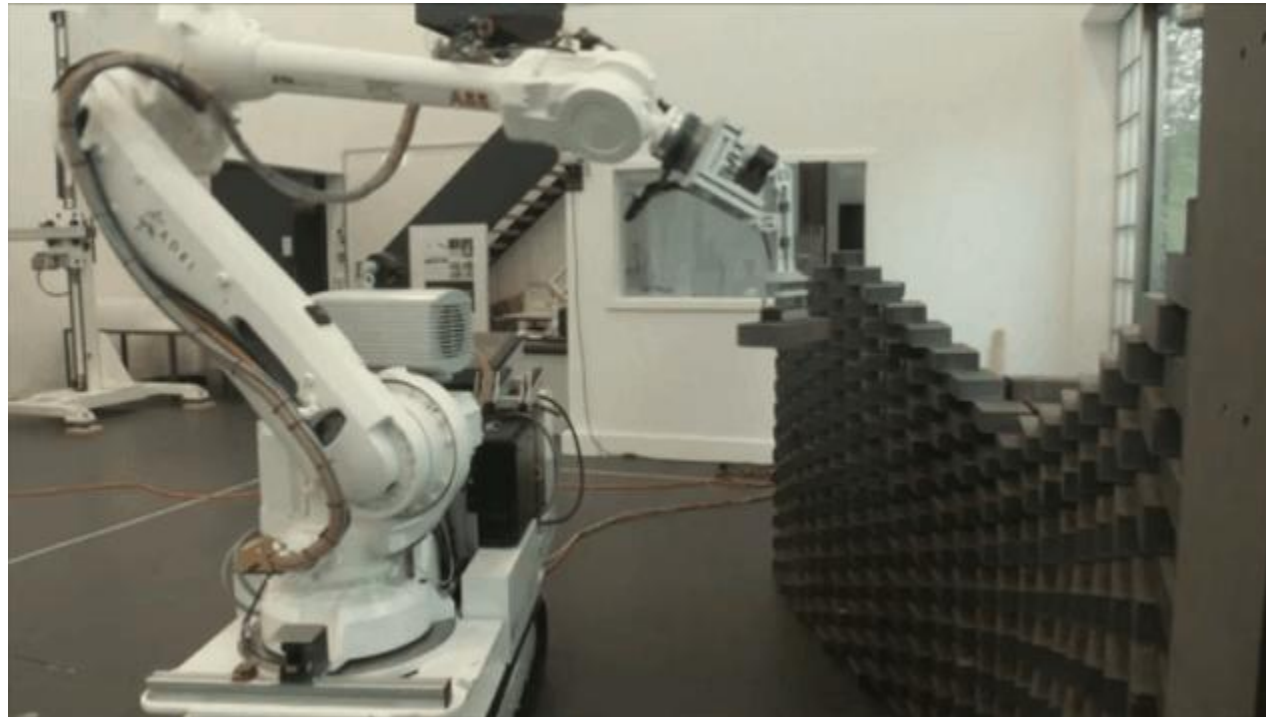
Welding

- Welding of 3d structures, steel beam assembly and steel cutting.



Bricklaying

- Works in tandem with construction workers, but lays down 3x as many bricks as human.
- Can lay bricks in unconventional patterns to achieve novel structures.



Drilling

- The robot provides accurate, efficient drilling in concrete ceilings and promises far less strain on workers.



Painting



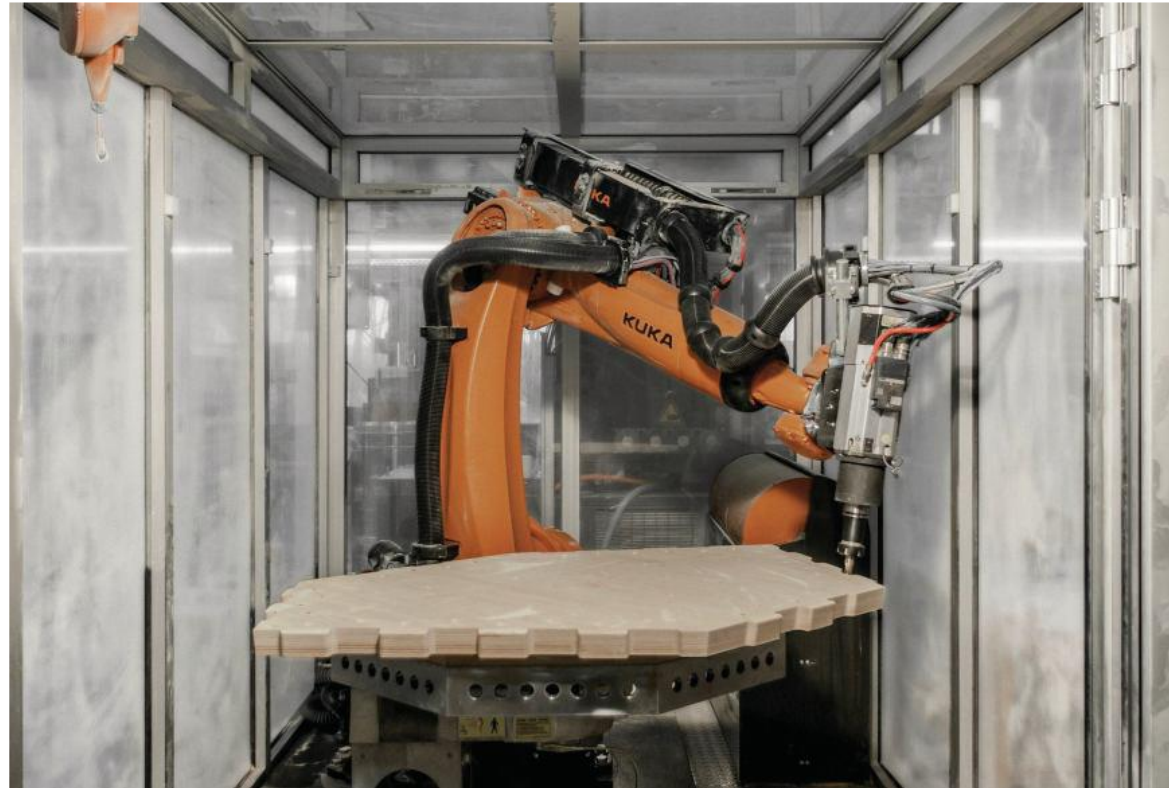
Exosuits

- Exosuits and exoskeletons help construction workers handle heavier loads without hurting their bodies.



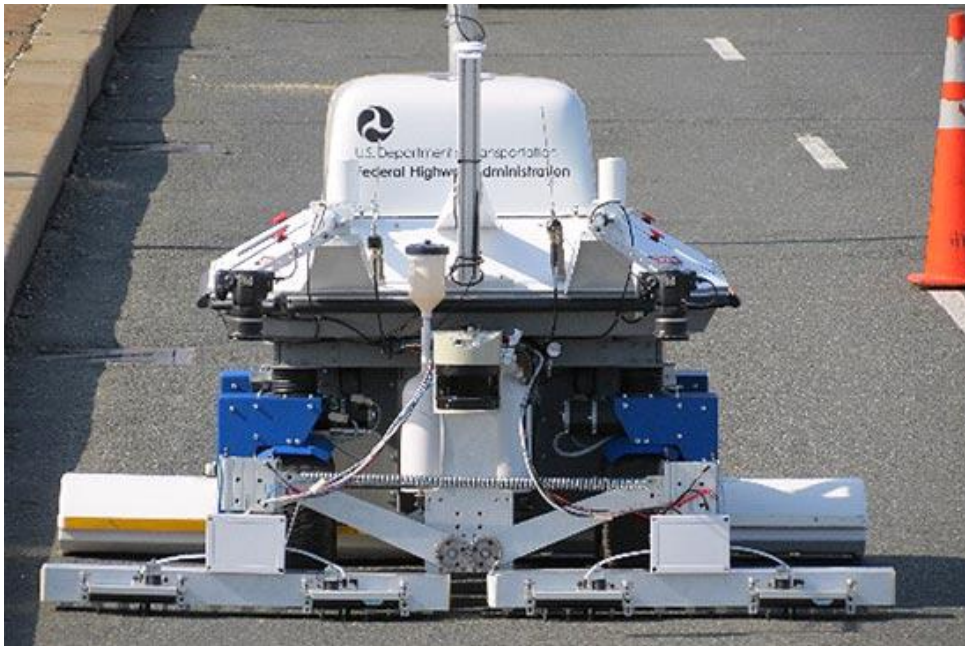
Prefabricated

- Robots manufacture prefab parts of buildings. In this case, the panels are designed within spatial constraints of the robot.



Inspection

- Non-destructive technical diagnostics of bridges, tunnels and other structures.



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Autonomous trucks

- Autonomous trucks are being developed to increase safety in construction areas.

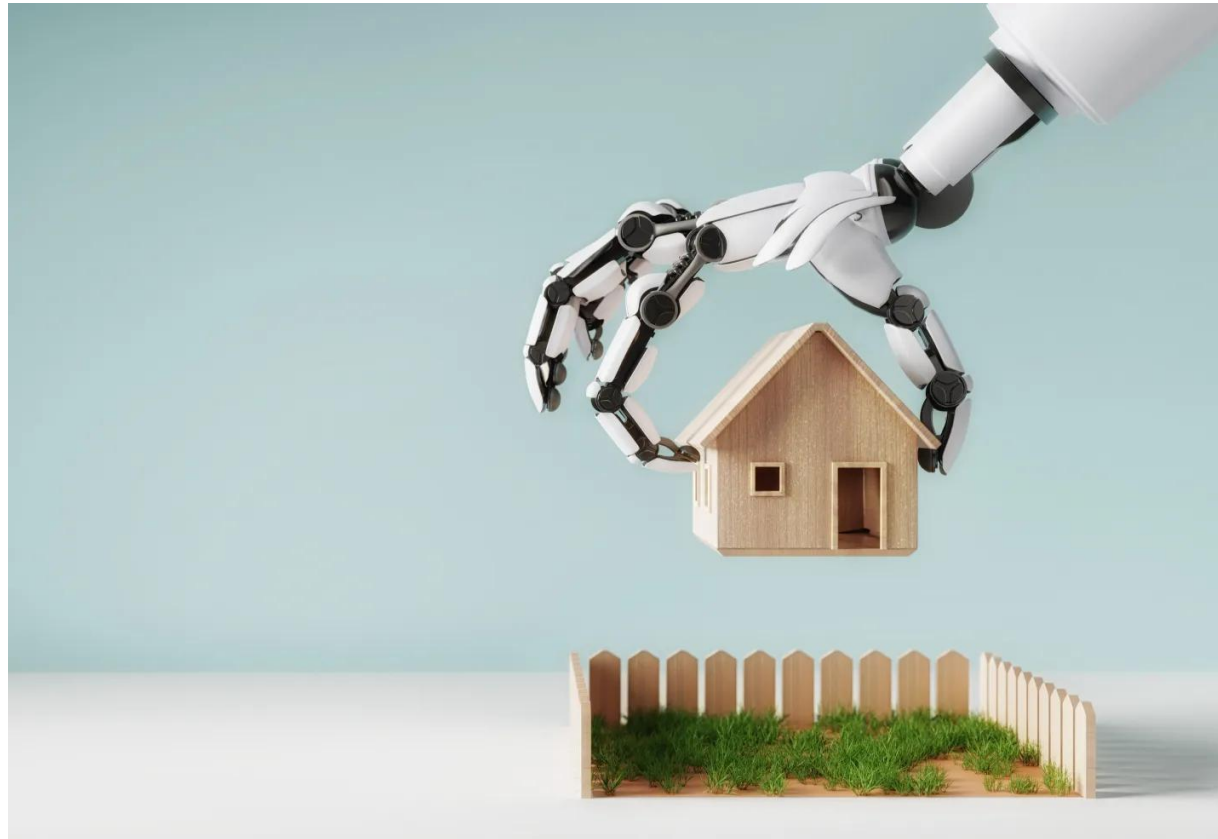


Other applications

- Concrete transportation/distribution
- Positioning of steel
- Fire resisting
- Painting
- Excavation/Earthmoving
- Tunneling

In-Class Discussion

What do you think would be the biggest challenge in using these robots on a real construction site?



PROBLEMS OF ROBOTS

What do you think would be the biggest challenge in using these robots on a real construction site?

Social Challenges

- Workforce Impact
- Resistance to Change
- Safety and Trust
- Regulatory and Ethical Issues
- High Capital Investment

Technical Challenges

- Dynamic Environment
- Sensor and Data Integration
- Operational Reliability
- System Integration

TAKEOUTS

- 1. Slow adoption (skepticism, price)**
- 2. Lots of money invested in the last years**
- 3. Still looking for the niches**
- 4. On the long run robots are inevitable**



Thank You!