Introduction to Robotics
CSE 461

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

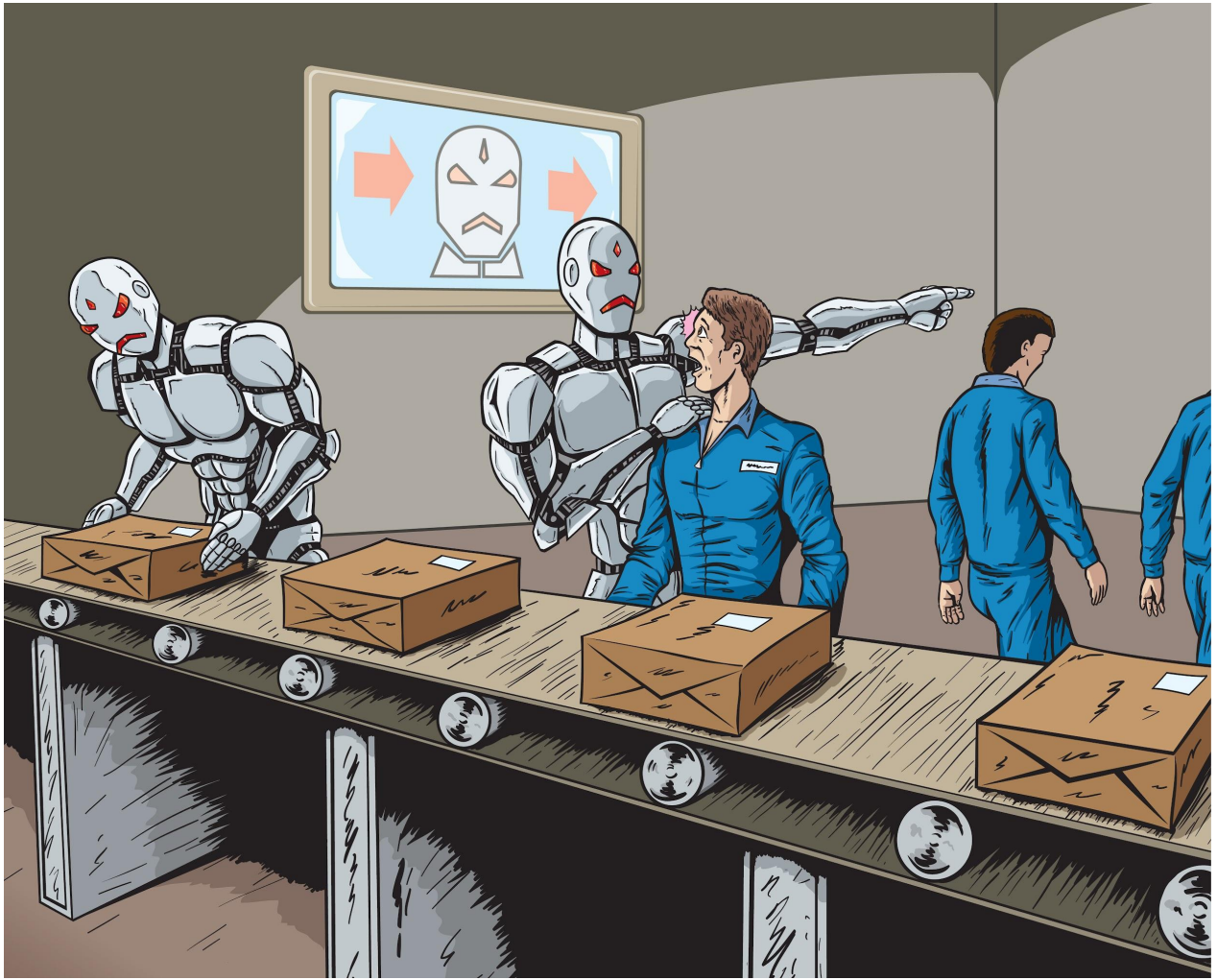
Riad Ahmed
Lecturer, Dept. of Computer Science and Engineering
Brac University

Clip

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

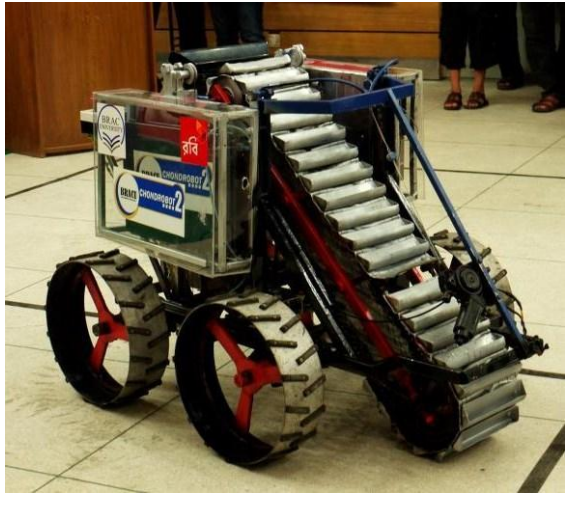
- The first rule to consider, what is known as the **Four D of Robotics**, i.e. is the task dirty, dull, dangerous, or difficult? If so, a human will probably not be able to do the job efficiently. Therefore, the job is appropriate for automation or for robotic labor.
- The second rule is that a robot 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)

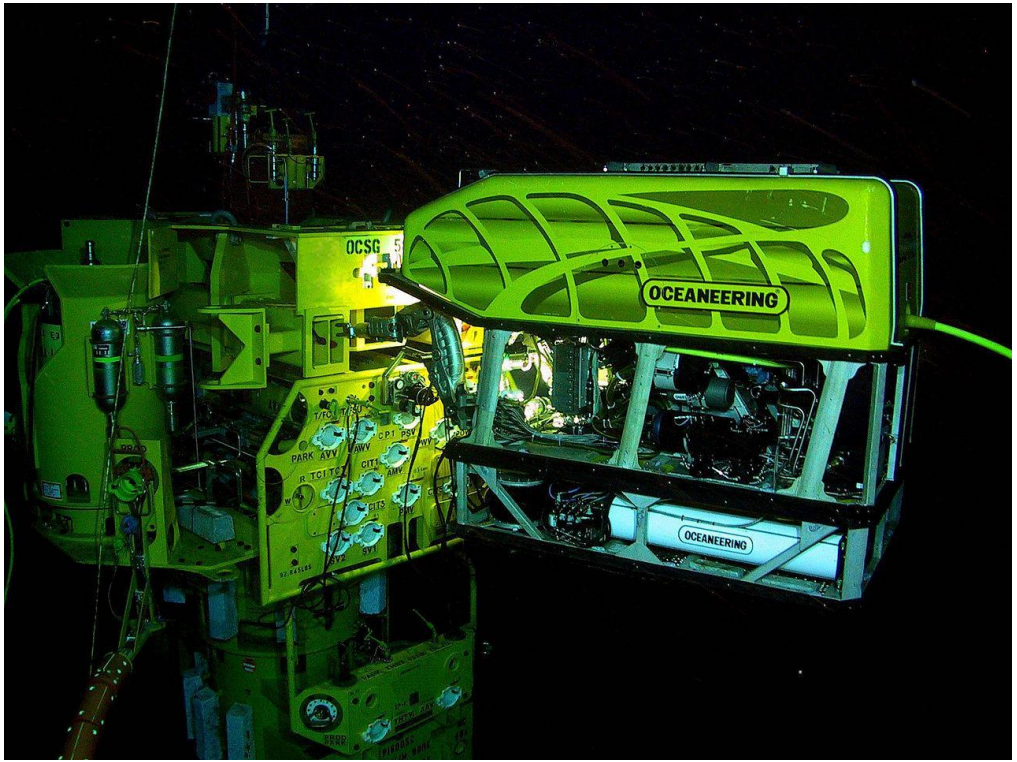
https://youtu.be/cZTCmx6N7Xc

Unmanned aerial vehicle (UAV)

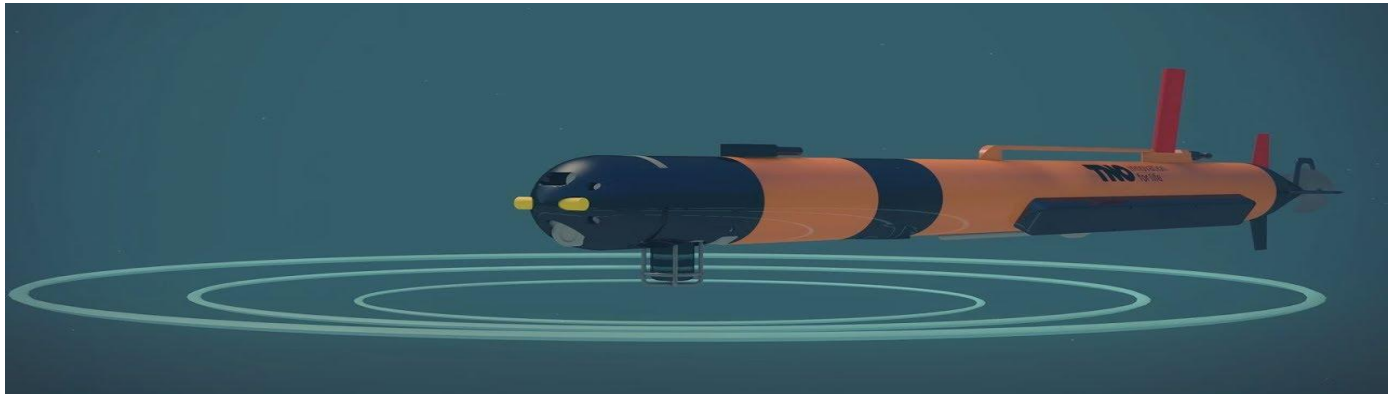
Unmanned combat aerial vehicle (UCAV)
Miniature UAV (SUAV)
Delivery drone
Micro air vehicle (MAV)
Target drone

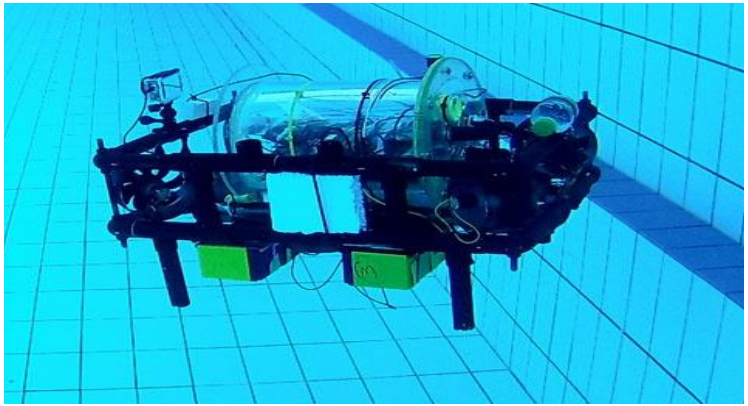
Unmanned surface vehicle (USV)

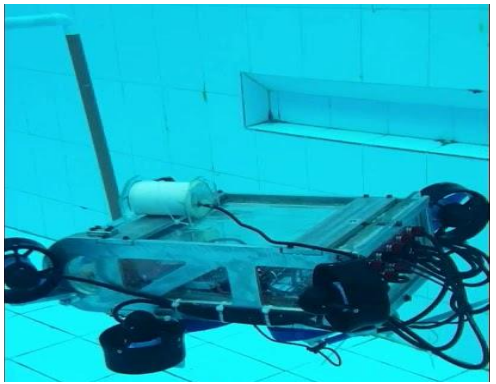
Remotely operated underwater vehicle (ROUV)



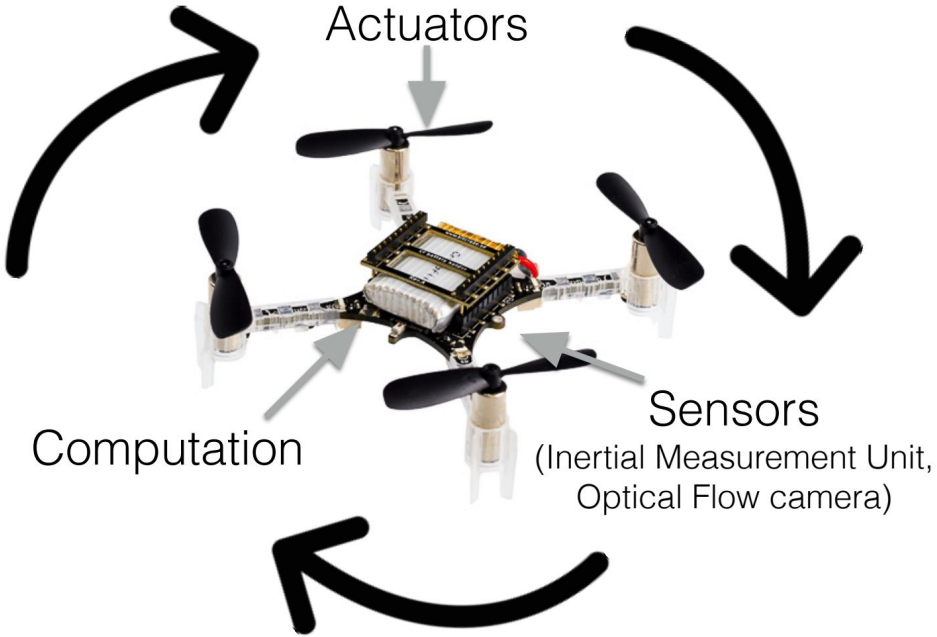
Autonomous underwater vehicle (AUV)





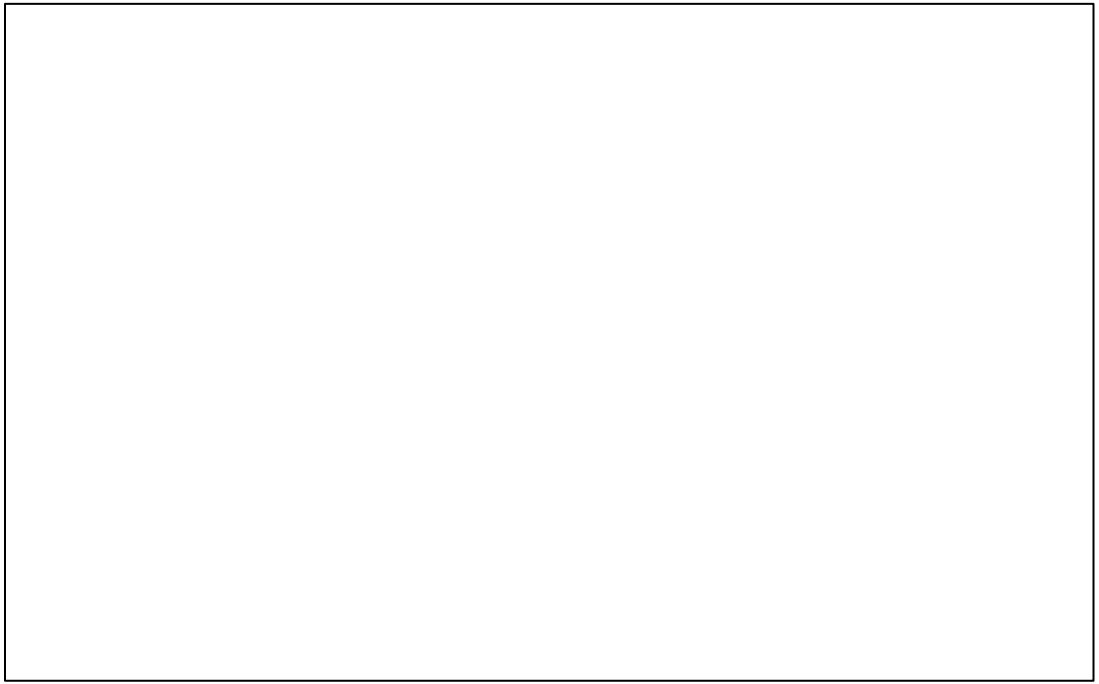


Anatomy of a robotic system



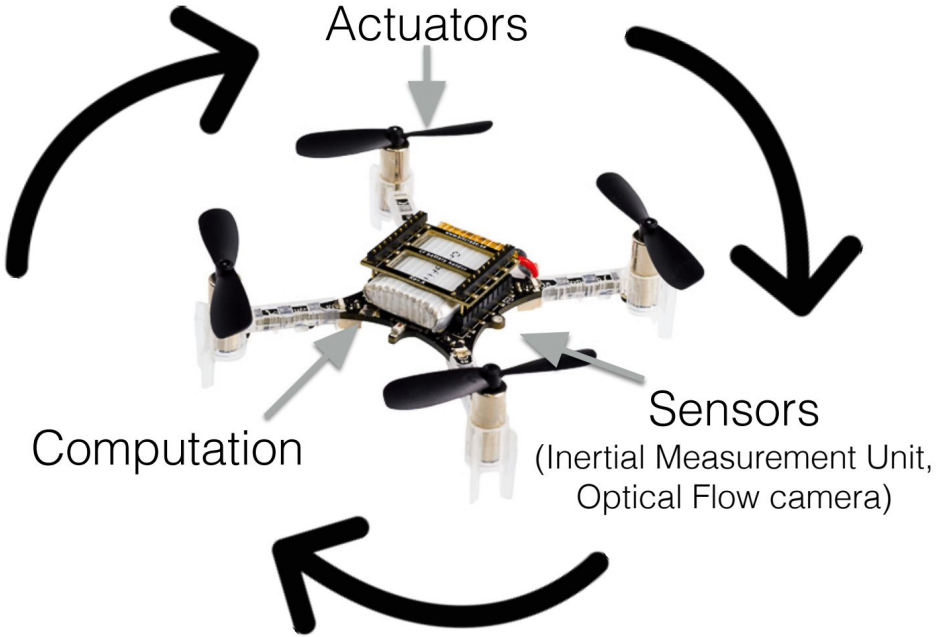
“Sense-Think-Act”

Anatomy of a robotic system



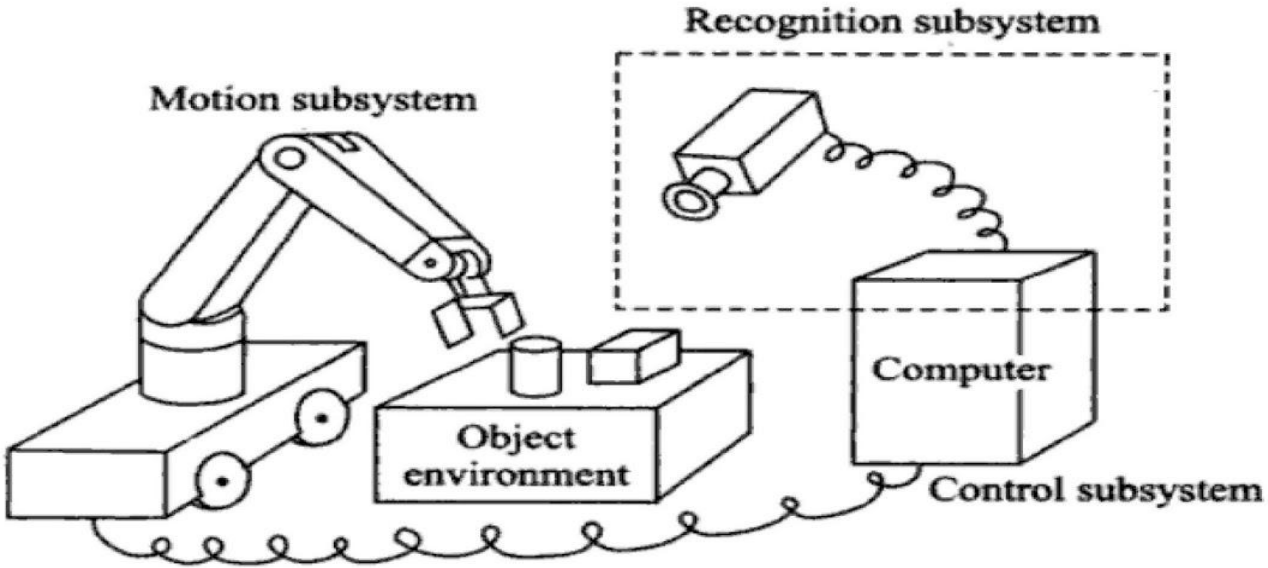
“Sense-Think-Act”

Anatomy of a robotic system



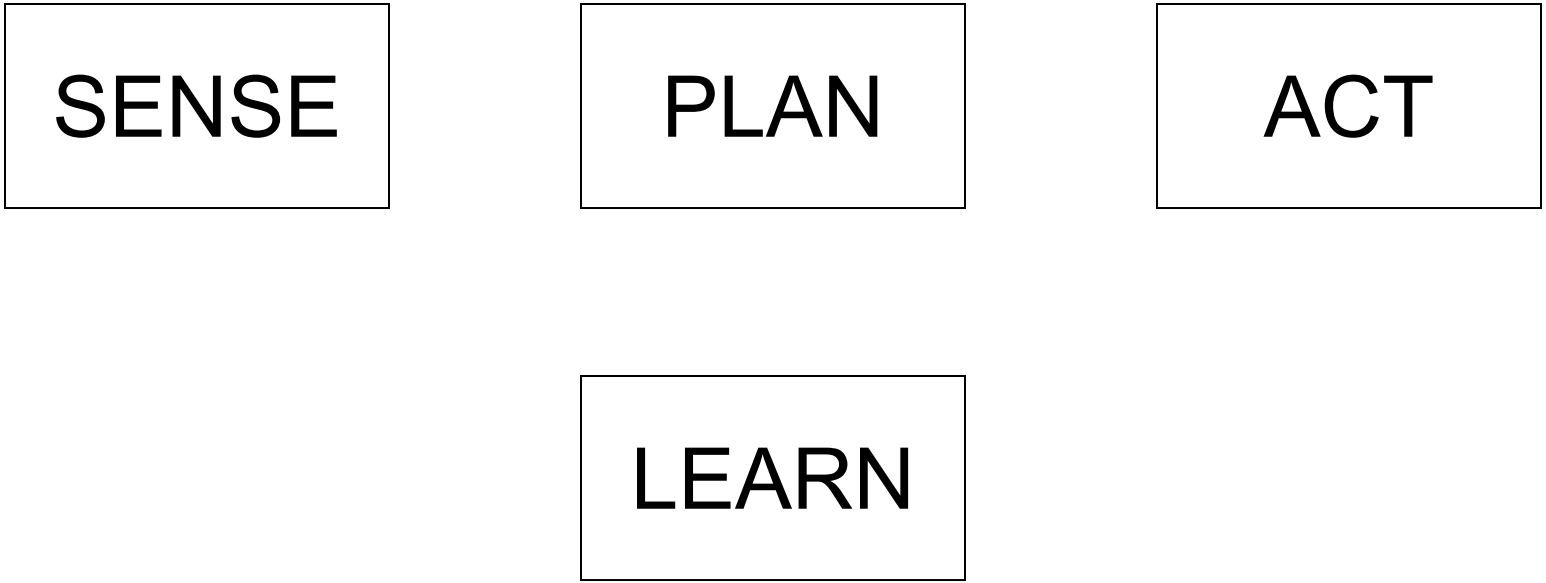
“Sense-Think-Act”

Three primitives of robotics



- Sense
- Plan
- Act

AI Primitives within an Agent



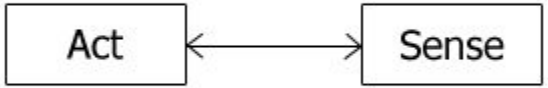
Let's take a break


Olympic Games


Robot for Human Welfare

Paradigms of Robotics

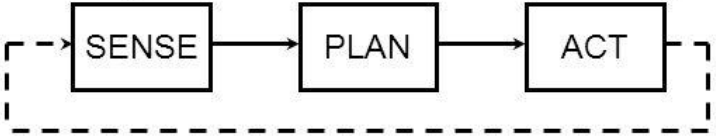
Reactive Paradigm



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

The Hierarchical Paradigm

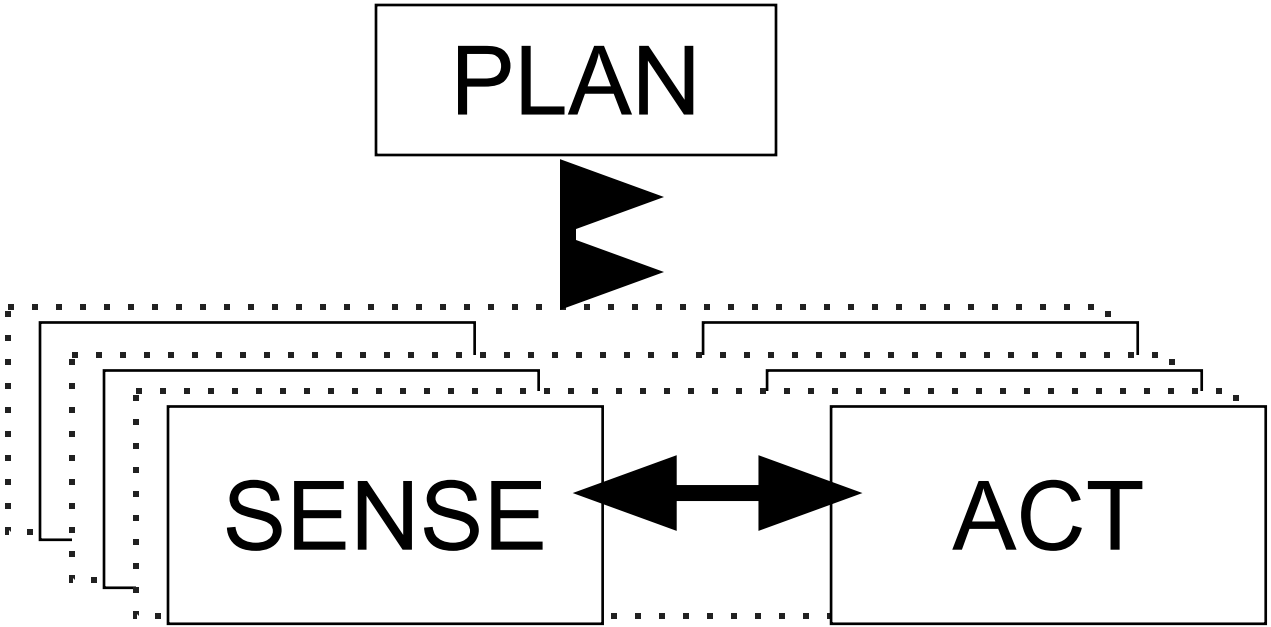
S,P,A organization of Hierarchical Paradigm



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	[redacted] directives →	Actuator commands

Hybrid deliberative/reactive paradigm



Advantages

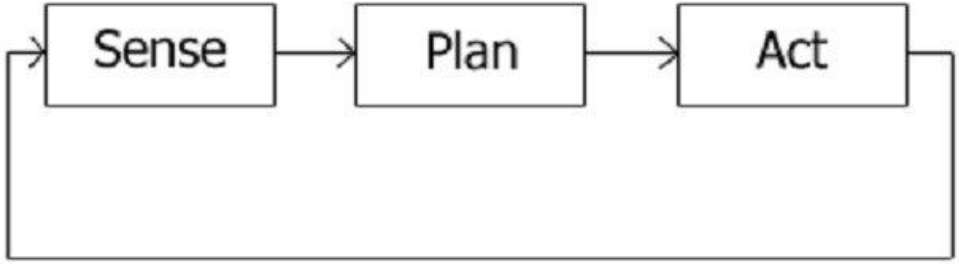
- Asynchronous processing technique allows to function Independently
- Planner can slowly compute next goal while robot can perform reactive task
- First reactive updates then global panner for planning
- Good software Modularity

Local and Global Model

- Reactive for Local control
- Deliberative for Global control

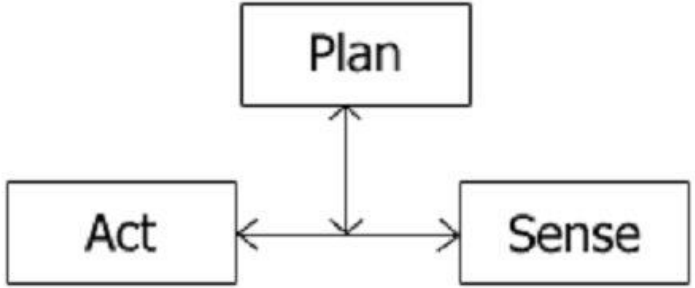
- However; Robot behavioral management requires to know its current mission, state and environment beside path-planning, map-making, monitoring etc. So, both local and global models are required to be considered for a robot performance.

Hierarchical/deliberative paradigm



The reactive paradigm

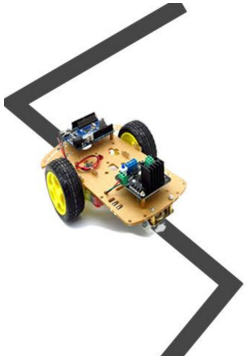
Hybrid deliberate/reactive paradigm



Group Activity

A : Line Following Robot

B : Mini Baymax



Next Class

- Subsystem

Thank You