

**Rodrigo Sierra**

**Assignment 01**

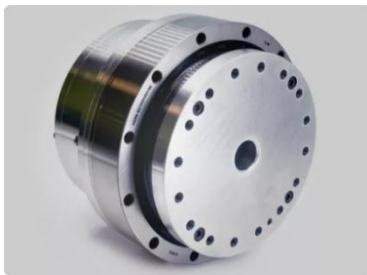
**Robot Operating Systems & Platforms**

**Sitaram Ayyagari**

## **Robotic Operating & Autonomous Systems & Platforms**

### **Glossary**

#### **Actuator**



Part of a machine that makes a robot move by converting a control signal (electrical) into physical motion. For instance, a robotic arm uses actuators to bend its joints in several industries.

*Image source: <https://www.asbis.com/aeros-robotic-actuators>*

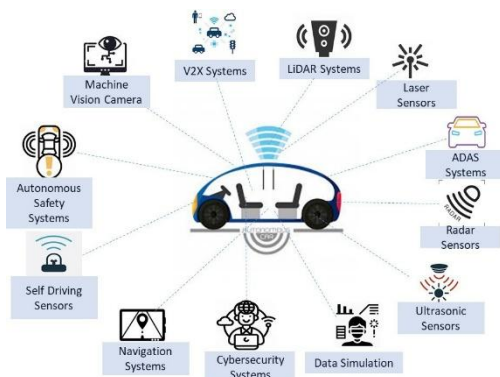
#### **Artificial Intelligence (AI)**



Computer programs that enable robots to understand, learn, and make decisions with the same level of intelligence as humans. For example, an autonomous mobile robot in a warehouse uses algorithms to analyze the environment and get the optimal path to pick up a package.

*Image source: <https://www.thescxchange.com/move/store/warehouse-robotics>*

#### **Autonomous System**



A system that can operate in an environment without human intervention. For instance, a self-driving car that navigates on city streets.

*Image source: <https://www.linkedin.com/pulse/leading-industry-verticals-autonomous-systems>*

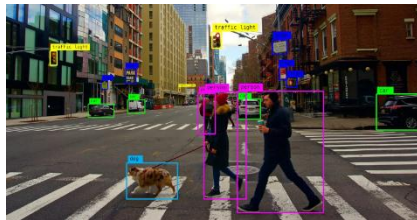
## Battery Management System (BMS)



An electronic system that monitors the state of the battery and avoids overcharging or draining. For example, drone's BMS prevents the battery from draining.

*Image source: <https://www.ayaatech.com/news/drone-battery-voltage-and-capacity-how-bms-ensures-optimal-performance/>*

## Computer Vision



CV is an AI field that allows computers and robotic systems to understand digital images or videos. For instance, an autonomous car identifies objects surrounding it.

*Image source: <https://www.algotive.ai/blog/what-is-computer-vision-and-how-does-it-work-with-artificial-intelligence>*

## Control System



It is a set of instructions that tells a robot how to achieve a task based on input and feedback to generate desired motion. For example, a robotic arm joint that continuously calculates the position to perform an action.

*Image source: <https://news.mit.edu/2019/robots-track-moving-objects-unprecedented-precision-0219>*

## Deep Learning in Robotics



A subset of Machine Learning where robots use neural networks to learn complex tasks from a huge quantity of data. For instance, a robot learns to recognize several types of objects.

*Image source: <https://robohub.org/deep-learning-in-robotics/>*

## End Effector



A device at the end of the robot arm that interacts with the environment (gripper, suction cup). For instance, the clamp at the end of a robotic arm that picks up and moves objects.

Image source: <https://www.universal-robots.com/blog/robot-grippers-explained/>

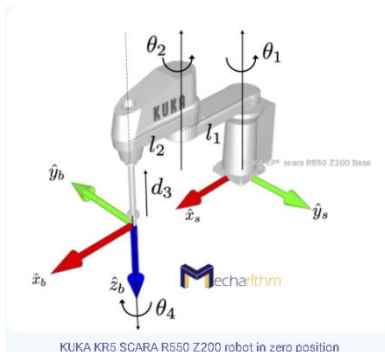
## Human-Robot Interaction (HRI)



It focuses on how humans and robots communicate and interact with each other. For example, a hospital robot is used to deliver medication.

Image source: <https://www.channelnewsasia.com/singapore/tech-ai-healthcare-ttsh-smart-ward-cgh-ae-emergency-robots-3634801>

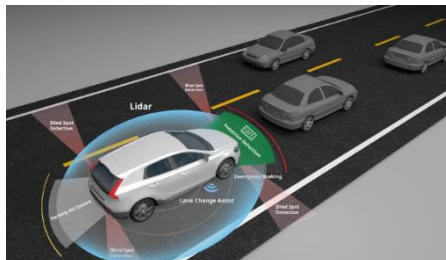
## Kinematics



It studies the motion without considering the forces that cause it. For example, calculating how a robot should move to reach an object.

Image source: <https://mecharithm.com/learning/lesson/forward-kinematics-in-robotics-using-screw-theory-21>

## LiDAR

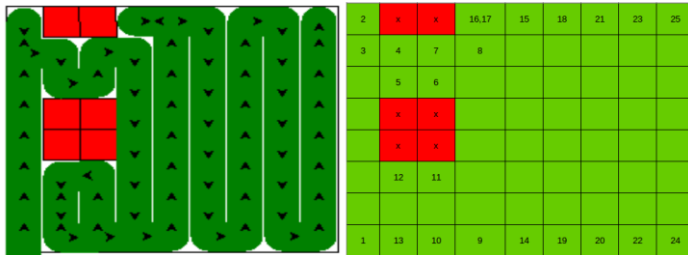


A sensing method that uses laser light to measure distances. For instance, an autonomous vehicle that senses distance from obstacles.

Image source: <https://www.rsipvision.com/adas-sensors-lidars/>

## Localization

Integrating the Roomba Mapping and measurements from the notes



It is how a robot knows its position. For instance, Roomba (vacuum robot) uses an internal map to track its position.

Image source:

<https://anrg.usc.edu/ee579/spring2016/Roomba/>

## Machine Learning in Robotics



Methods used by robots to learn from experience improve their results over time. For example, an industrial quality control robot.

Image source: <https://www.kuka.com/en-de/applications/quality-inspection>

## Motion Planning



Process to figure out how robots move from one location to another, avoiding obstacles. For example, a robot lawn mower that plans its own path.

Image source: <https://www.smonet.com/products/robotic-lawn-mower/r1m1000-smonet-automower-robot-electric-lawn-mower/>

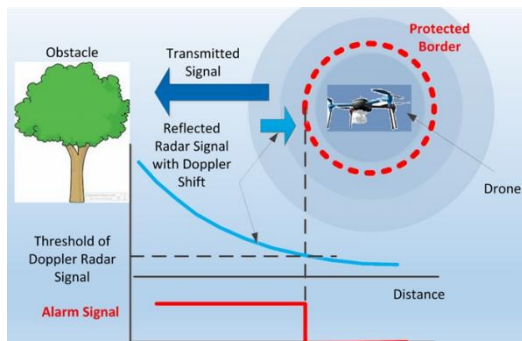
## Pathfinding



A subprocess of motion planning used to determine the best route from start to finish. For instance, the Roomba finds the best route to reach the charging dock.

Image source: [https://www.irobot.com/en\\_US/roomba-105-combo-robot-plus-autoempty-dock/Y354020.html](https://www.irobot.com/en_US/roomba-105-combo-robot-plus-autoempty-dock/Y354020.html)

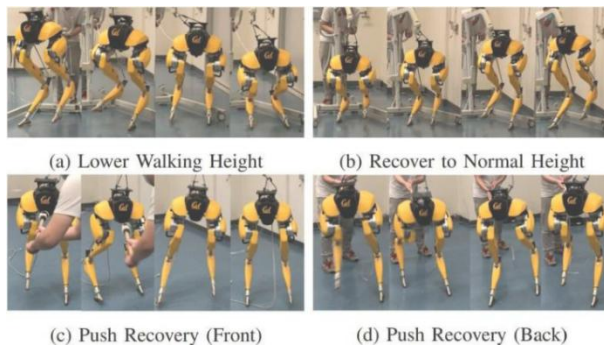
## Perception



How robots sense and understand their surroundings. For example, a drone that detects trees to avoid them.

Image source: <https://www.everythingrf.com/news/details/4168-PMI-RF-Develops-Radar-Sense-Avoid-System-for-Small-Drones-to-Provide-Obstacle-Detection>

## Reinforcement Learning

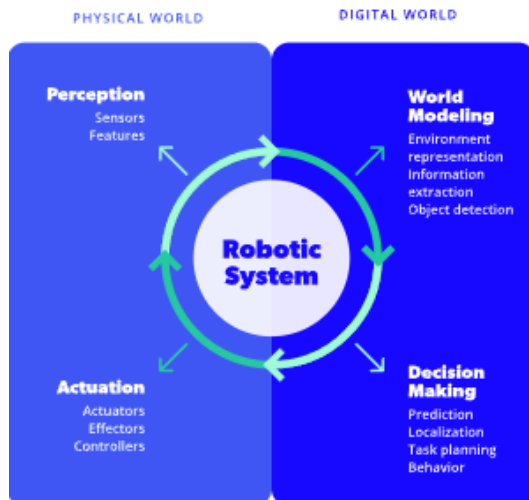


A type of ML where robots improve by trial and error (rewards and penalties). For instance, a robot learning to walk.

Image source: <https://techxplore.com/news/2021-04-robot.html>



## Robotic Operating System (ROS)



A software framework that helps build, program, and run robots. For example, ROS allows developers to connect necessary elements to a robot project.

Image source: <https://www.edge-ai-vision.com/2023/01/ros-the-framework-to-accelerate-your-next-robotics-project/>

## Sensor Fusion

The process of combining several sources of sensors to get a better understanding of the environment. For instance, industrial automation from part acquisition to finished goods warehouse inventory.

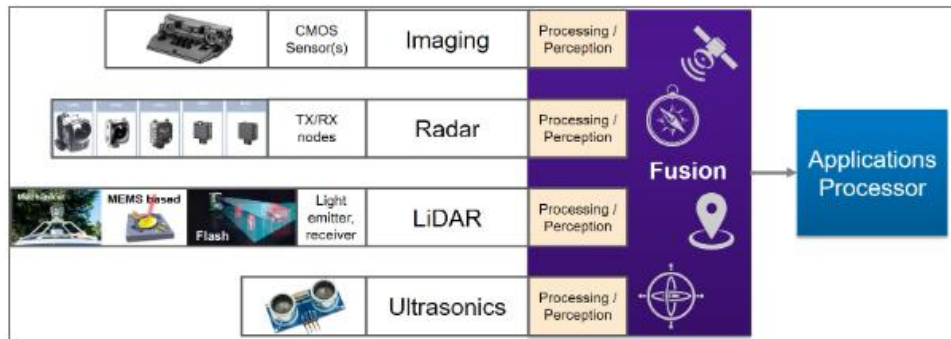


Figure 8. The ability to merge the computation of all sensor data within a single processing unit allows for straightforward design of a scalable range of autonomous products (courtesy Synopsys).

Image source: <https://www.edge-ai-vision.com/2019/01/multi-sensor-fusion-for-robust-device-autonomy/>

## SLAM (Simultaneous Localization and Mapping)



It is a method where robots build a map while determining their position within it. For example, a vacuum robot maps room to room while it is cleaning.

*Image source: [https://ozrobotics.com/shop/tecbot-m1-self-rinsing-laser-robot-vacuum-cleaner-and-mop-slam-navigation-4000-pa-](https://ozrobotics.com/shop/tecbot-m1-self-rinsing-laser-robot-vacuum-cleaner-and-mop-slam-navigation-4000-pa-white/?srsltid=AfmBOopNwtTTWM76La3xdOYgNZ093ybxR9i-PnXAvMKnFAIK4E70oXK2)*

*white/?srsltid=AfmBOopNwtTTWM76La3xdOYgNZ093ybxR9i-PnXAvMKnFAIK4E70oXK2*