



# Introduction to Robotics

## CSE 461

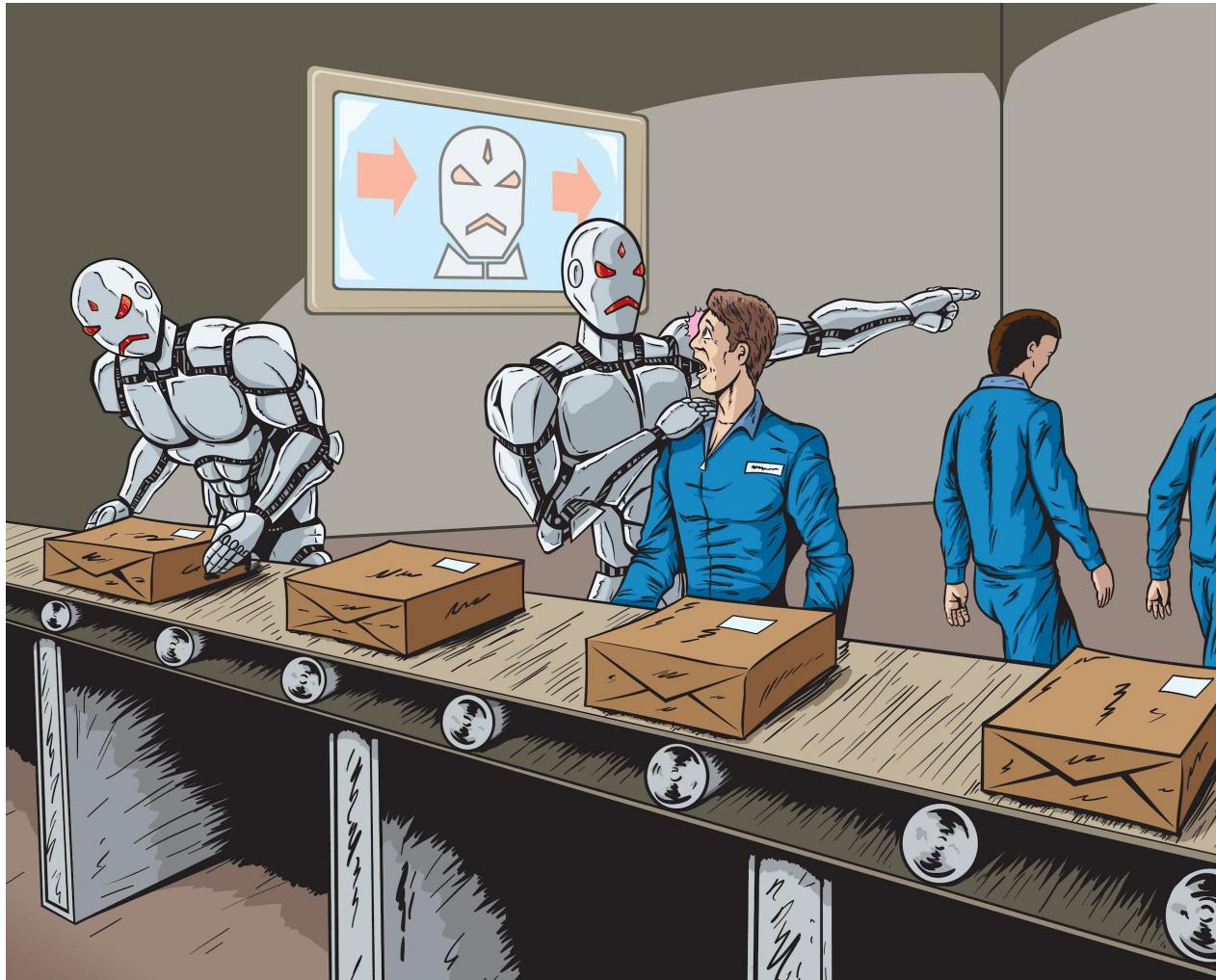
Lecture 2 : Chapter 1(Introduction to robotics: basics)

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# Law of Robotics

1. A robot **must not harm human being**, nor through in action allow one to come to harm.
2. A robot must **always obey human beings**, unless that is in conflict with the first law.
3. A robot must **protect from harm**, unless that is in conflict with the first two laws.
4. A robot always should **have a kill switch**.

Will robots make  
people Jobless ?



# Uses of robots

## 4D

# Do Things that Living Things Can't



- **Fukushima**
- **World Trade center**
- **RANA Complex**
- **Tajrin fashion**



# Dull, Dirty, difficult and Dangerous



# Dull, Dirty, difficult and Dangerous



# Dull, Dirty, difficult and Dangerous



# Thumb Rules on the decision of a Robot Uses

- The first rule to consider, what is known as the **Four D of Robotics**, i.e. is the task dirty, dull, dangerous, or difficult? If so, a human will probably not be able to do the job efficiently. Therefore, the job is appropriate for automation or for robotic labor.
- The second rule is that a robot may **not leave a human jobless**. Robotics and automation must serve to make our lives more enjoyable, not miserable.
- A third rule involves **asking whether you can find people who are willing to do the job**. If not, the job is a candidate for automation and Robotics.
- A four rule of thumb is that the use of robots or automation must **make short-term and long-term economic sense**.

# Some Special Vehicles

# Uncrewed Vehicle

An uncrewed vehicle, also known as an **unmanned vehicle** or an **autonomous vehicle**, refers to a vehicle that operates **without human presence onboard**.



# Remote control vehicle (RC)



# Unmanned ground vehicle (UGV)



<https://youtu.be/cZTCmx6N7Xc>

# Unmanned aerial vehicle (UAV)



Unmanned combat aerial vehicle (UCAV)

Miniature UAV (SUAV)

Delivery drone

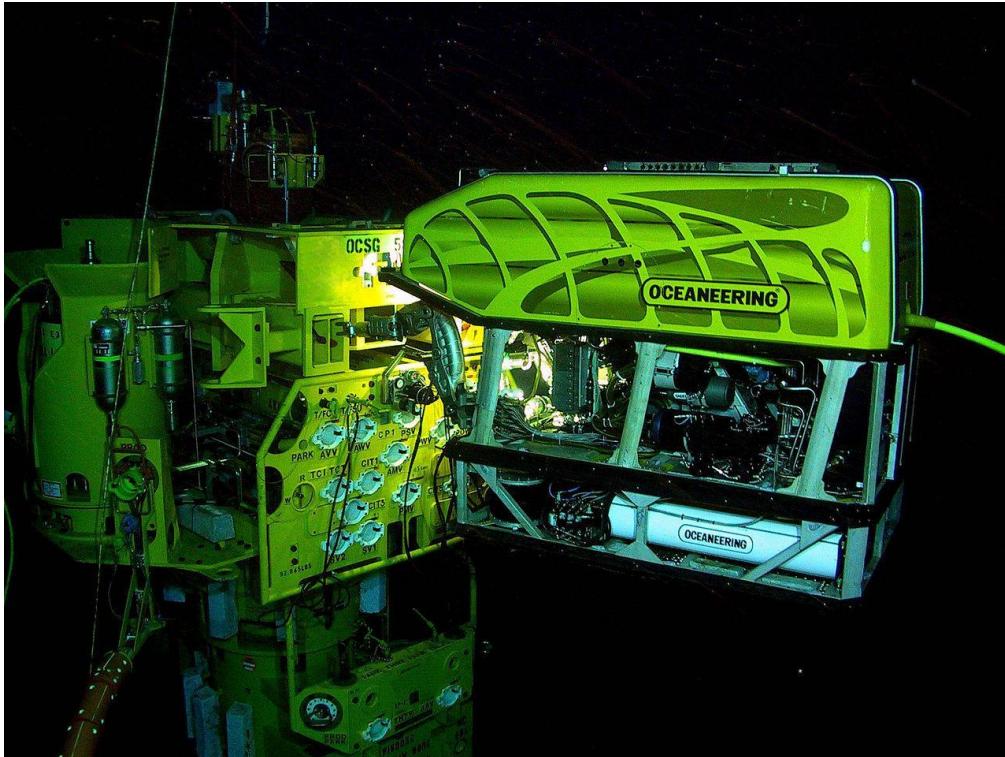
Micro air vehicle (MAV)

Target drone

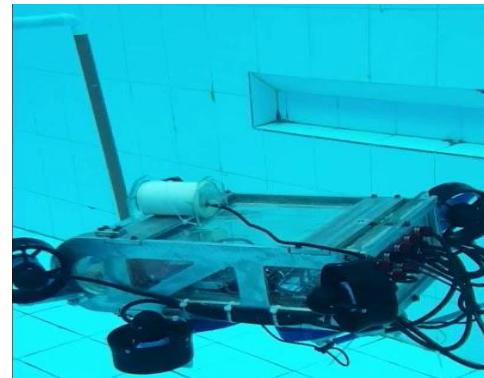
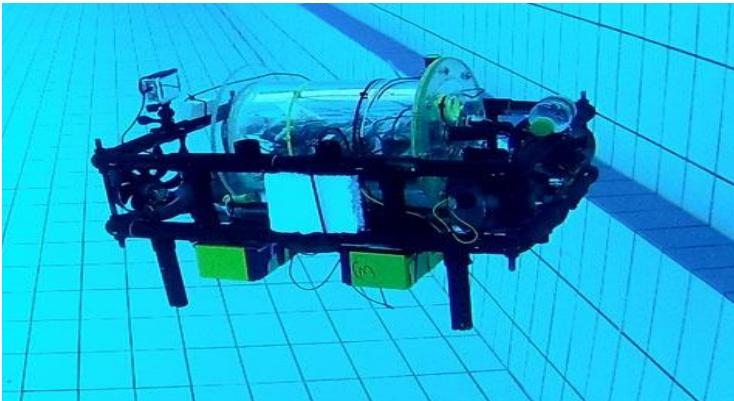
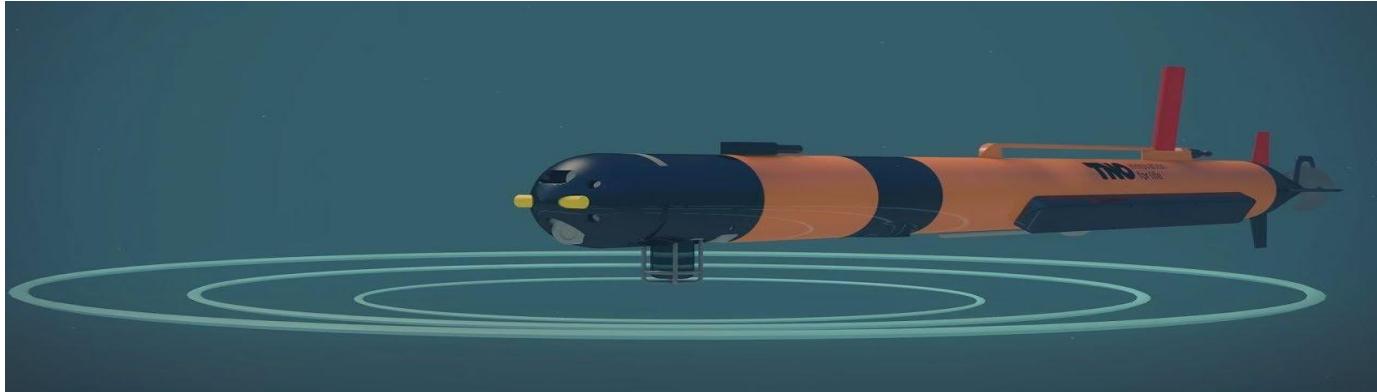
# Unmanned surface vehicle (USV)



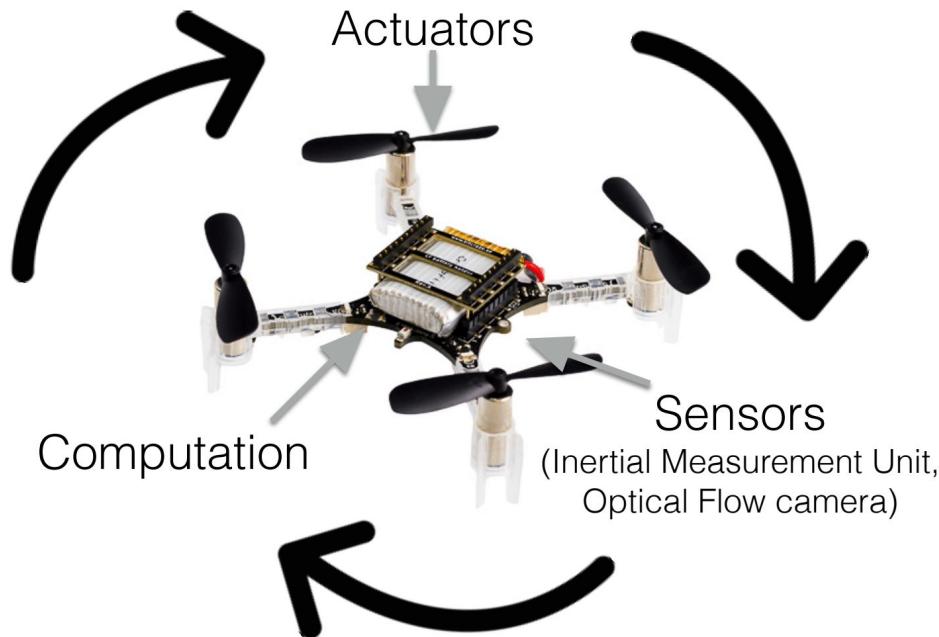
# Remotely operated underwater vehicle (ROUV)



# Autonomous underwater vehicle (AUV)



# Anatomy of a robotic system



**“Sense-Think-Act”**

# AI Primitives within an Agent

SENSE

PLAN

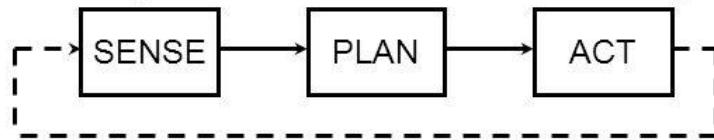
ACT

LEARN

# Paradigms of Robotics

# The Hierarchical Paradigm

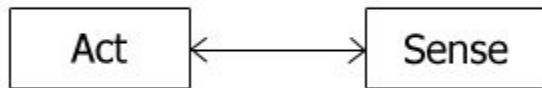
S,P,A organization of Hierarchical Paradigm



Alternative description of how the 3 primitives interact in the Hierarchical Paradigm

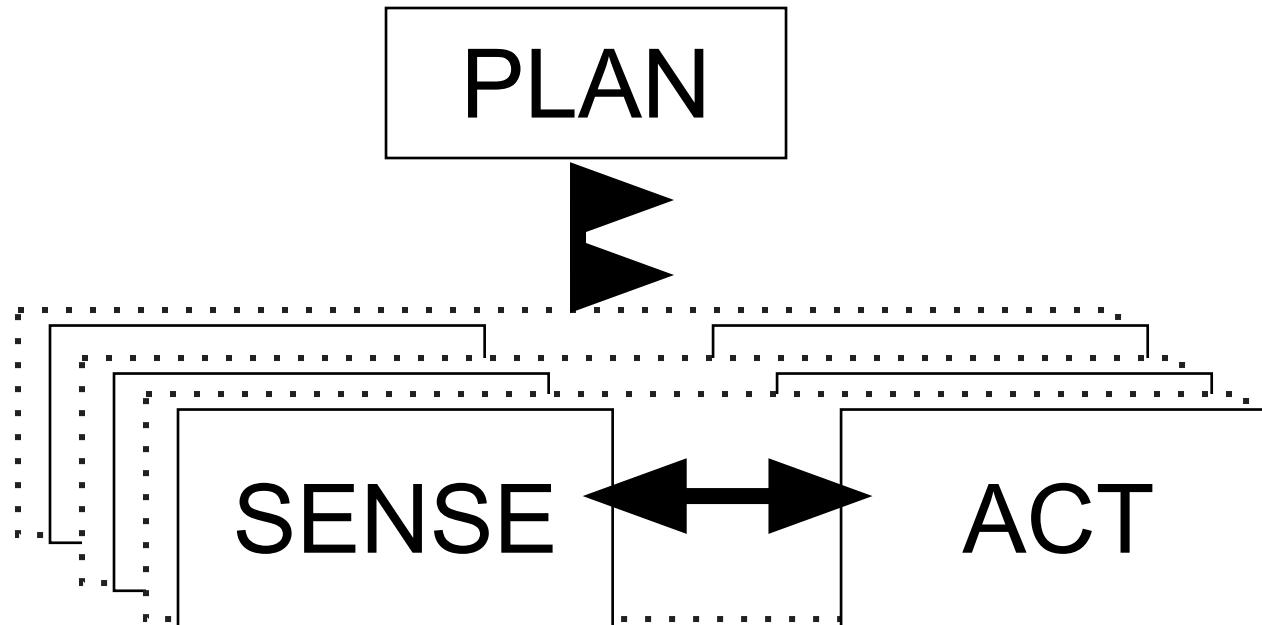
ROBOT PRIMITIVES	INPUT	OUTPUT
SENSE	Sensor data	Sensed information
PLAN	Information (sensed and/or cognitive)	Directives
ACT	directives	Actuator commands

# Reactive Paradigm



Robot Primitives	INPUT	OUTPUT
SENSE	Sensor Data	Sensed Information
PLAN		
ACT	Sensed Information	Actuator Commands

# Hybrid deliberative/reactive paradigm



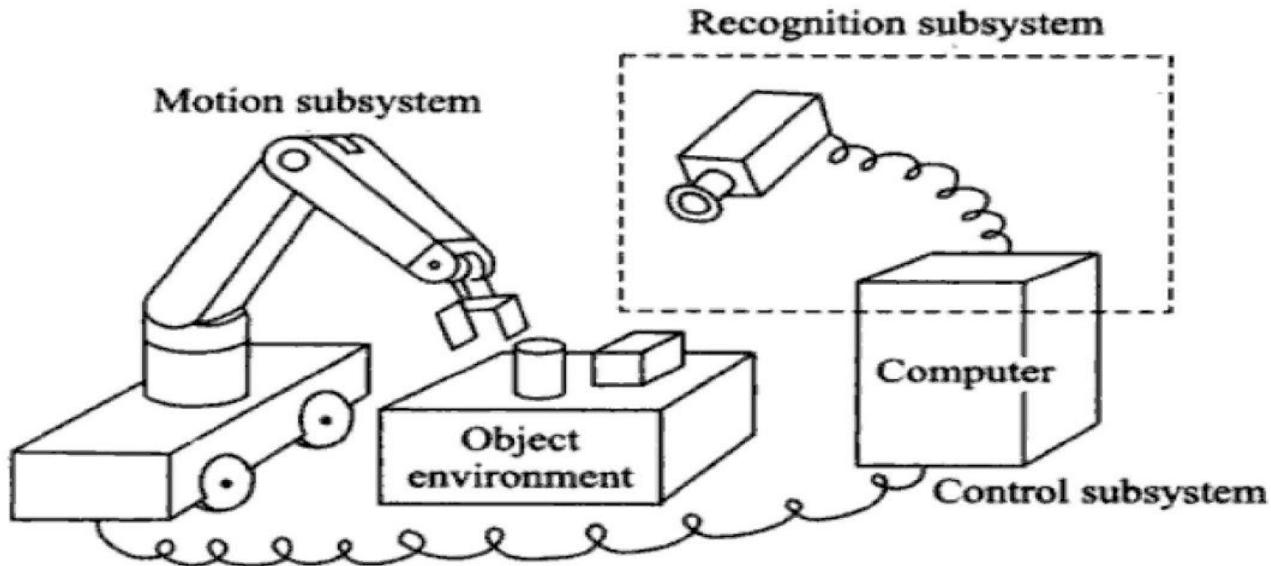
# Advantages

- Asynchronous processing technique allows to function Independently
- Planner can slowly computer next goal while robot can perform reactive task
- First reactive updates then global panner for planning
- Good software Modularity

# Local and Global Model

- Reactive for Local control
- Deliberative for Global control
- However; Robot behavioral management requires to know its current mission, state and environment beside path-planning, map-making, monitoring etc. So, both local and global models are required to be considered for a robot performance.

# Three primitives of robotics



- Sense
- Plan
- Act

# Next Class

- Subsystem

Thank You