# Control Systems

## 1
## “Introduction to Control Systems”

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“Control Systems”

*Control Systems* → a very wide area

*A palavra "sistema"* (*system*) tem um significado muito amplo.

Things which are very different may be examples of *systems*.

# What is *Control Systems*?

The human being has a natural desire to control everything.

When we press a button, such as for example to call an elevator (*lift*), we are exercising a type of control.

When we drive a vehicle, either a motorcycle, or a car, or even an helicopter or a airplane, we are also exercising some type of control.

# What is *Control Systems*?

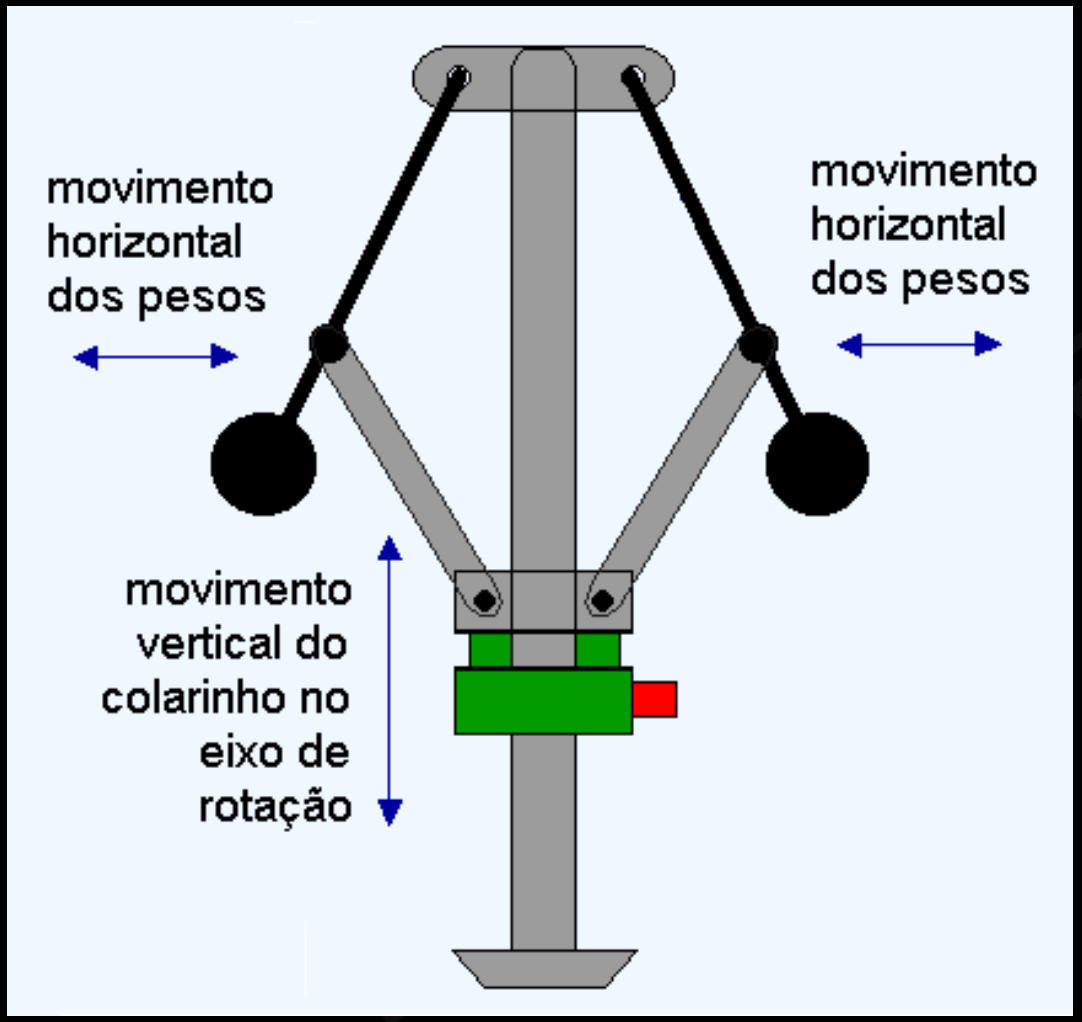
***Control Systems*** is the art of

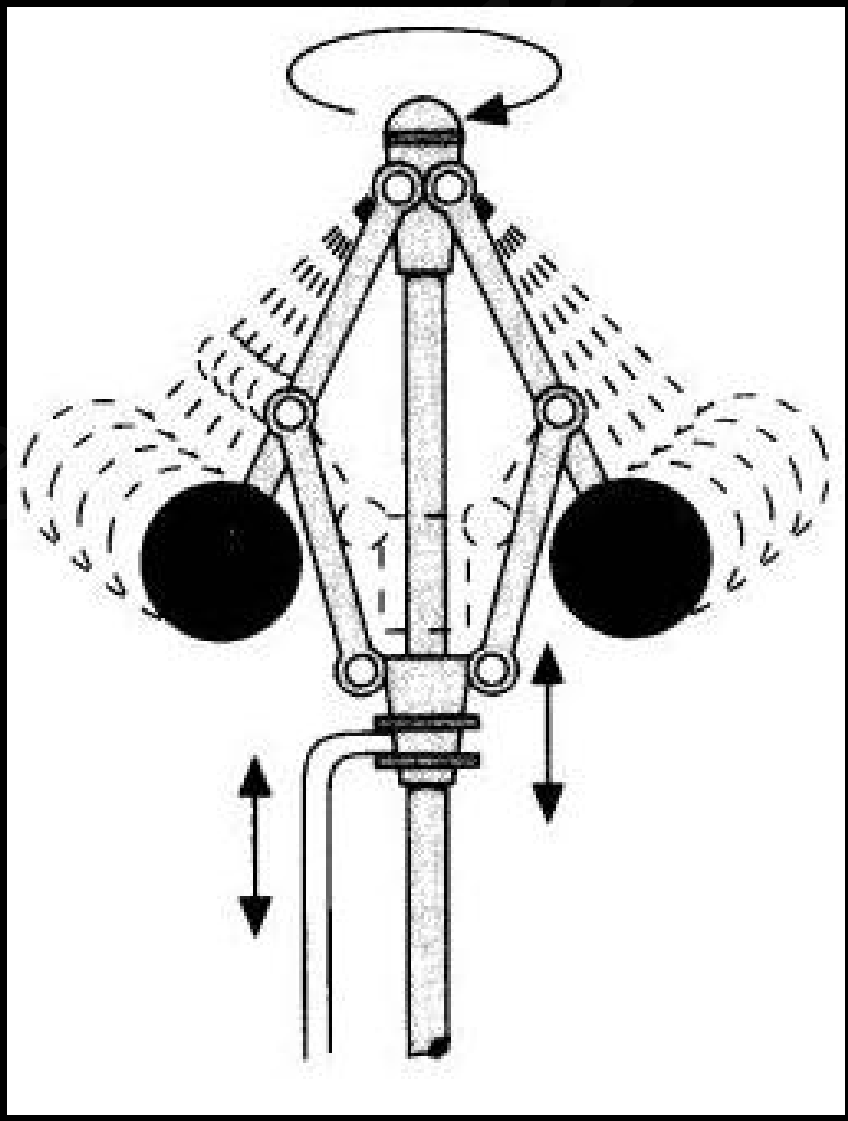
*guide*, *conduct*, *manoeuvre*, *comand*, *drive*, *manage* or *control*

a *device*, an *utensil*, an *equipment*, an *appliance*, a *mechanism*, a *tool*, a *machine*, an *structure*, a *process*, or rather, a *system*.

# What is *Control Systems*?

In engineering, man has been controlling devices for centuries.



The centrifugal governor (or regulator).

# What is *Control Systems*?

Similar devices to that has been used

- in ancient Greece by the priests to open and close the heavy doors *of their temples*.

and also

- in 17th century, in *mills*,
- in 18th century, in *steam engines (James Watt)*, for
  - *pumping water from a well* or
  - *in steam engines* in *vessels* or
  - *in steam engines* for *pulling trains*;

and even nowadays:

- in the *engine of a car* or
- in the *engine of a locomotive*.

Through the centuries men has been improving the techniques to **control systems**.

# What is *Control Systems*?

In particular, in 20th century men constructed several types of *machines* or *devices* which he is able to control more and more efficiently.

The vehicles that men has constructed last century (20th century) are great examples of ***Control Systems***.

# What is *Control Systems*?

They are all sort of machines controlled by man and with increasing sophistication: vehicles with 2 wheels, with 4 wheels, that goes on water, or under the water, that fly or that goes on the space.

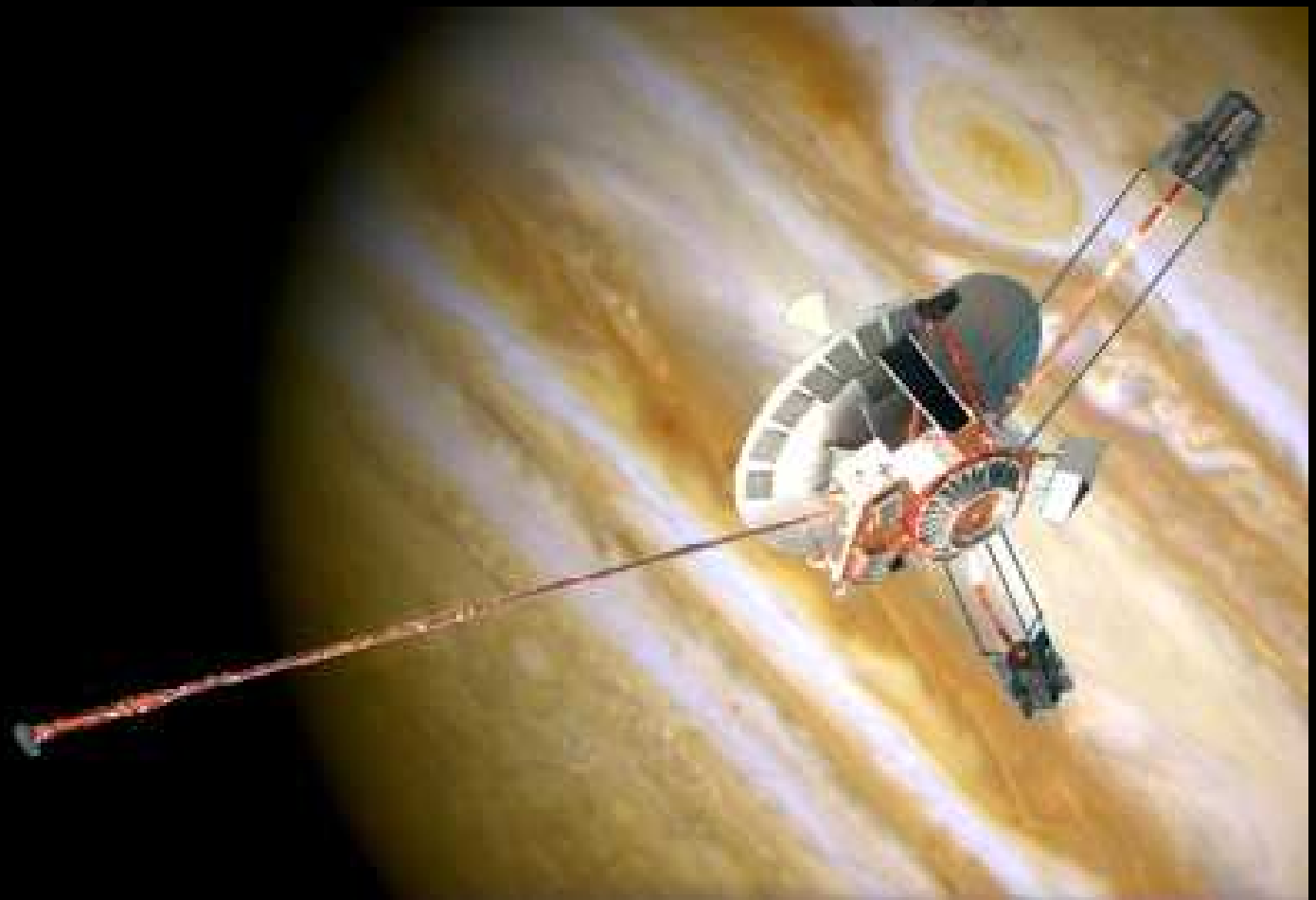



# *Control Systems*

We got to the Moon, and, tele-guided, we also got to *other planets*.

## *Control Systems*

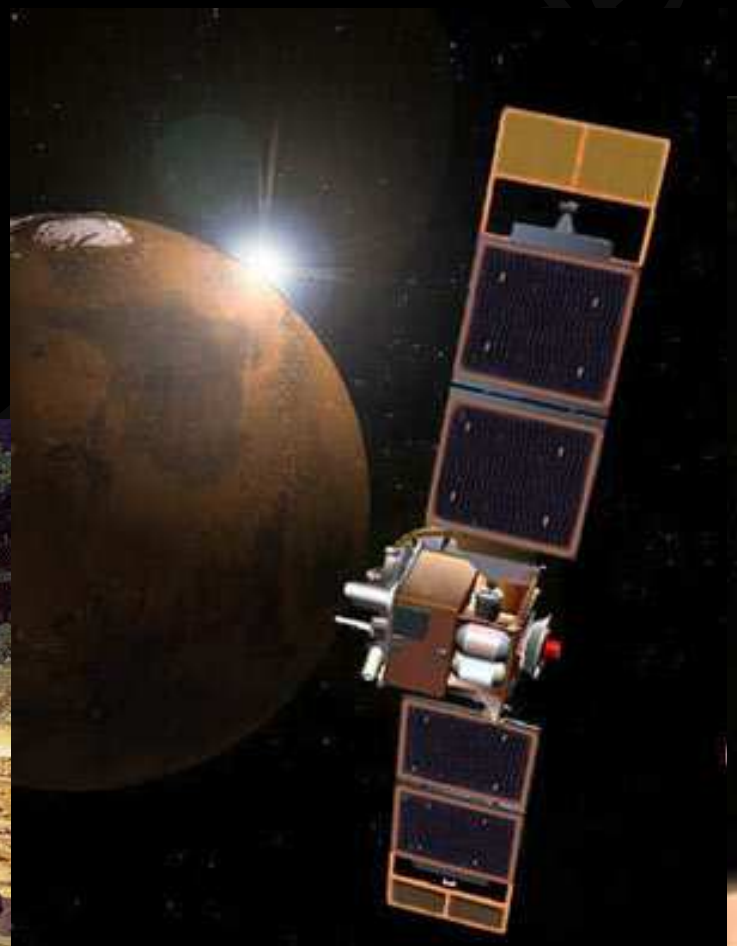
Today there are space probes (such as for exemple *Pioneer 10 and 11* and the *Voyager 1 and 2*) that have already left our solar system and are going towards some star where is only going to arrive after millions of years, when this planet will not exist anymore.



# Control Systems

Even now in the 21st century, in 2004, men has landed a robotic space vehicle in Mars, called *Mars Rover Spirit*, which weighs 185 kg and moved about 100 meters per day.

*Mars Rover Spirit* went to Mars packed inside an unmanned spaceship *Mars Surveyor* during its 480 millions km trip that took to get there, when then it opened.



# *Control Systems*

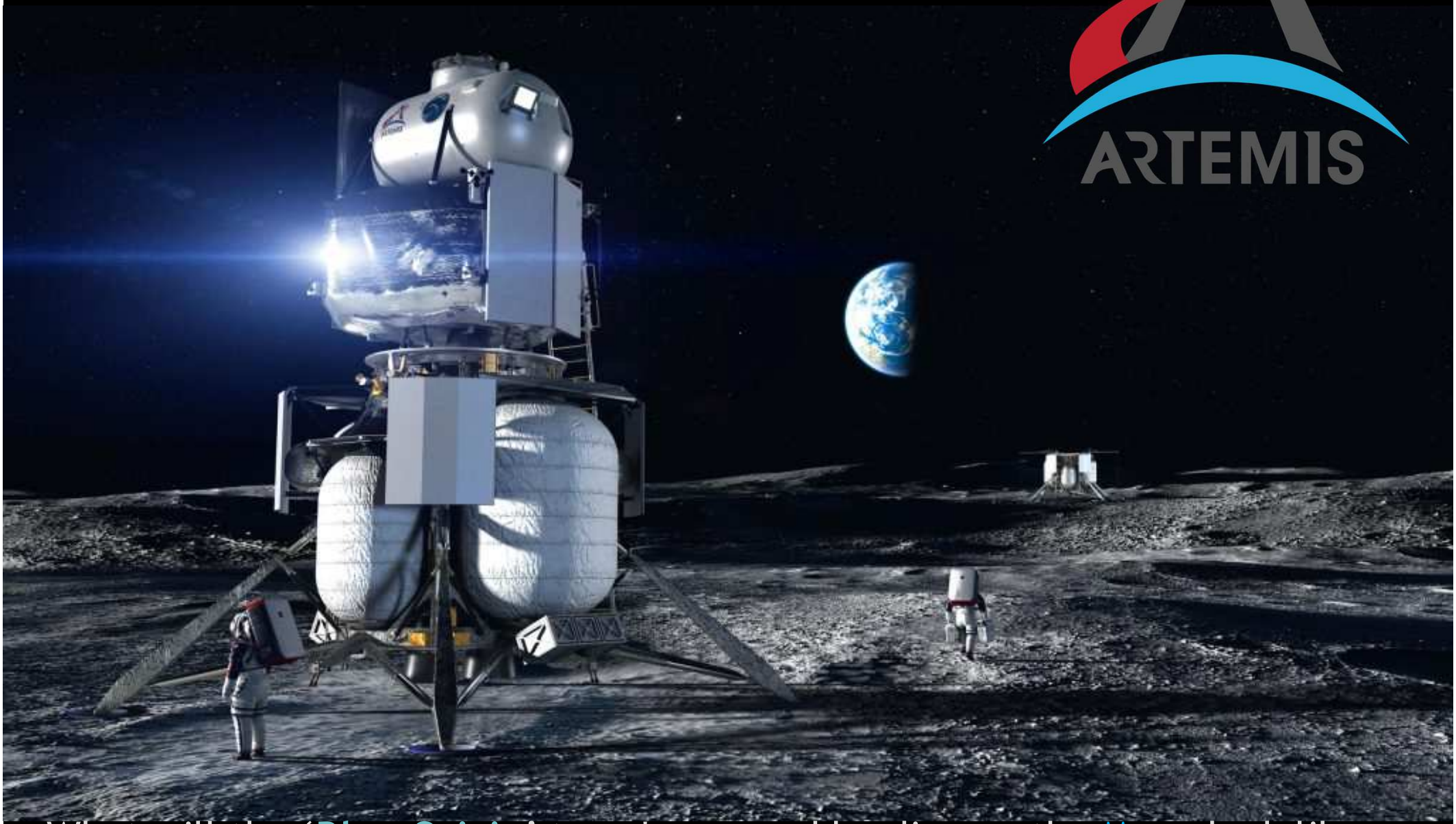
The *Mars Rover Spirit* robot drove around in Mars 591 days Martian days, *exploring*, *photographing*, *sending* images to Earth and reaching about 3 km (three kilometres) away from the point it landed in Mars.

# Control Systems

Artemis Program is a manned spaceflight program developed by NASA, US commercial spaceflight companies and international partners, with the goal of landing the first woman and the next man on the Moon by 2024.


Artemis would be the first steps in a long-term goal of establishing a "sustainable" human presence on the Moon, laying the foundation for private companies to build a lunar economy and eventually send humans to Mars.

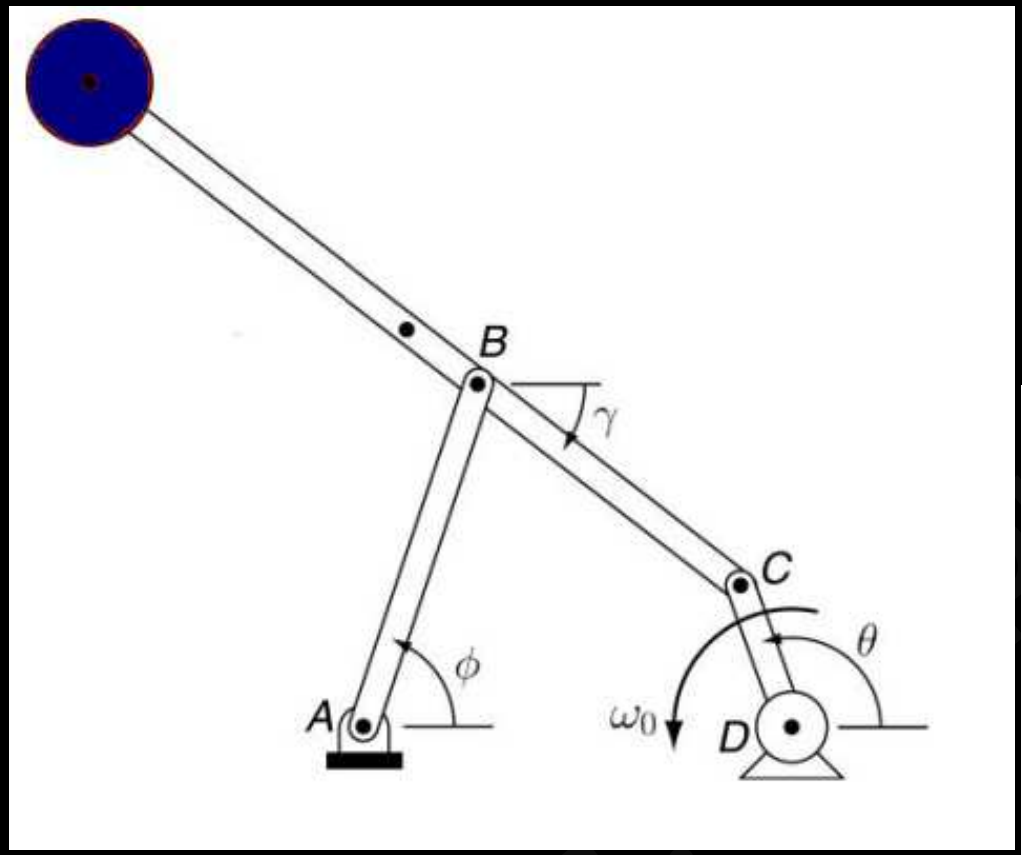
# Control Systems

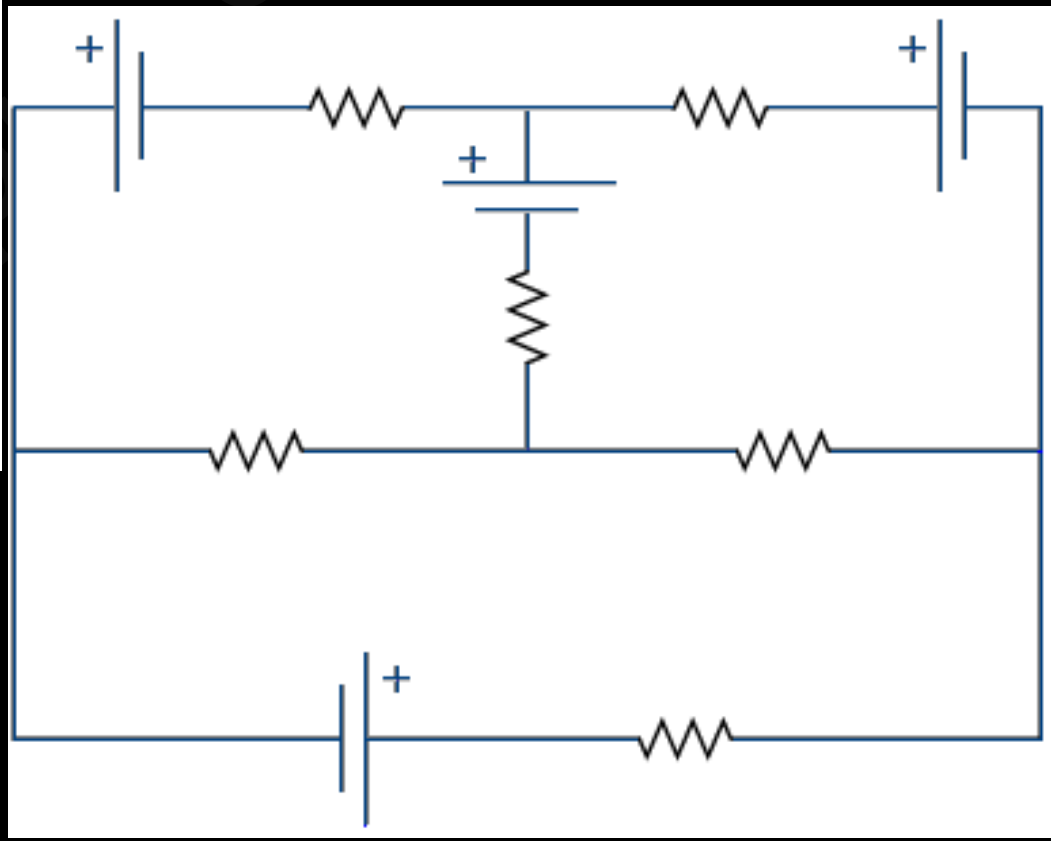



What will the '**Blue Origin**' team's manned landing on the Moon look like as part of the Artemis program?

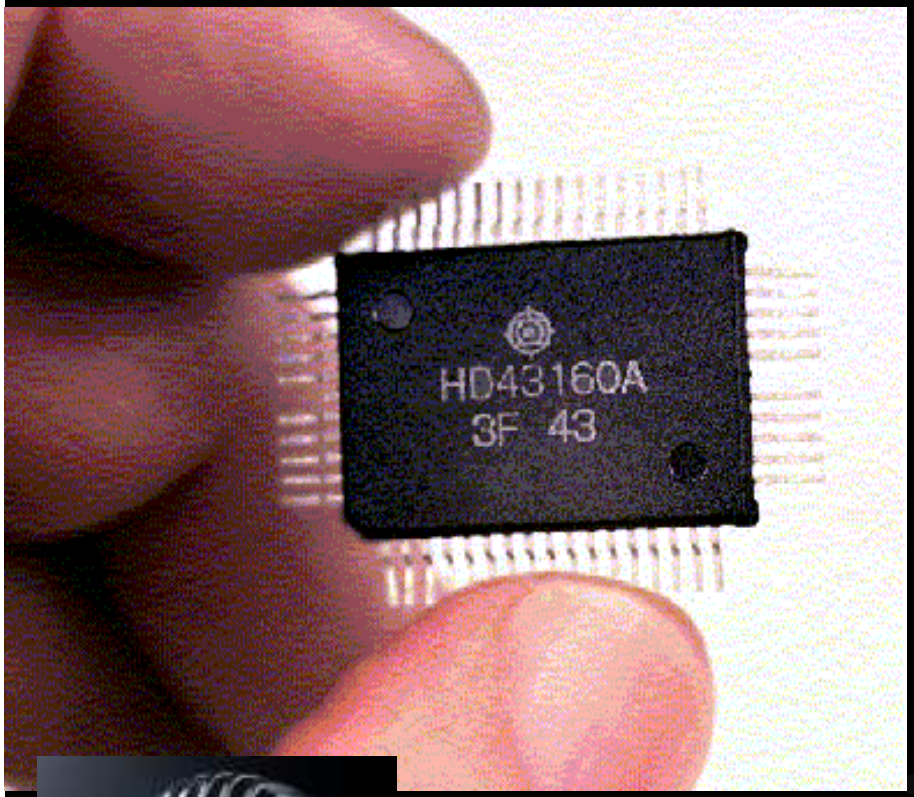
# Some examples of *Control Systems*

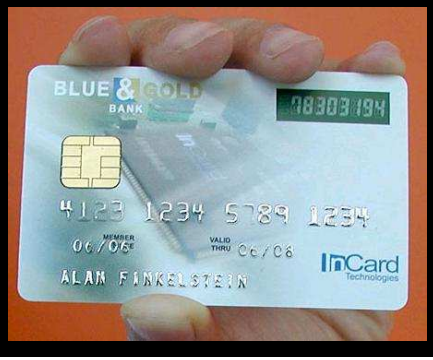
The notion of ***systems*** is intuitive.
Almost everything that is around us is some type of ***system***.



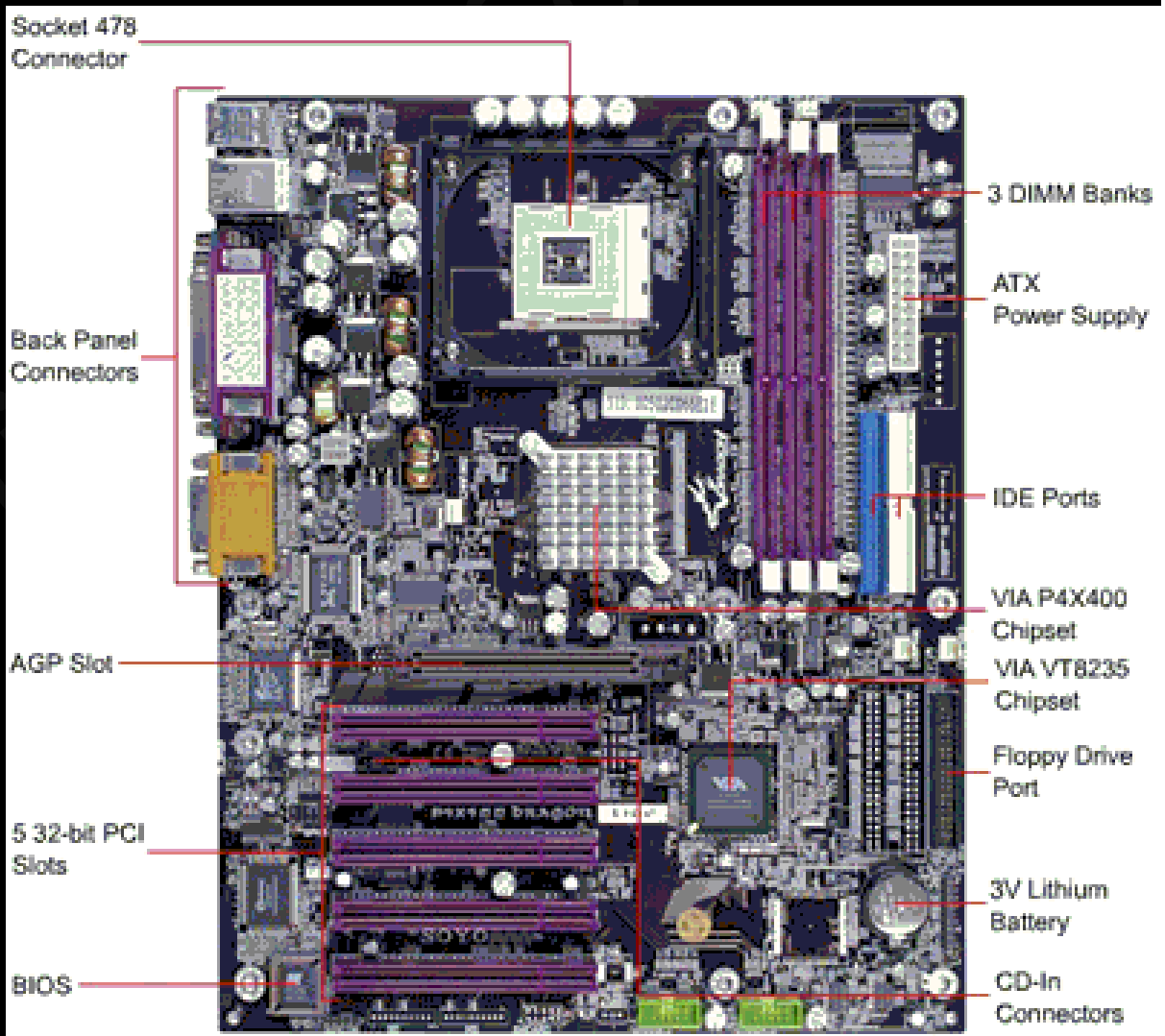



# Some examples of *Control Systems*



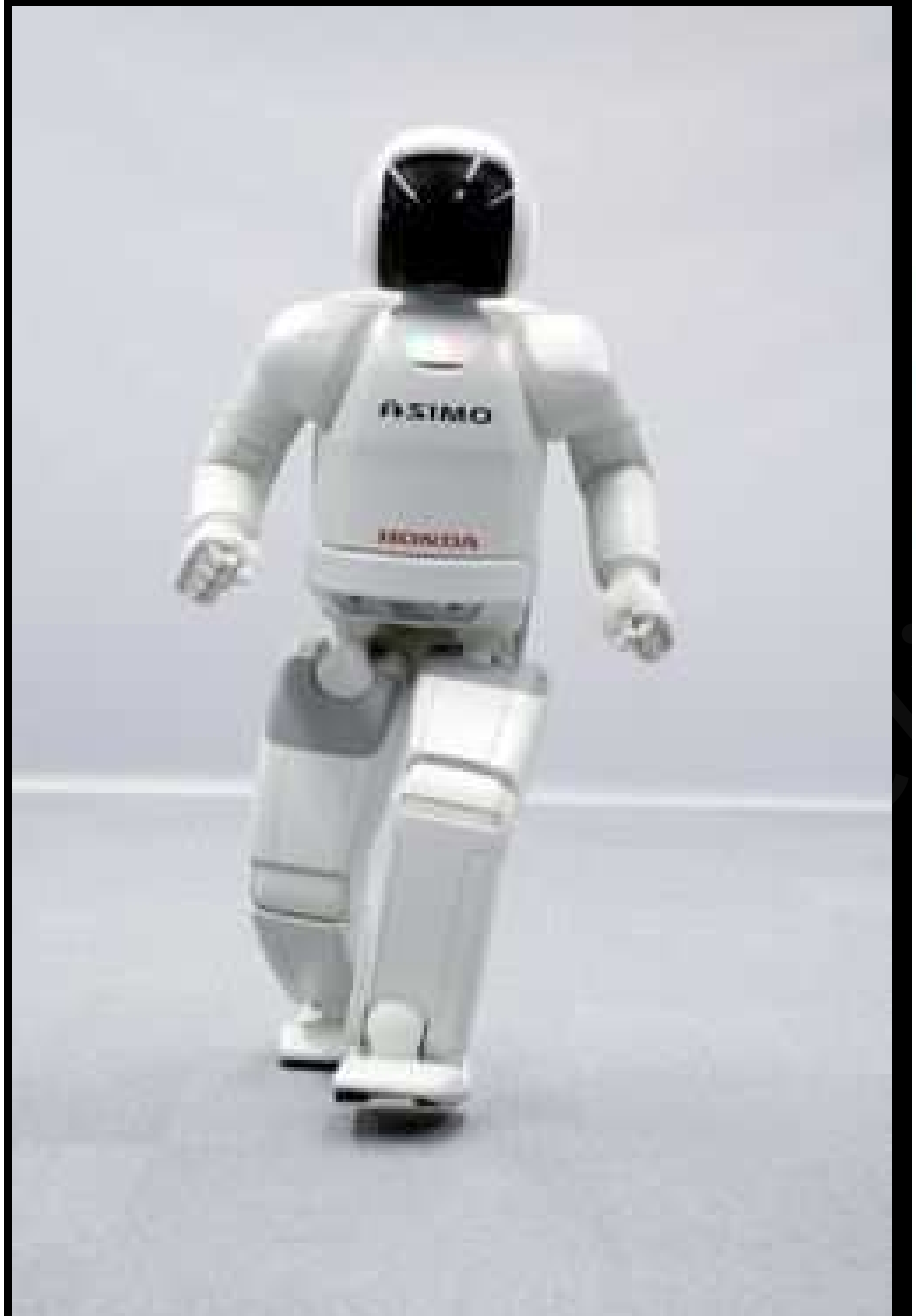



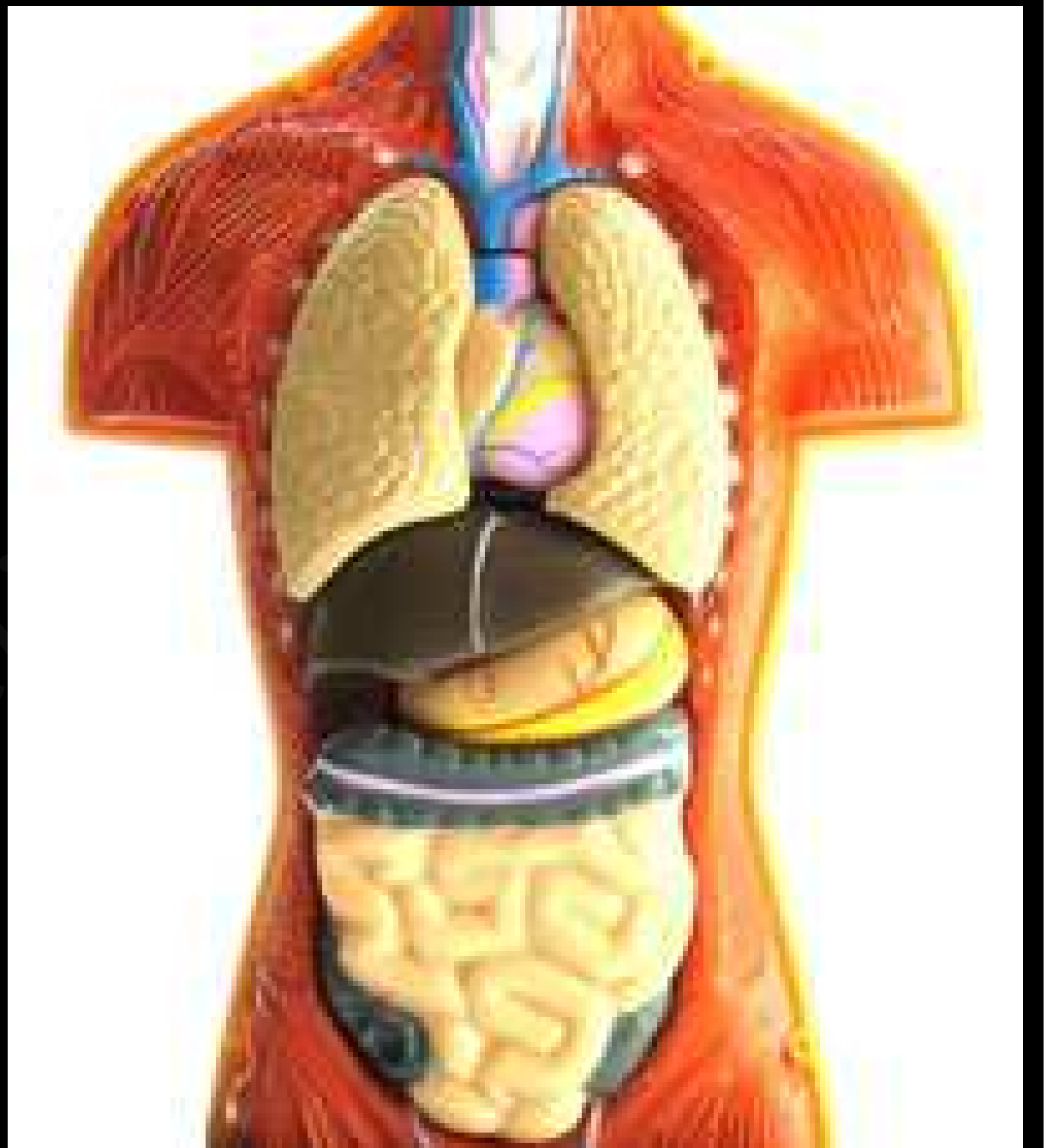


# Some examples of *Control Systems*

Almost everything that is around us is some type of ***system***.



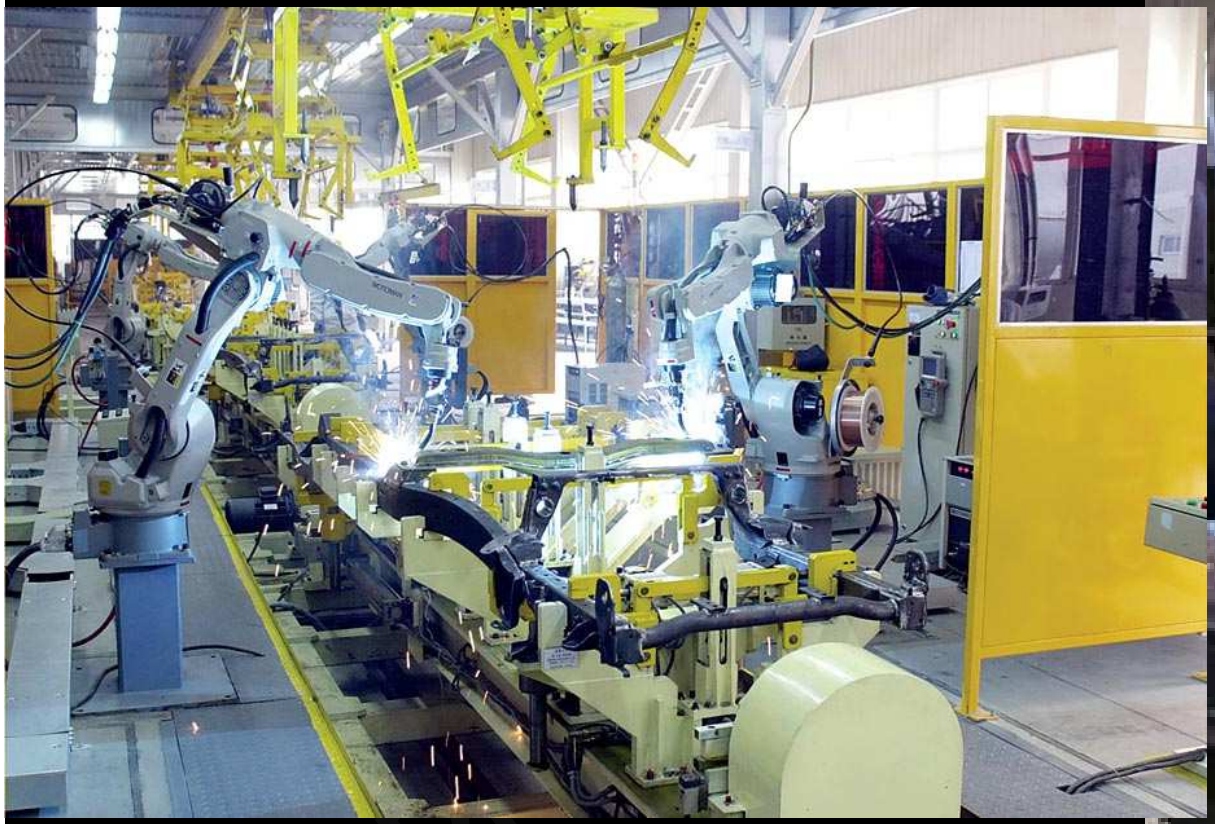
# Some examples of *Control Systems*

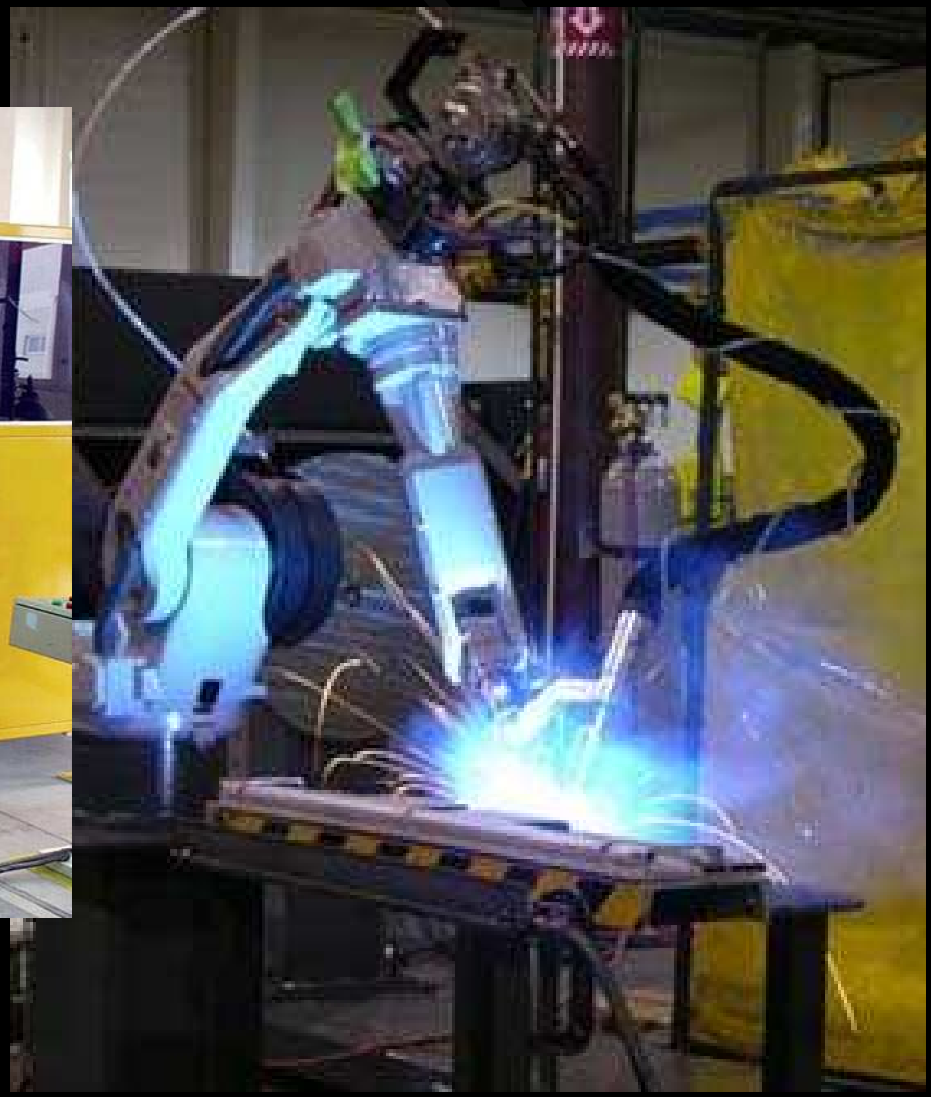
Almost everything that is around us is some type of ***system***.


# Some examples of *Control Systems*

# Robotics

***Robotics*** is today a great example of ***Control Systems***, and of ***Automation*** in particular.





# Robotics

***Automation*** is the reduction of the necessity of human intervention.

# Robotics

However, automation in industry do not consist in *robots* only.

There are many machines which are not *robots* but are *automatized*.

Just to mention some few examples in the alimentary/food industry: the handling of the mass (*bread*, *cakes*, *cookies*, *etc.*); or the packing phase; or also the bottling of *drinks*; etc.

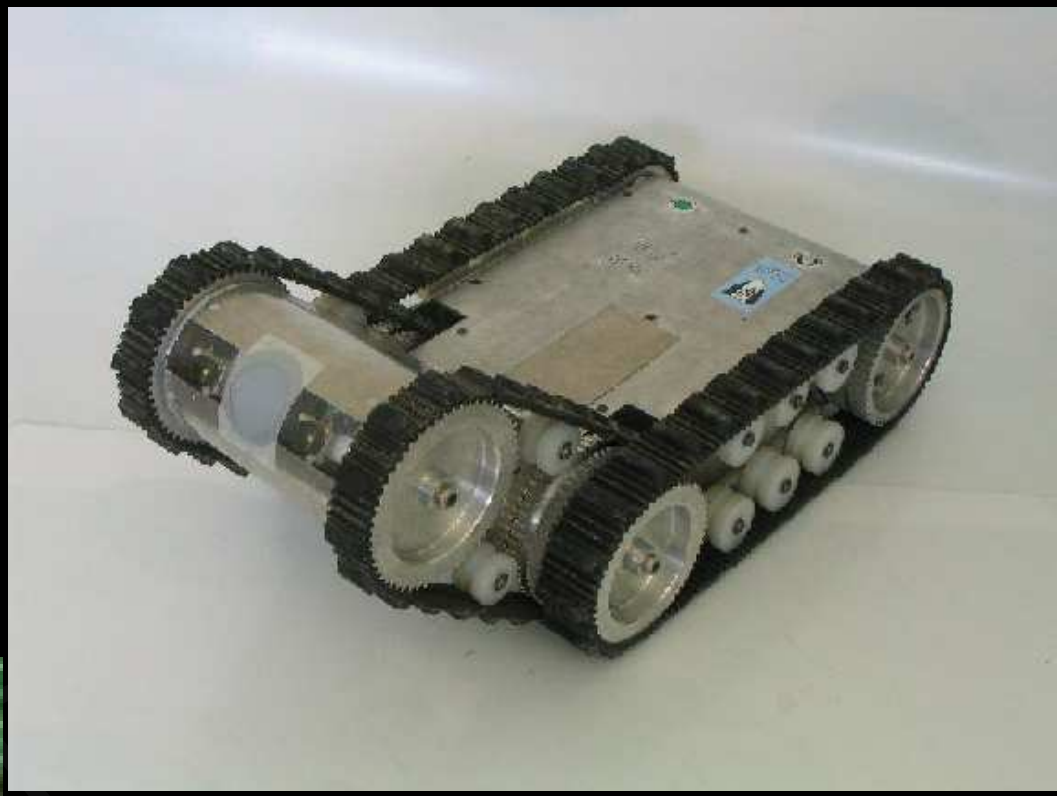
# Robotics

On the other hand, today we can see *robots* not only in the industry:

- *robots* for *domestic use*;
- *robots* for *medical purposes*,
- *robots* in *hospitais*;
- *robots* for *dangerous tasks* or in *risk zones* such as:
  - *robots* to dismantling *bombs*;
  - *robots* to enter in *radioactive zones*;
  - *robots* to rescue people in *fires*, *earthquakes*, etc.;
  - *robots* that goes to the *bottom of the sea*, etc.
- *UAVs (unmanned aerial vehicle* or *drones)*;
- *AUVs (autonomous underwater vehicle)*

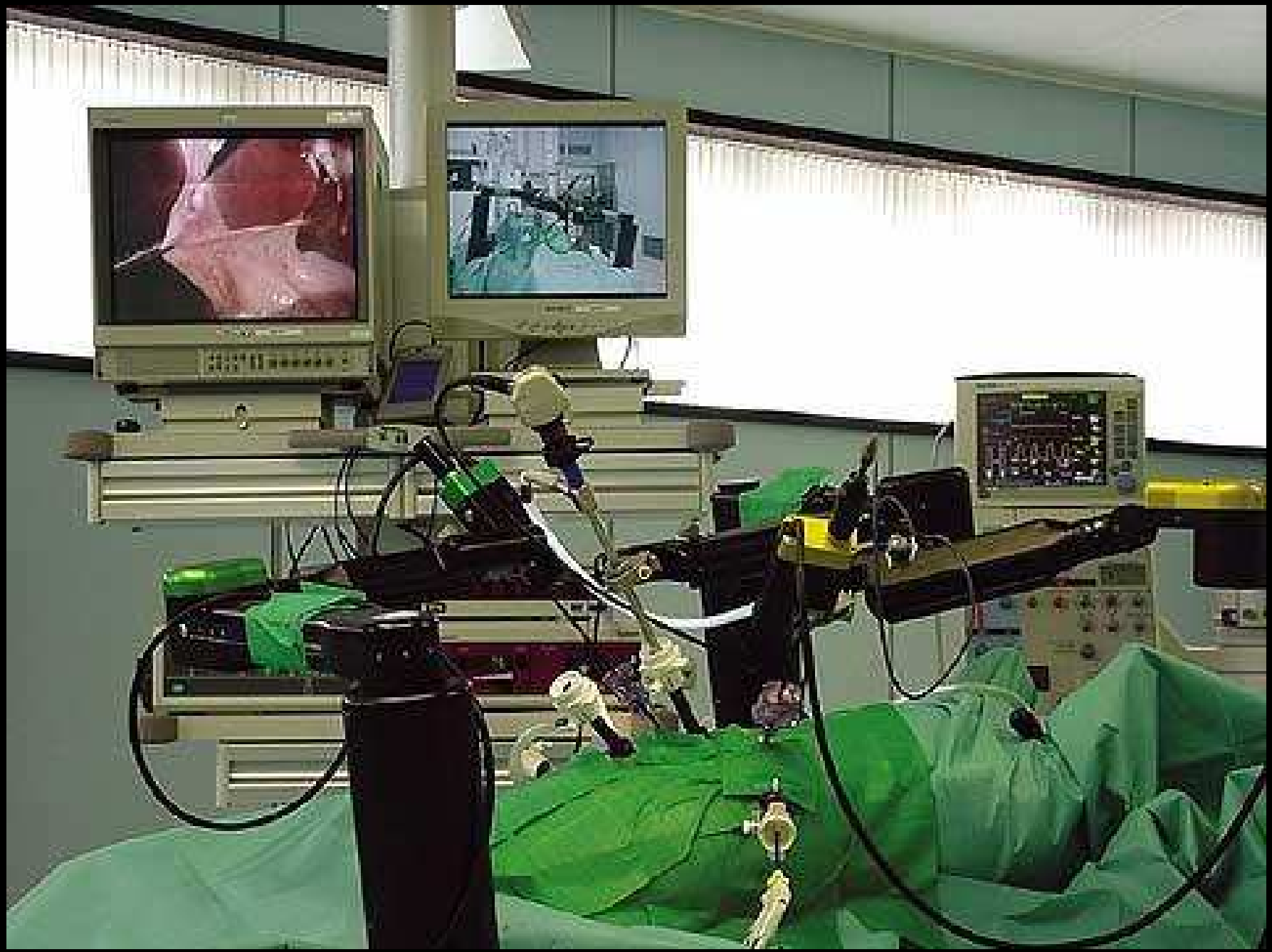
# Robotics

Robots for *rescuing* and *saving*



# Robotics

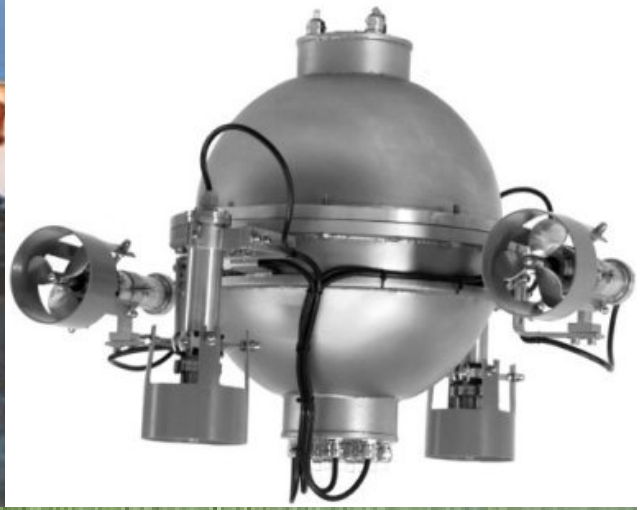
## Robots in *medical surgeries*



# Robotics

UAVs *'drones'*

# Robotics

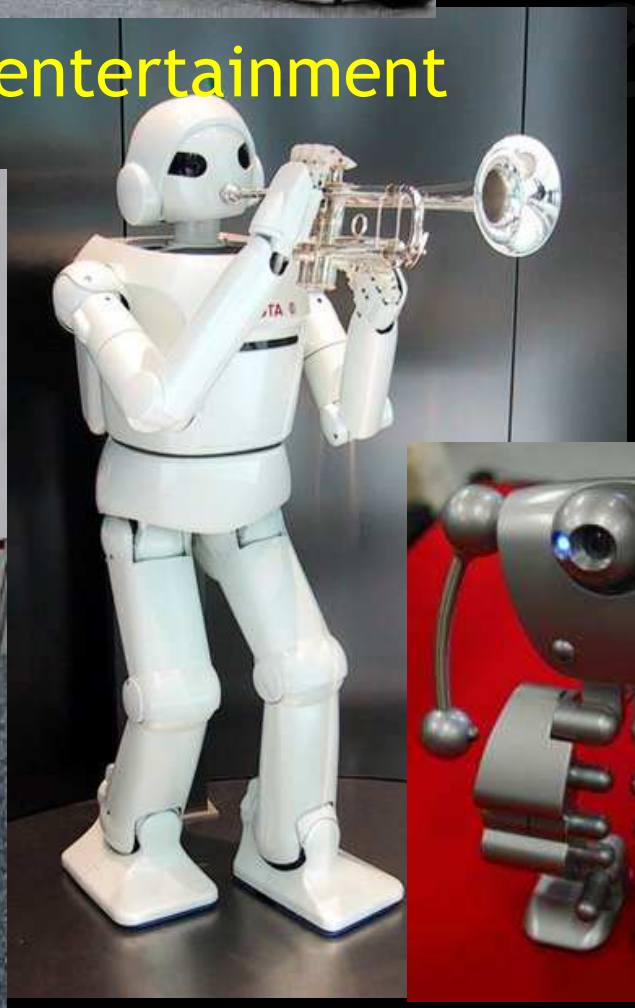



# Robotics


robonaut

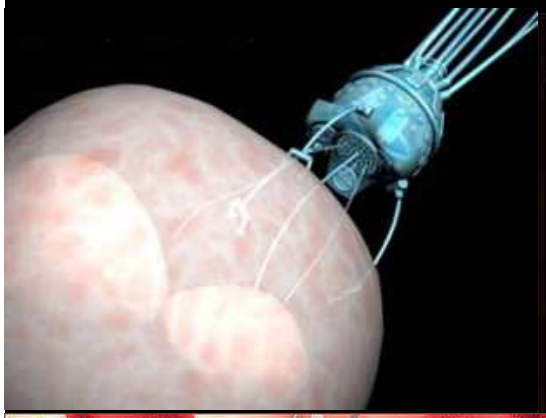
educational


entertainment

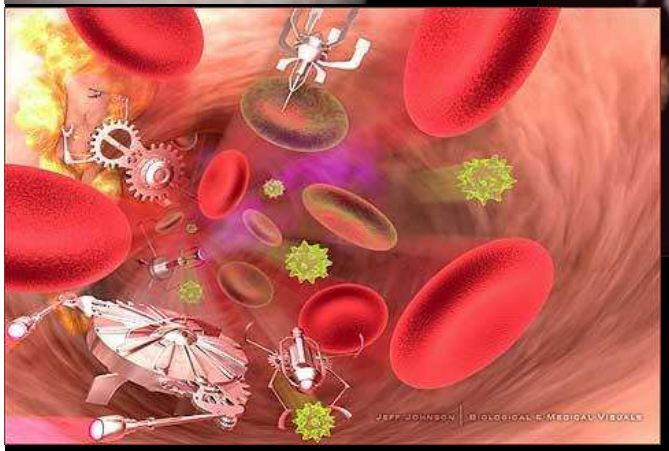


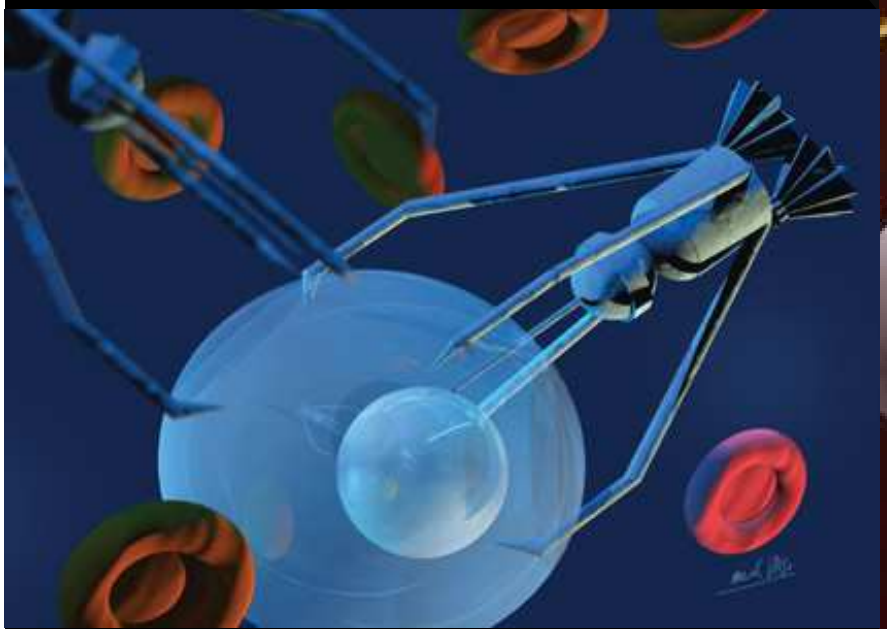
exoskeleton

# Robotics



nanorobots





# Robotics


humanoid robots

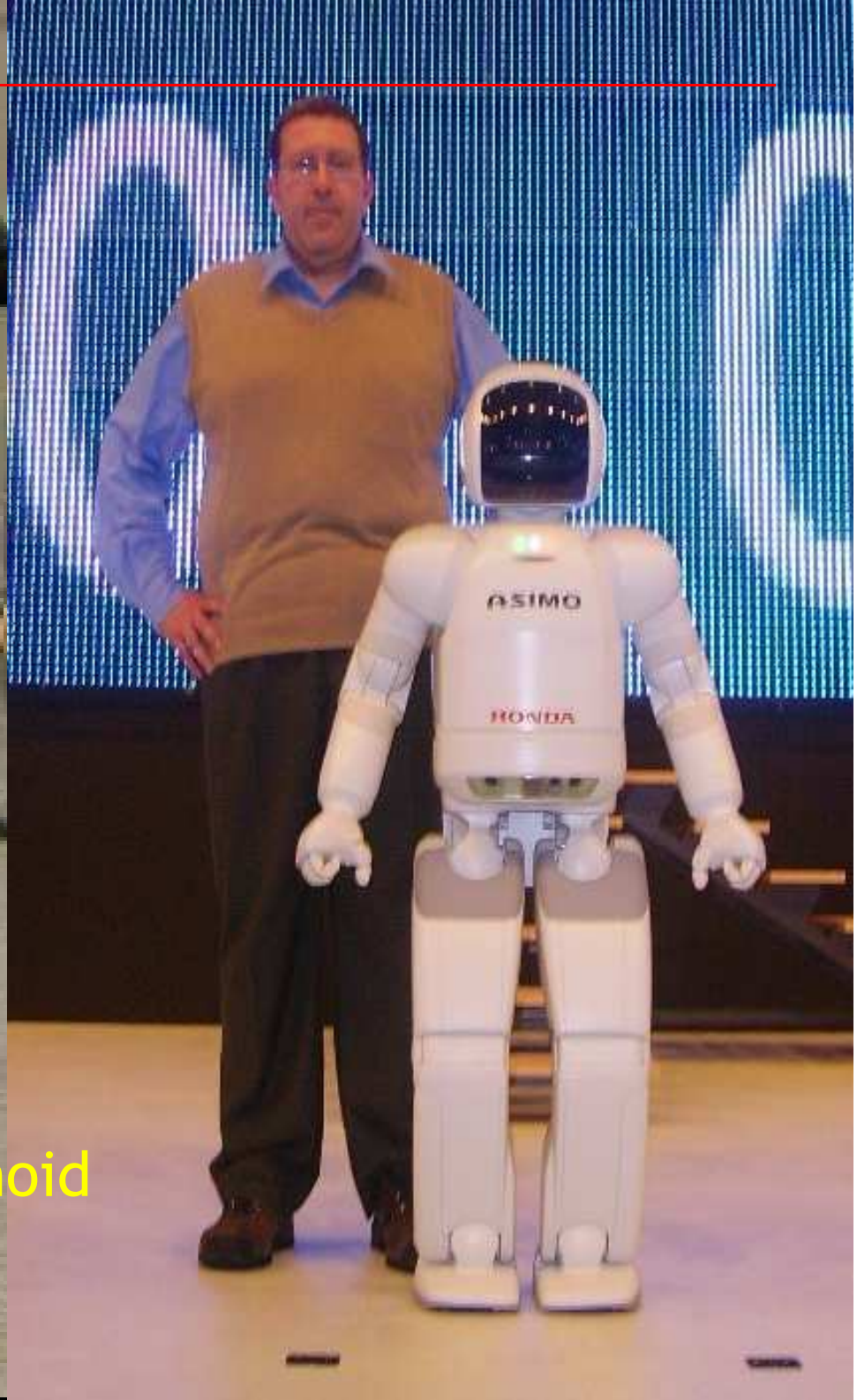
# Robotics


humanoid robots

# Robotics

humanoid
robots

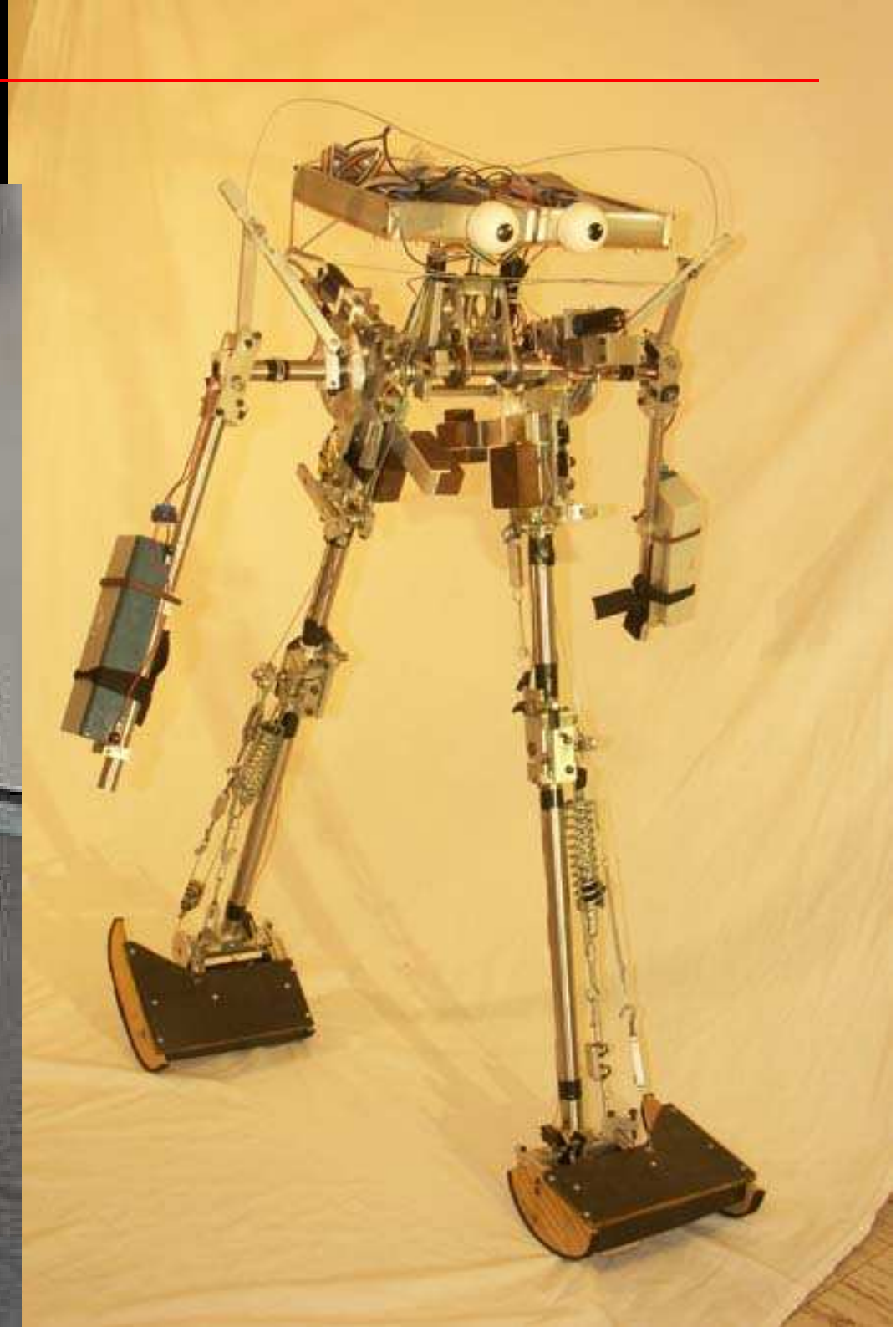
# Robotics


humanoid robots

# Robotics

humanoid robots



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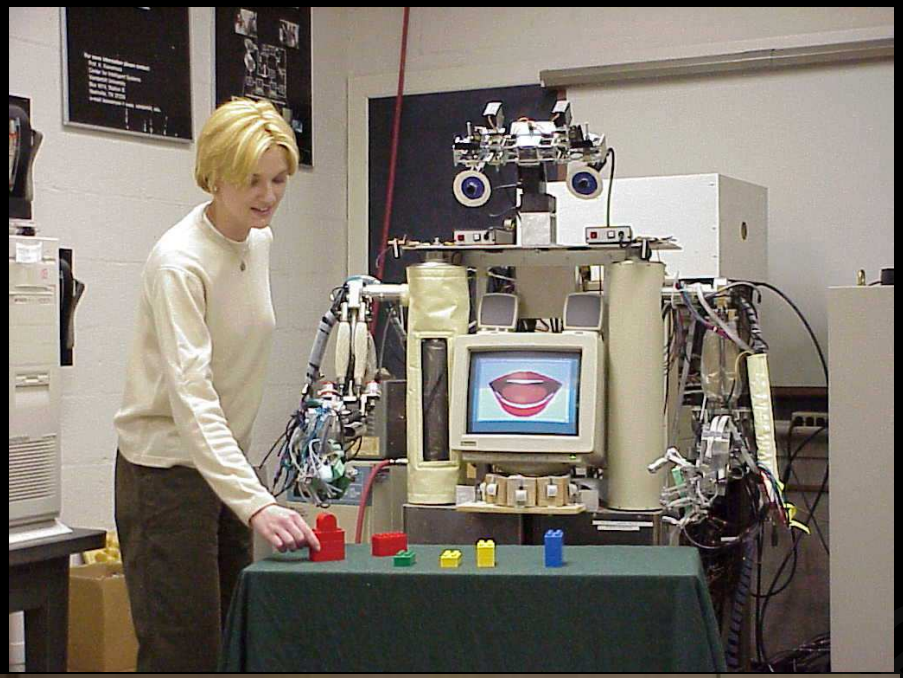
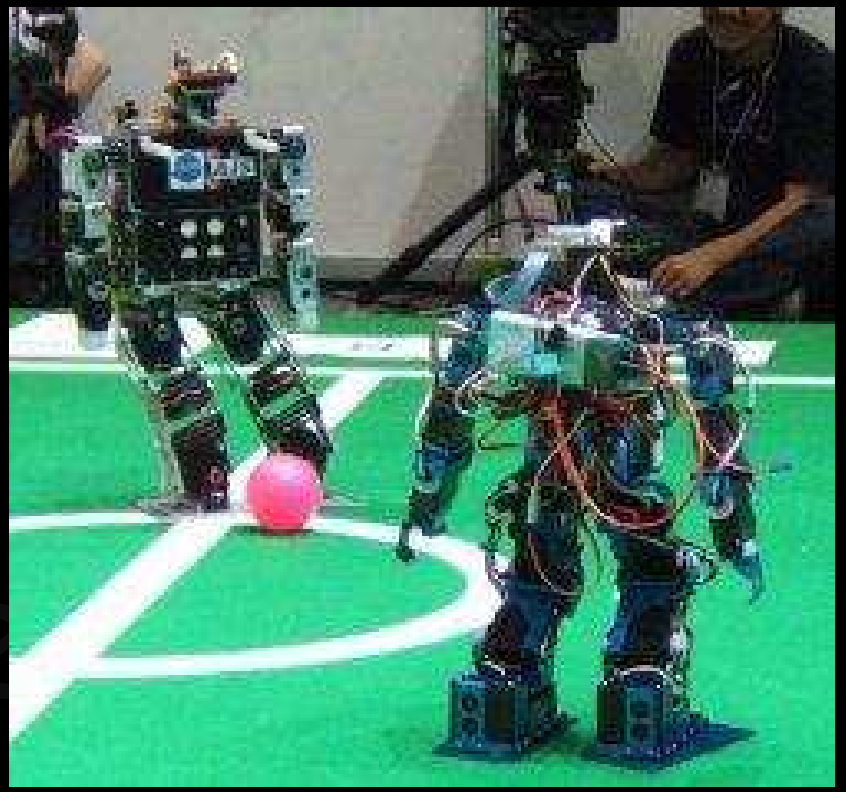
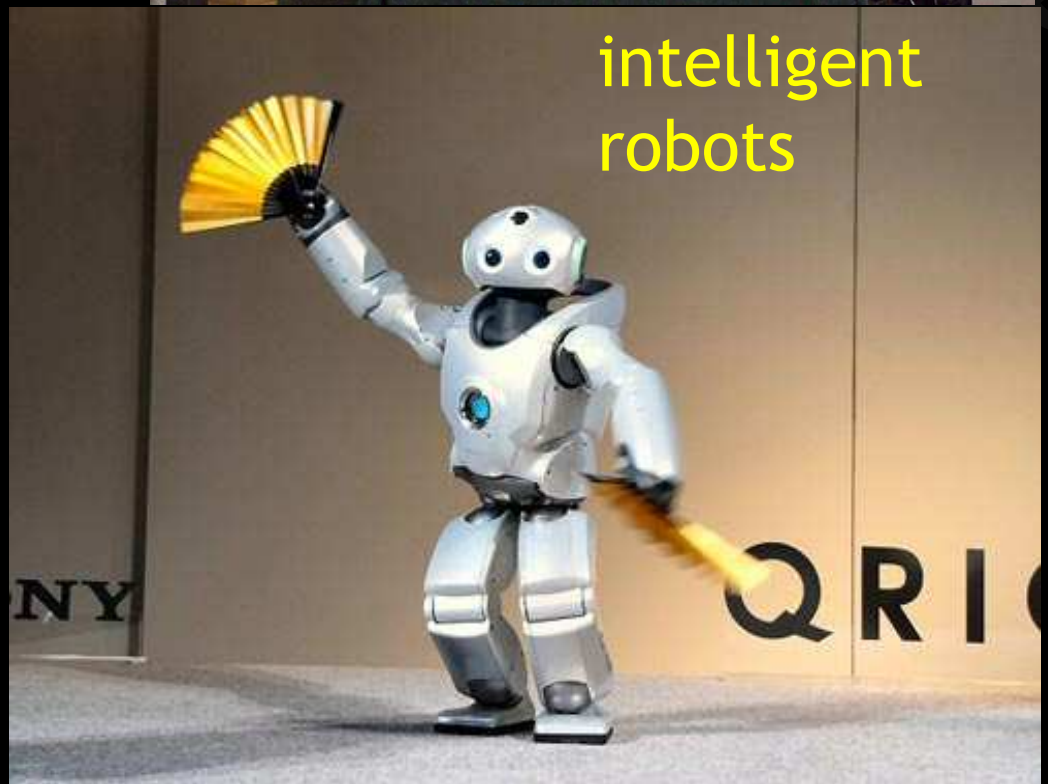
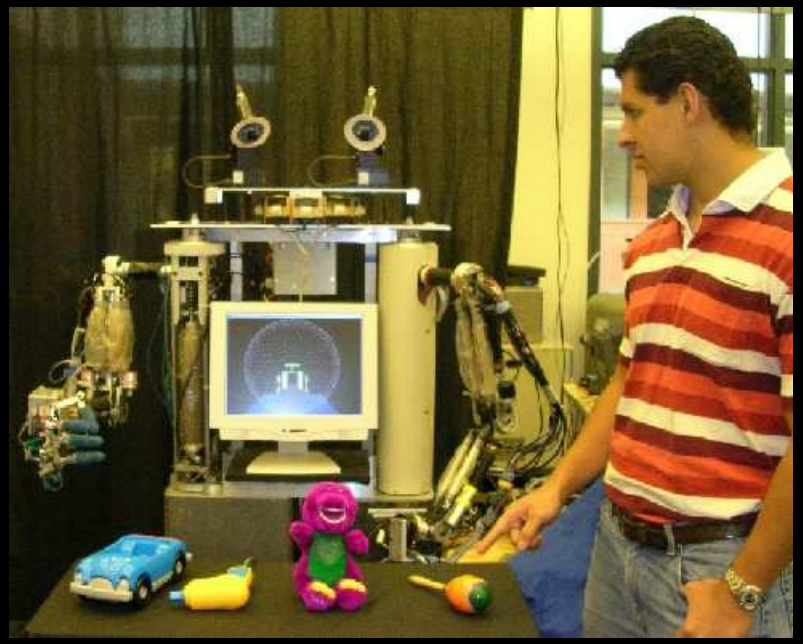


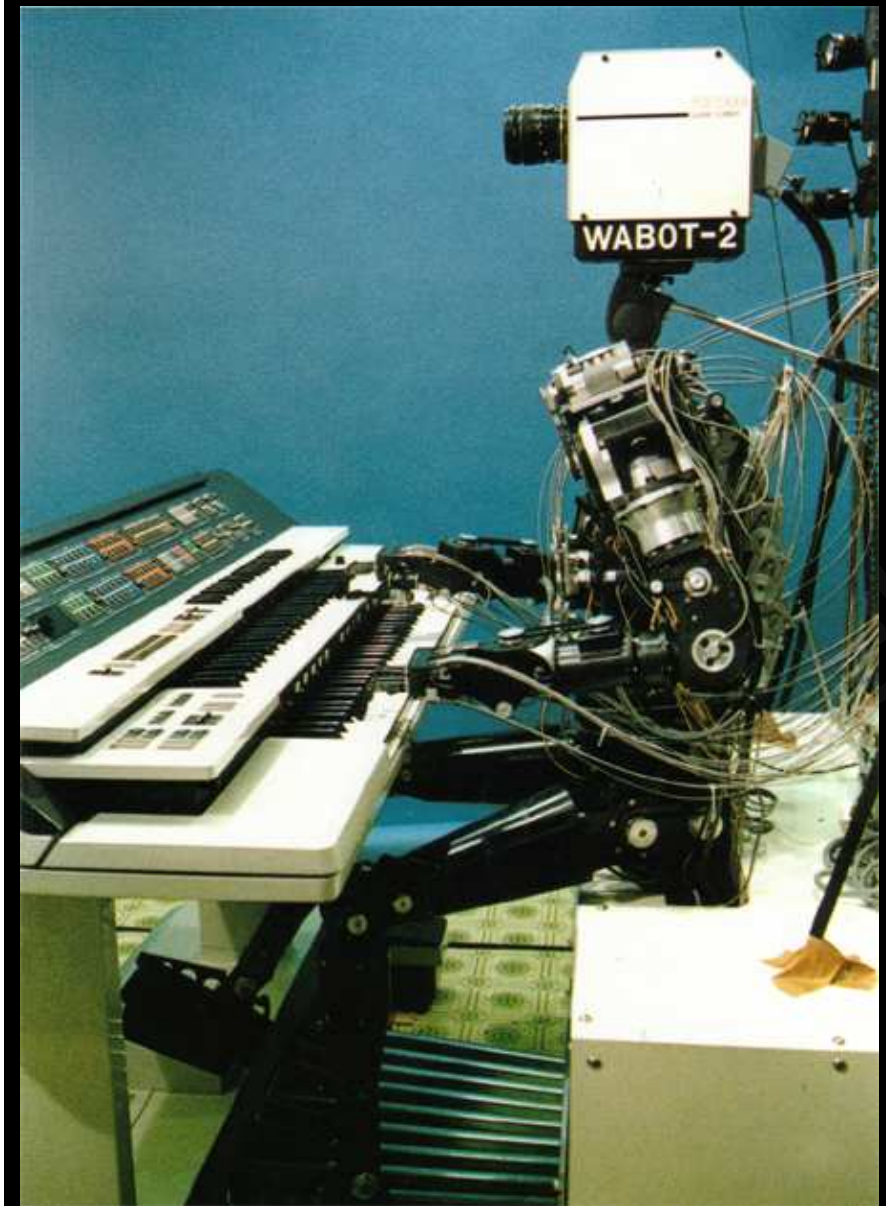


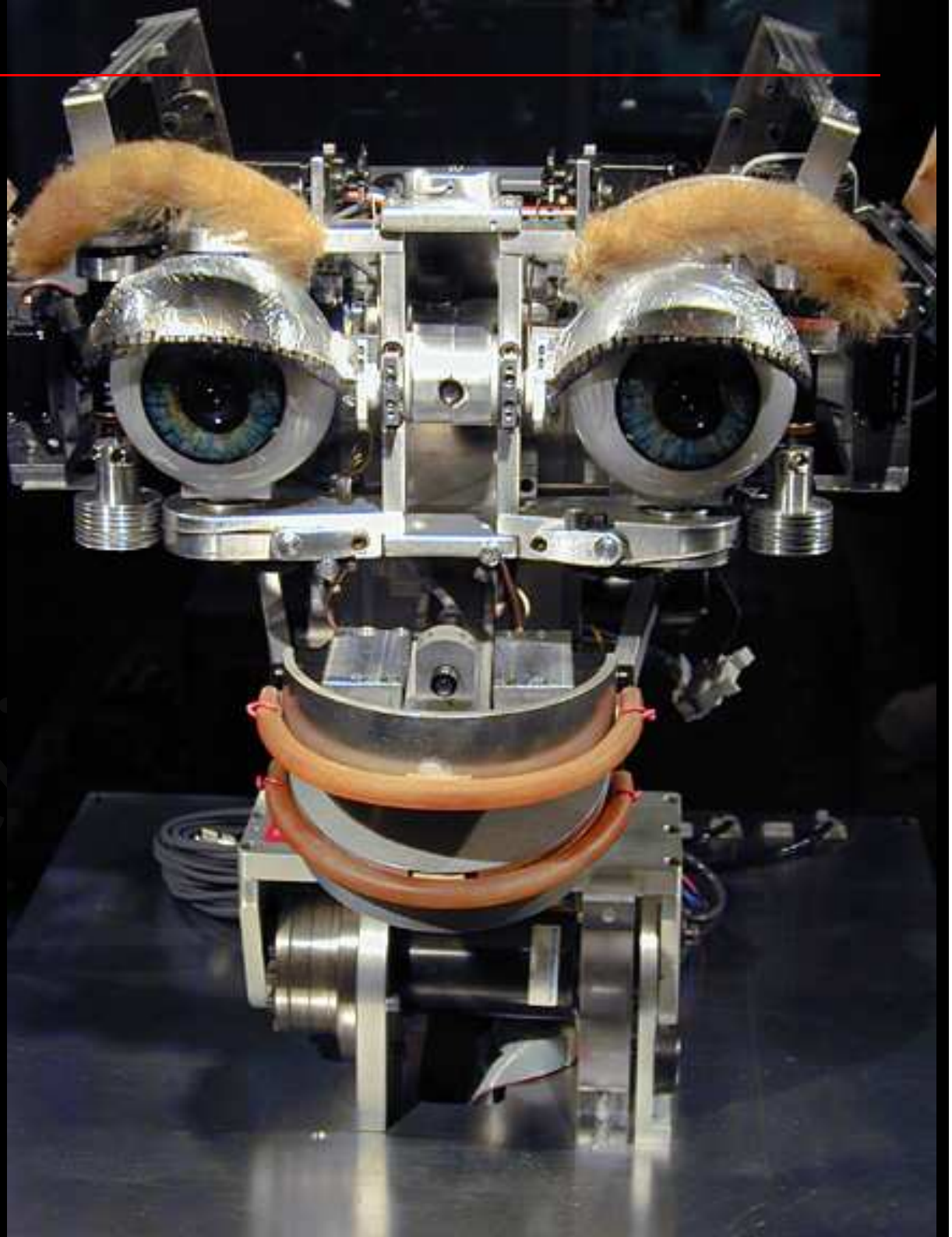


# Robotics

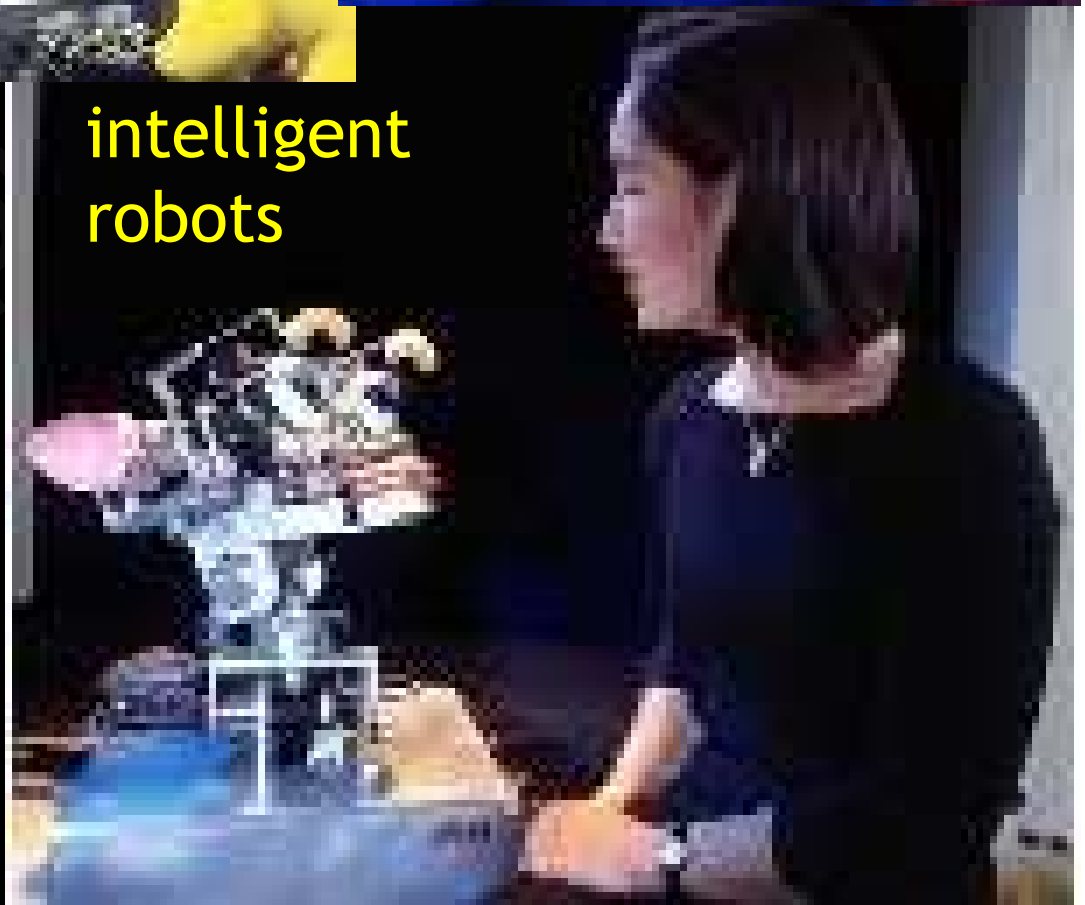
intelligent
robots



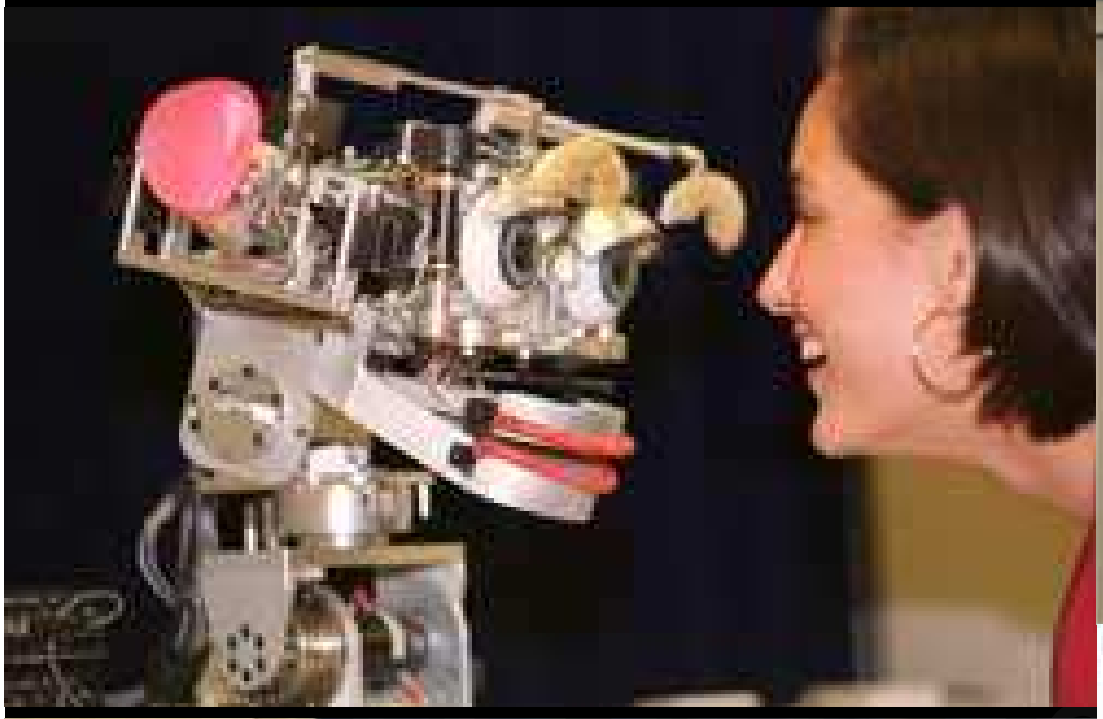



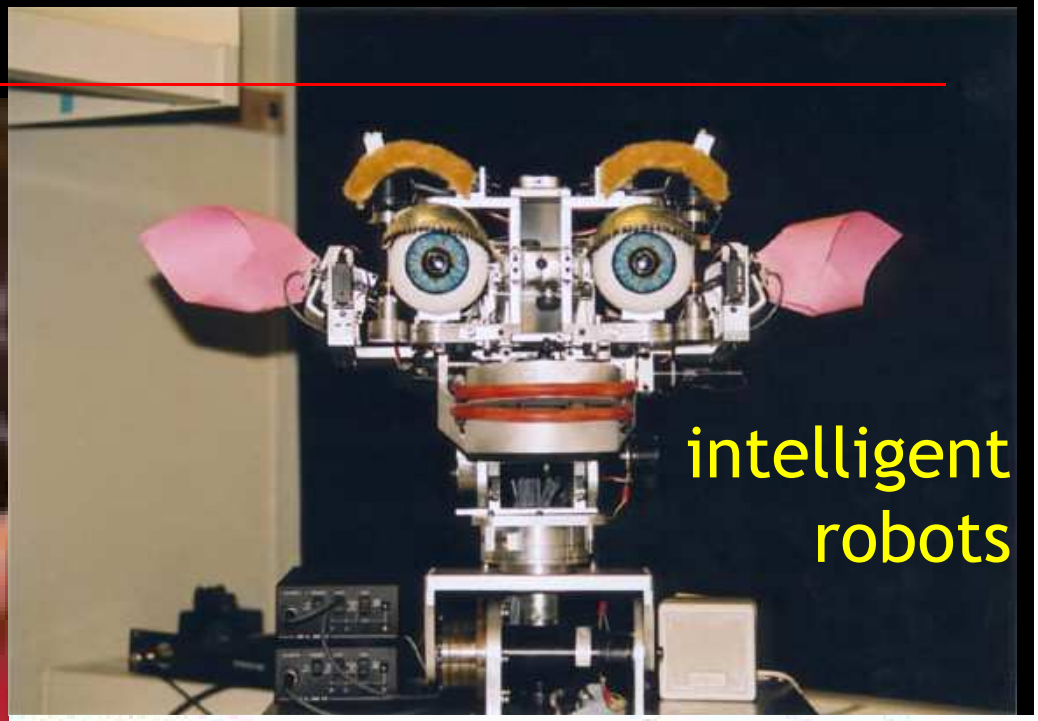
# Robotics

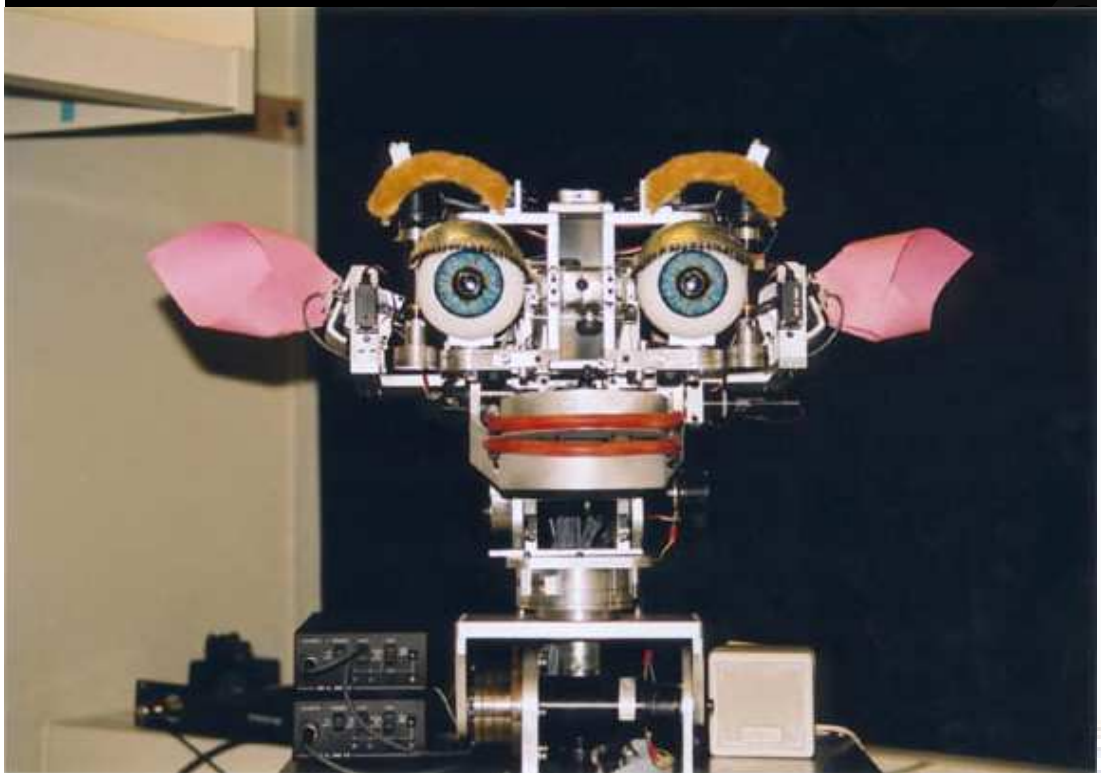
intelligent robots



# Robotics

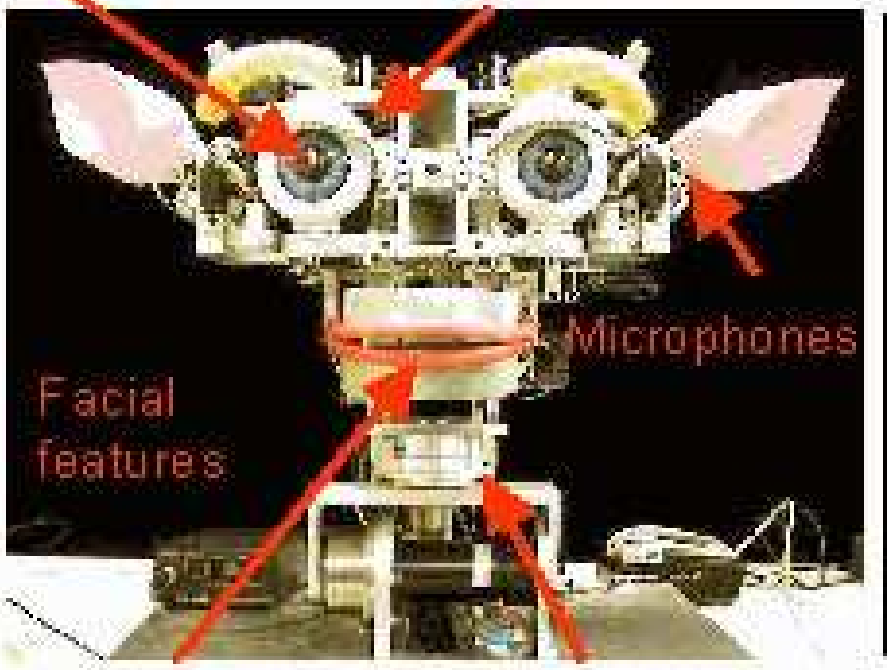




Cameras

Gaze direction

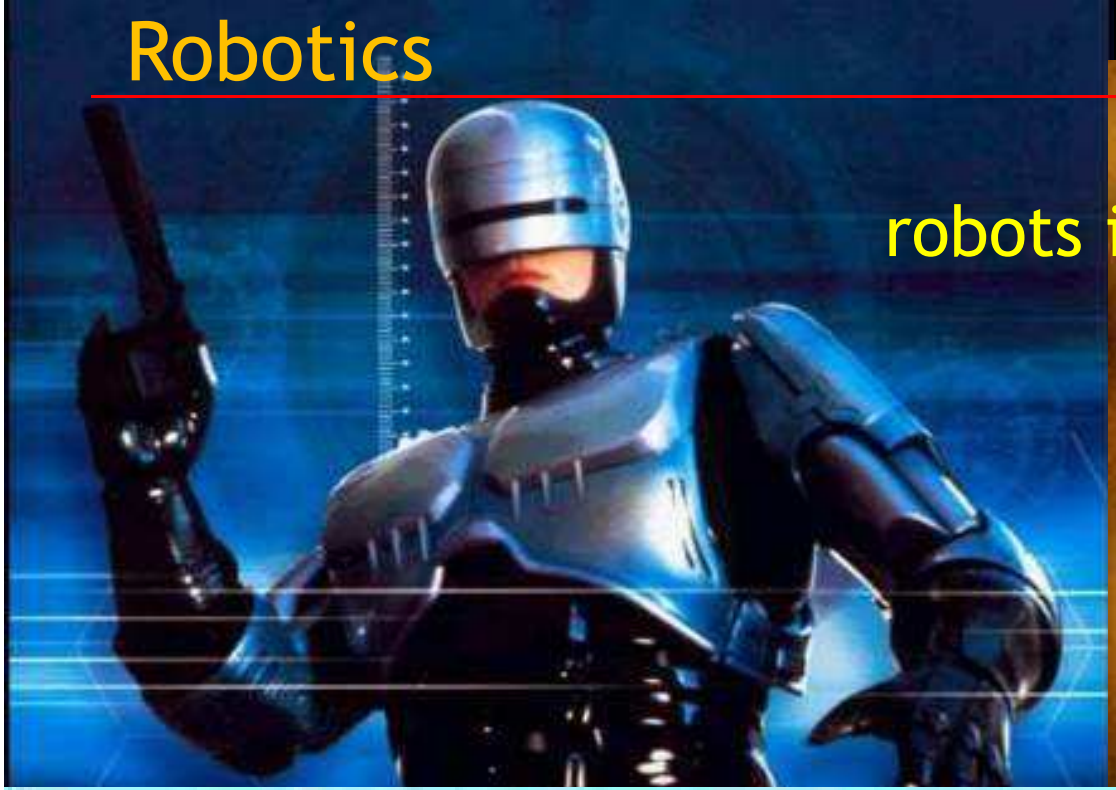



Speech synthesizer

Head orientation

# Robotics

robots in the fiction



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# Thank you!

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