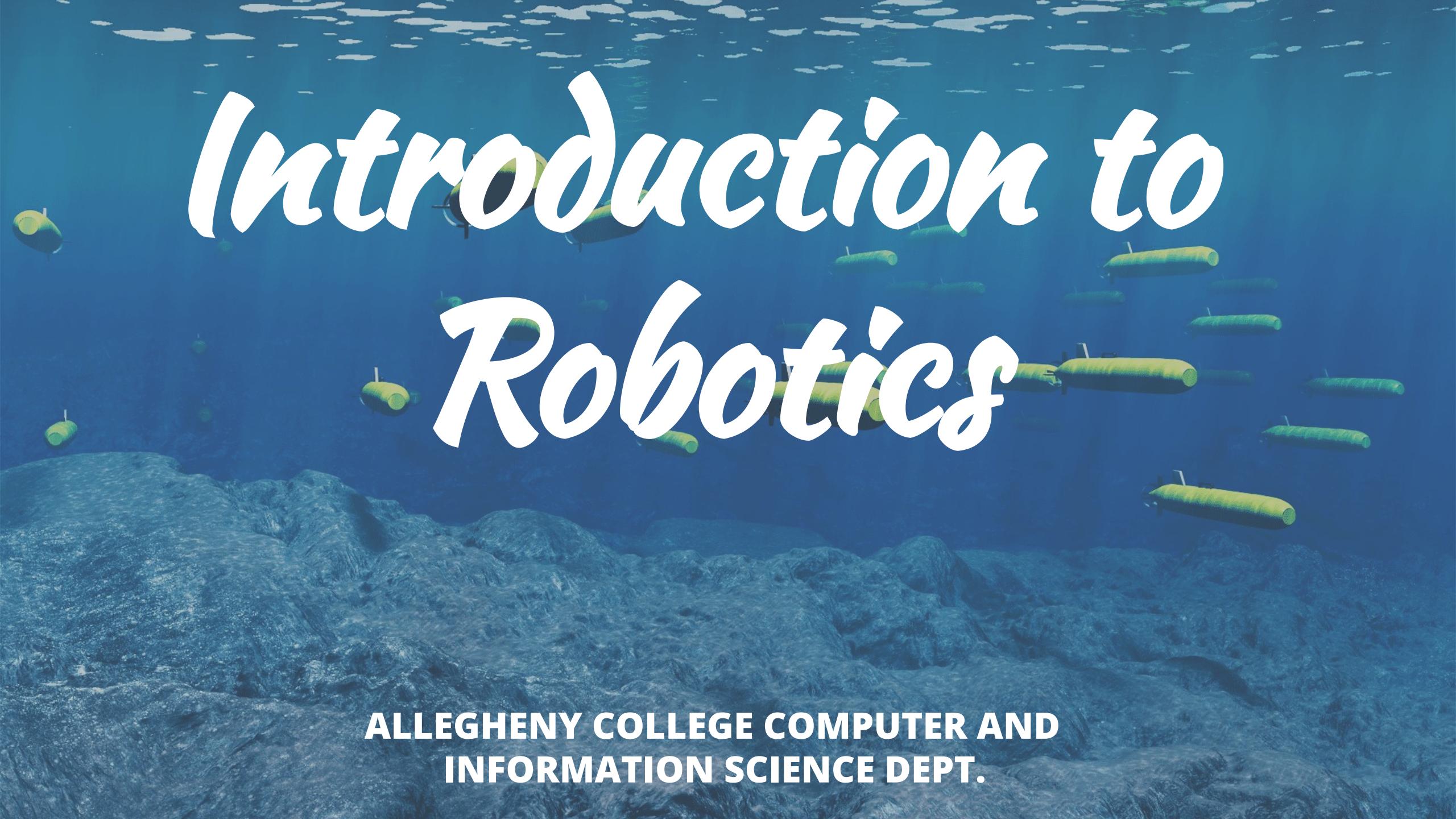


Introduction to Robotics

The background of the slide features a deep blue ocean scene. In the upper half, a school of small, green and yellow cylindrical robots with propellers at the front are swimming in various directions. They are set against a backdrop of light rays filtering down from the surface, where small white clouds are visible. The bottom half shows a rocky ocean floor with large, dark greyish-blue boulders.

ALLEGHENY COLLEGE COMPUTER AND
INFORMATION SCIENCE DEPT.

Today's Agenda

- 01** Uses of Robots
- 02** Types of Robots
- 03** Why Robotics?





Uses of Robotics

- Assembly
- Welding
- Painting
- Material handling
- Improve efficiency, precision, and safety
- Reduce human labor in hazardous environments



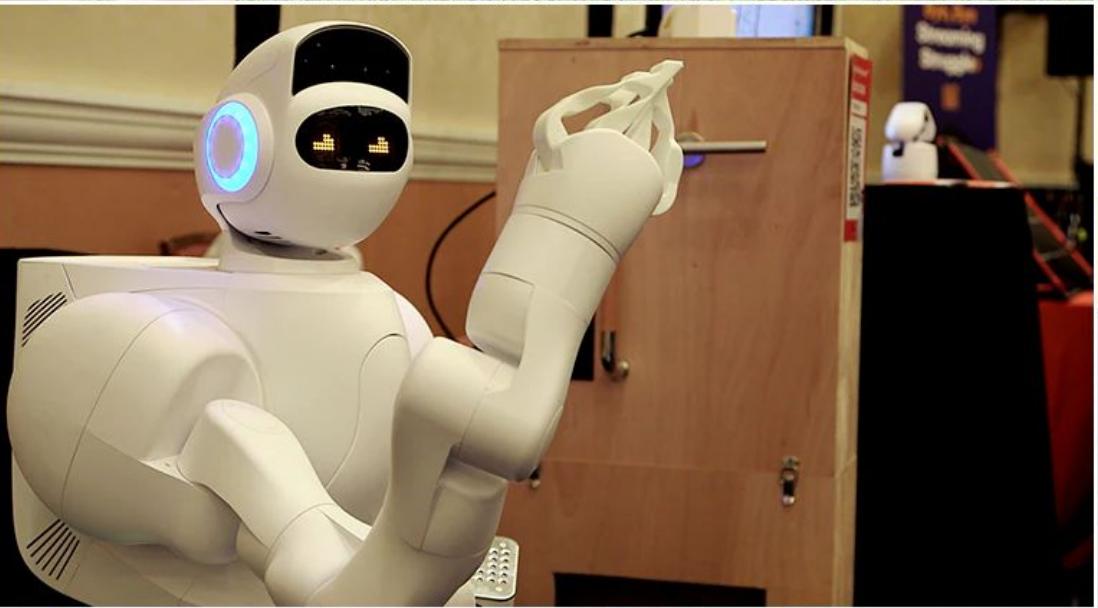
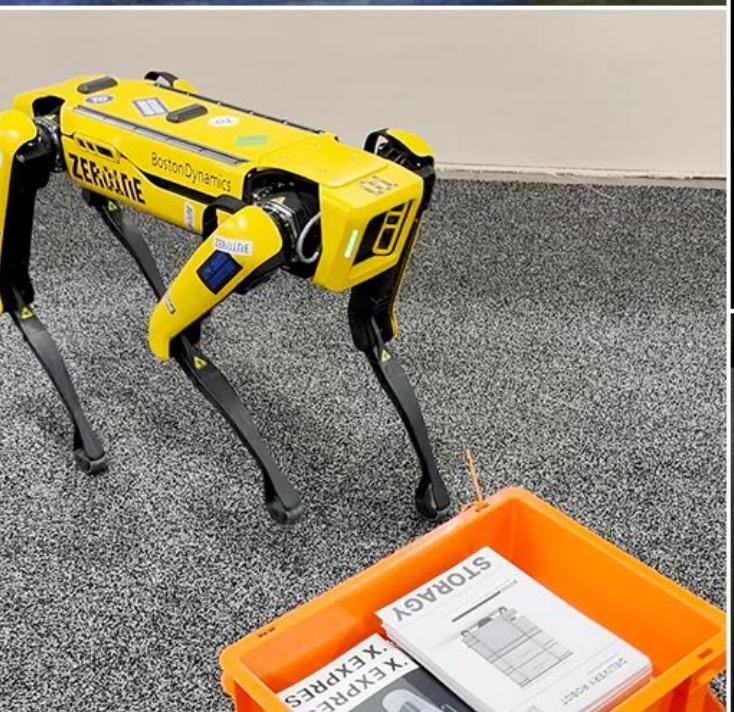
Manufacturing



A close-up photograph of a white and grey AIBO robot dog. The robot has large, expressive black eyes and a small black mouth. Its body is primarily white with grey accents on its ears, paws, and the back of its head. It is positioned on a light-colored wooden surface. In the top left corner of the slide, there is a small blue square graphic.

Entertainment

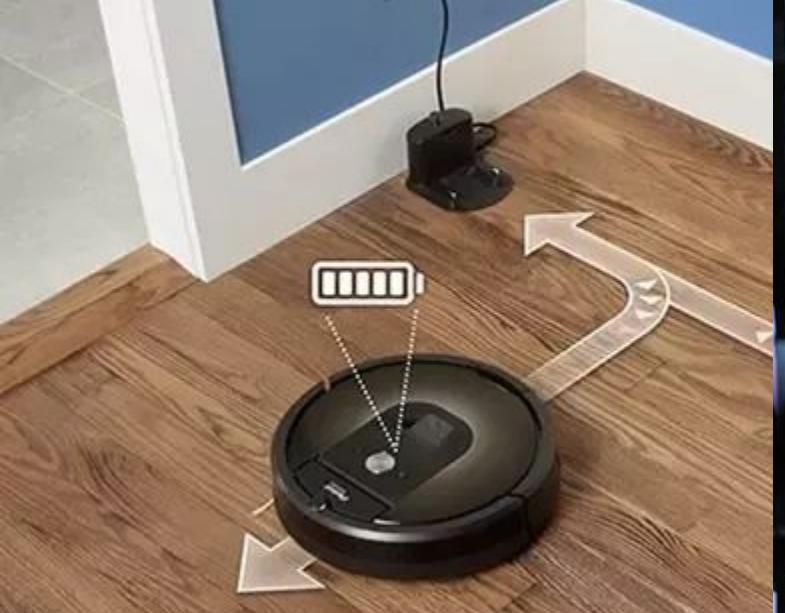
- Theme parks
- Movies
- Toys
- Create interactive experiences
- Perform complex stunts
- Serve as engaging companions or performers



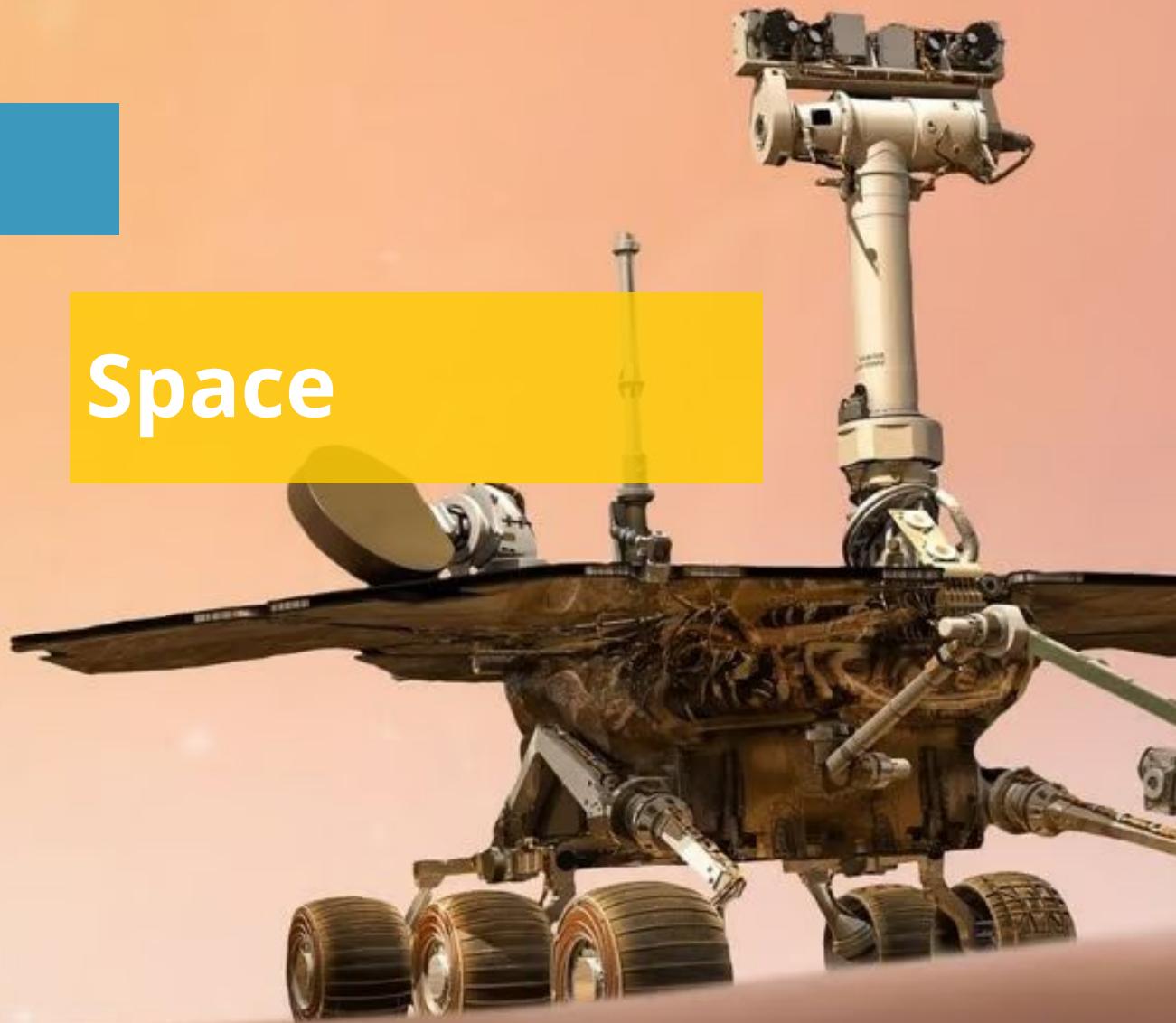
- Robotic vacuum cleaners
- Lawn mowers
- Personal assistants (smart home devices)
- Enhance convenience
- Automate routine tasks



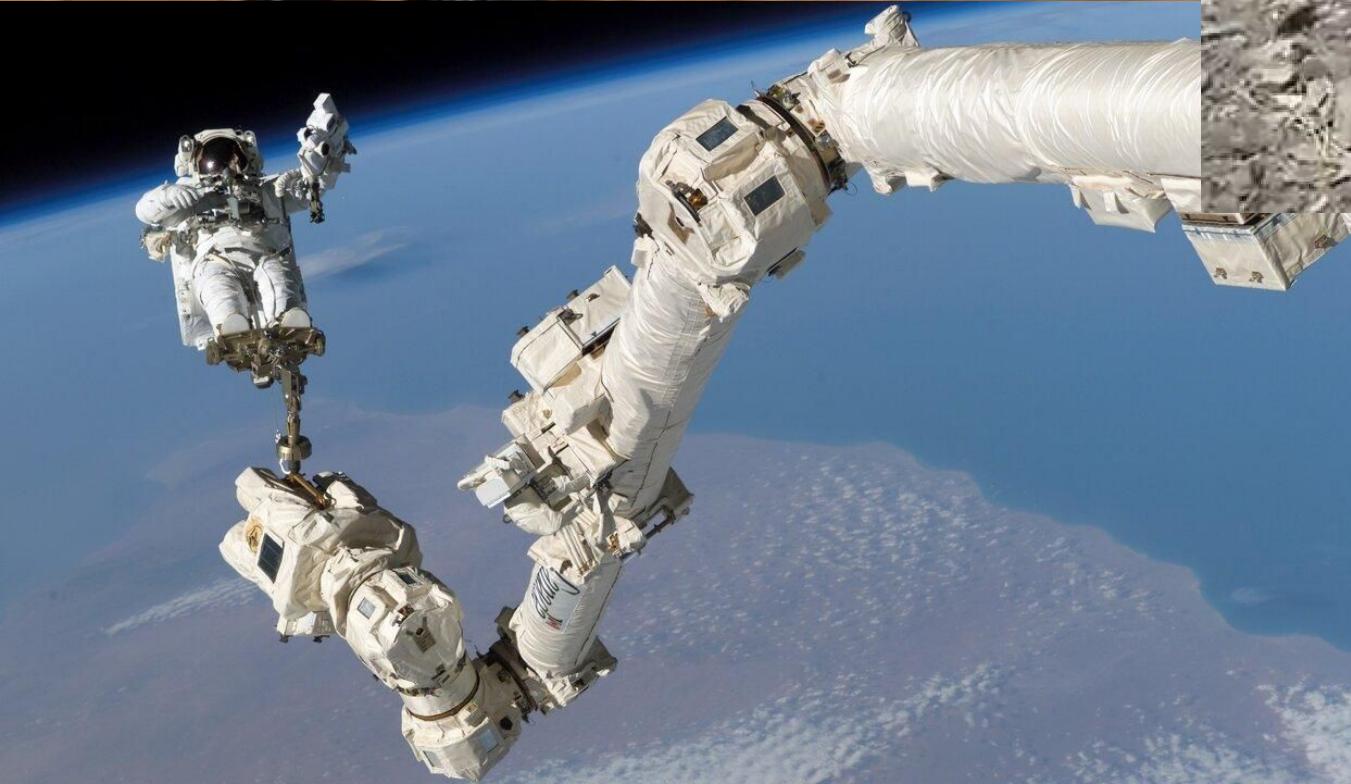
Consumer



Space



- Planetary exploration
- Satellite maintenance
- Assembly of space structures
- Operate in harsh or remote environments
- Contribute to space research and operations



- Surveillance
- Reconnaissance
- Bomb disposal
- Combat
- Enhance personnel safety
- Provide intelligence
- Support military operations



Military



A white agricultural robot with a camera and sensor arm is shown working in a green field. The robot is equipped with a sensor arm that it uses to inspect plants. The background shows a large greenhouse structure.

Agriculture

- Planting
- Harvesting
- Weeding
- Monitoring crop health
- Increase productivity
- Reduce labor costs
- Enable precision farming

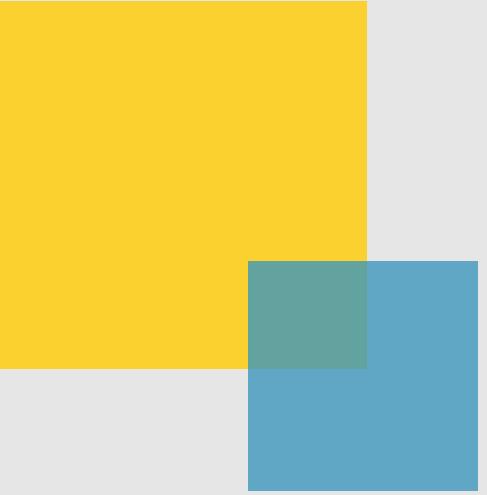


- Bricklaying
- Concrete pouring
- Site surveying
- Improve construction speed, accuracy, and safety
- Address labor shortages
- Ensure consistent quality in building projects

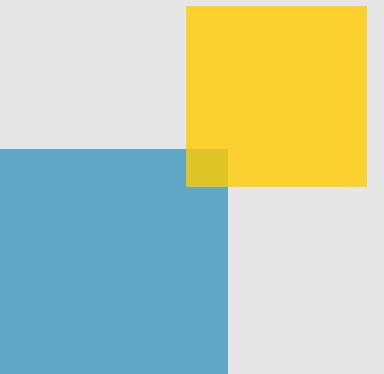
Construction





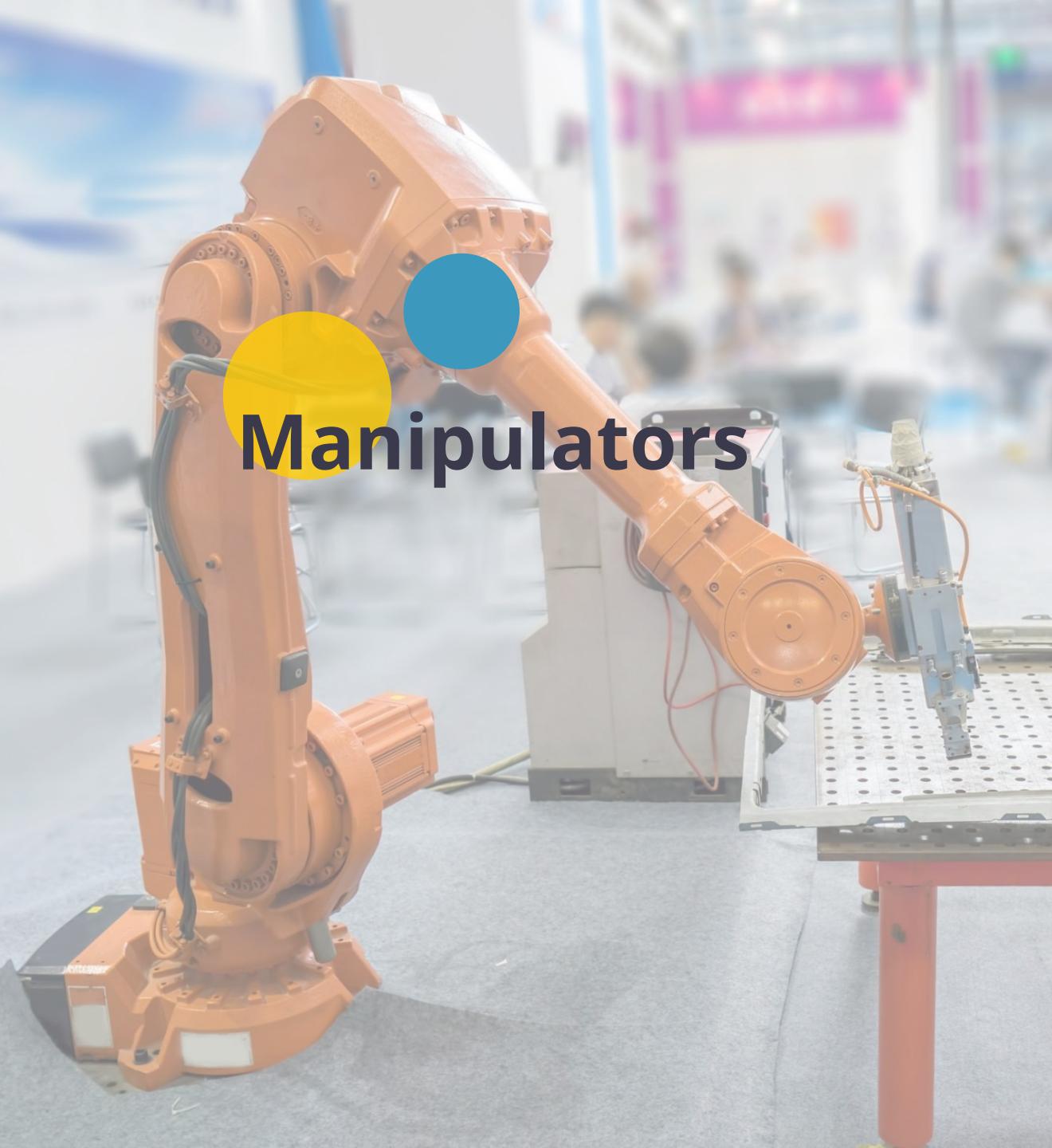


*And Many
More!!*





Types of Robots



Manipulators

What They Are: Robotic manipulators, often referred to as robotic arms, are devices designed to replicate the motion and function of a human arm. They consist of joints and links that allow for a wide range of movements.

How They Work: These robots are usually stationary and are mounted on a base. They use motors, actuators, and controllers to move and position tools, parts, or materials with precision.

Applications:

- **Manufacturing:** Assembly lines, welding, painting, and packaging.
- **Healthcare:** Surgical robots like the da Vinci system.
- **Research:** Manipulating hazardous materials or conducting experiments in controlled environments.

What They Are: Wheeled robots are mobile robots that use wheels for movement. They are one of the most common types of robots due to their simplicity and efficiency on flat surfaces.

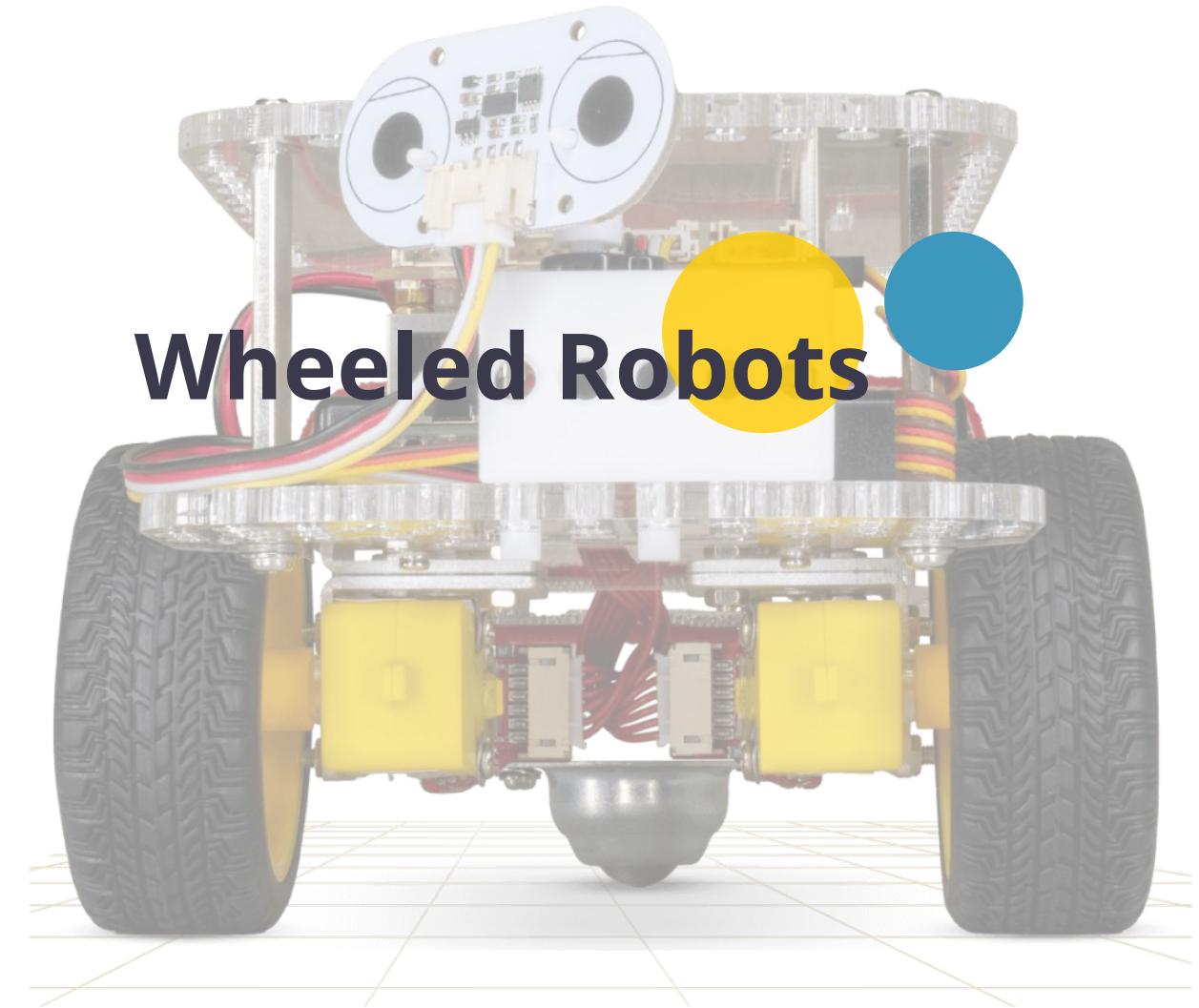
How They Work: These robots are equipped with wheels that are powered by motors, allowing them to move in different directions. They often include sensors for navigation and obstacle avoidance.

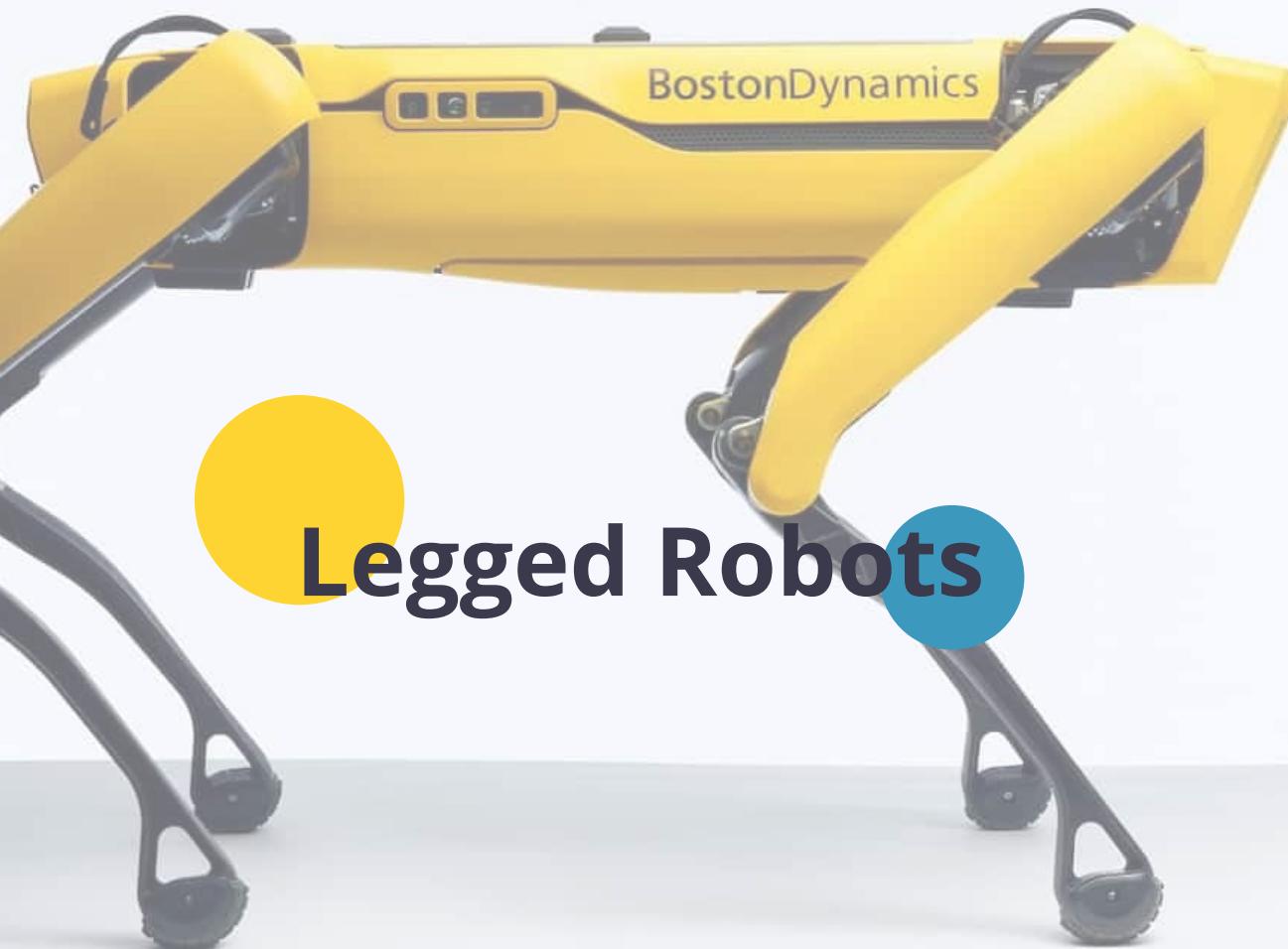
Applications:

- **Food Delivery:** Autonomous robots used in urban areas to deliver meals from restaurants to customers' doorsteps.
- **Space Exploration:** Rovers like NASA's Mars rovers (e.g., Curiosity, Perseverance) that explore planetary surfaces.

Notable Models:

- **PiGoPi:** An educational robot kit based on the Raspberry Pi, used for teaching programming and robotics.
- **Turtlebot:** An open-source personal robot kit that is popular in robotics research and education.





What They Are: Legged robots are designed to move using legs instead of wheels, which allows them to navigate rough and uneven terrain that wheeled robots cannot handle.

How They Work: These robots use a combination of sensors, actuators, and algorithms to control the movement of their legs, enabling them to walk, run, climb, or jump.

Applications:

- Search and Rescue: Navigating disaster sites where debris or obstacles make it difficult for wheeled robots.
- Military and Surveillance: Stealthy movement in difficult terrains.

Notable Models:

- **Boston Dynamics Spot:** A quadruped robot used for industrial inspection, mapping, and remote operation in hazardous environments.
- **Boston Dynamics Atlas:** A bipedal humanoid robot with advanced mobility, capable of performing complex movements like backflips and parkour.

What They Are: Humanoid robots are robots designed to resemble the human body. They have a torso, head, two arms, and two legs, and are often built to perform tasks that involve human interaction or mimic human behavior.

How They Work: These robots use a combination of sensors, cameras, and artificial intelligence to interact with their environment and perform tasks. They often have articulated joints for lifelike movement.

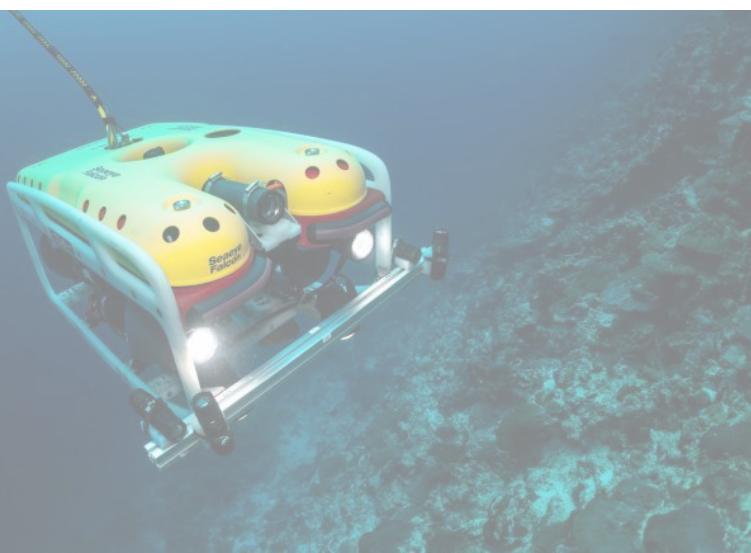
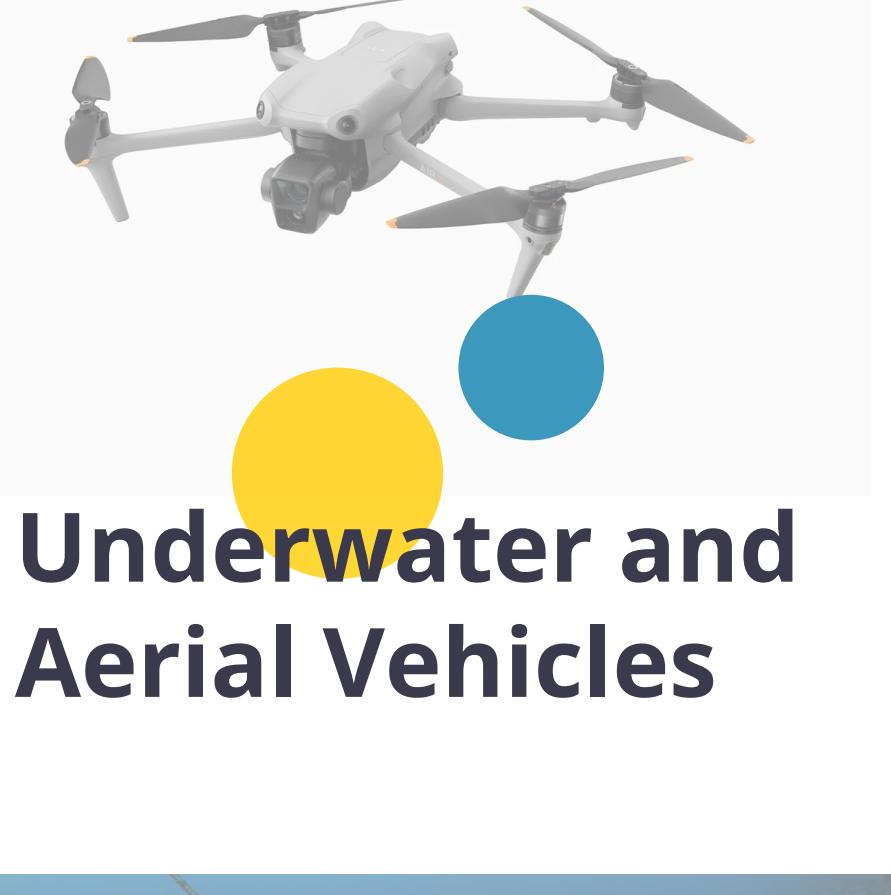
Applications:

- Service Industry: Assisting customers, guiding people in public spaces, or performing repetitive tasks.
- Research: Studying human-robot interaction and developing new AI techniques.

Notable Models:

- ASIMO by Honda: One of the first humanoid robots capable of walking and climbing stairs autonomously.
- Sophia by Hanson Robotics: A social humanoid robot known for its advanced facial expressions and ability to engage in conversation.





What They Are: These robots are designed for operation in the air (aerial vehicles, or drones) or underwater (submarines, or subs). They can be autonomous or remotely operated and are used for exploration, surveillance, and research.

How They Work:

- **Aerial Drones:** Use propellers and motors for flight, with GPS, cameras, and sensors for navigation and data collection. Some are capable of autonomous flight based on pre-programmed routes or AI algorithms.
- **Underwater Subs:** Use thrusters for movement and are equipped with sonar, cameras, and other sensors to explore underwater environments.

Applications:

- **Drones:** Aerial surveillance, photography, agriculture (e.g., crop monitoring), and package delivery.
- **Submarines:** Marine research, underwater exploration, and inspection of underwater structures like oil rigs.

Notable Models:

- **DJI Phantom:** A popular consumer drone used for photography and videography.
- **Bluefin-21:** An autonomous underwater vehicle (AUV) used for deep-sea exploration and search missions.
- **Bebop Drones:** Compact drones known for their ease of use and camera capabilities.



*Why
Robotics?*



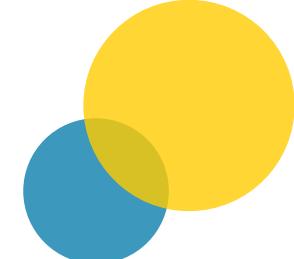
Career Opportunities and Job Security

- High Demand for skilled professionals in software development, engineering and automation
- By 2025, robots are expected to handle over 50% of workplace tasks, creating new jobs and opportunities in various sectors
- 55% of organizations have started implementing some form of robotic process automation.

Source: Worldmetics.com



National Average Salary for Careers in Robotics



- Design Engineer - \$84,848 per year
- User Interface Designer - \$87,148 per year
- Mechanical Engineer - \$89,424 per year
- Sales Engineer - \$89,628 per year
- Robotics Engineer - \$107,080 per year
- Hardware Engineer - \$106,813 per year
- Algorithm Engineer - \$122,287 per year
- Aeronautical Engineer - \$103,595 per year
- Machine Learning Engineer - \$152,244 per year

Source: Indeed.com

Sources

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- "Robotics in Workplace Statistics Statistics: Market Data Report 2024." Worldmetrics.org, 2024, worldmetrics.org/robotics-in-workplace-statistics/. Accessed 20 Aug. 2024.
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