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Intro to Robotics

By Morokot Sakal

Bio: Morokot Sakal

Education (2012 - 2020):
A.Eng in Mechanical Engineering, Ibaraki College, Japan
B.Eng in Mechanical Engineering, Tohoku University, Japan
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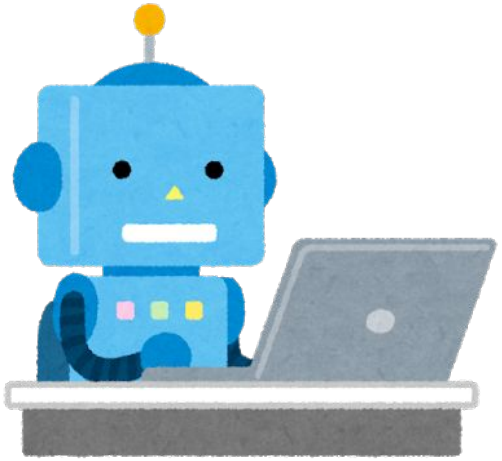
Course Motivation

To **introduce** the field of **Robotics** and provide guidance to **where to get started** with Robotics



Intended Audience

- **High school student**
- People who interested in robotics in general
- No prior experience is required

What you will learn

Morning session:

What is a Robot?

Types of Robot

Components of a Robot

Pathway to learning Robotics

Q&A session

Afternoon session:

Intro to VEXcode VR platform

Driving around

Using sensors

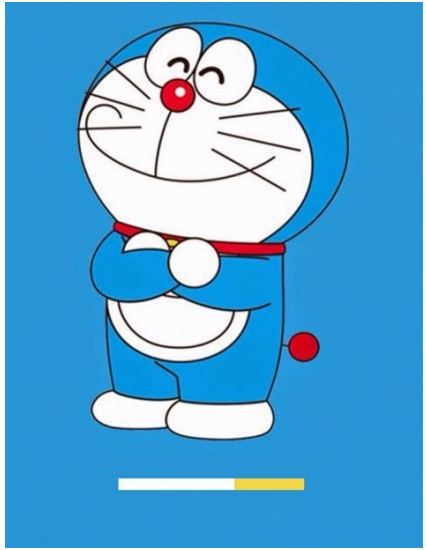
Final coding challenge

Q&A session

What is a Robot?

Example of robotics in science-fiction

BB-8 from Star War



Doraemon

Jarvis of Iron Man

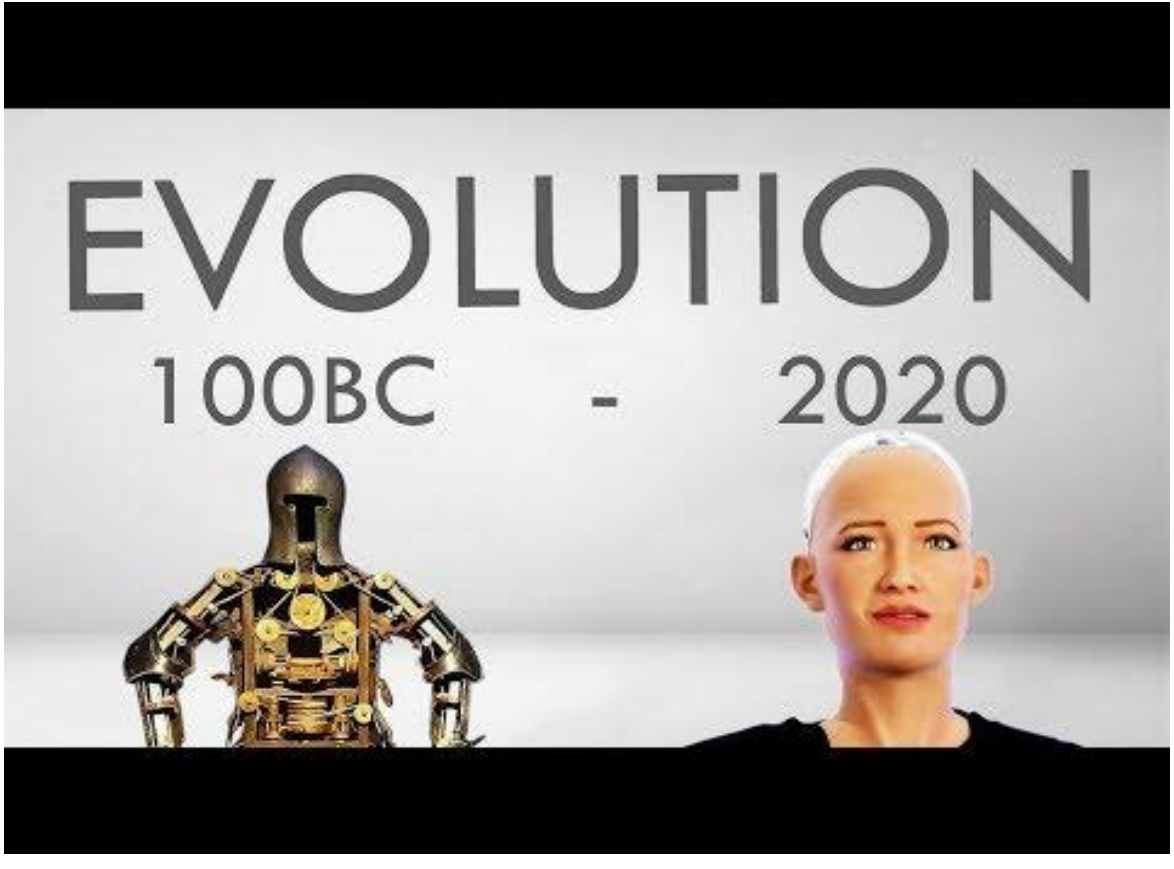
Example of recent robot

autonomous vehicles
[Google]

Commercial drones
[DJI]

Mars Rover
[NASA JPL]

Robots evolution



What is your favorite robot?

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Definition

Old: Robota (Czech word) = Forced labor or a worker

New: A robot is an **autonomous** system which exists in the physical world, can **sense** its environment, and can **act** on it to achieve some goals

Since the field of Robotics is evolving, its definition is erratic

Definition based on characteristic

Working long duration: If one system can **work in longer duration** without **supervision**, that system can be considered as robot

Example: a system which has autonomous charging capability

Definition based on characteristic (cont.)

Ease of operation: the easier it is to operate, the more it is tend to be a robot

Definition based on characteristic (cont.)

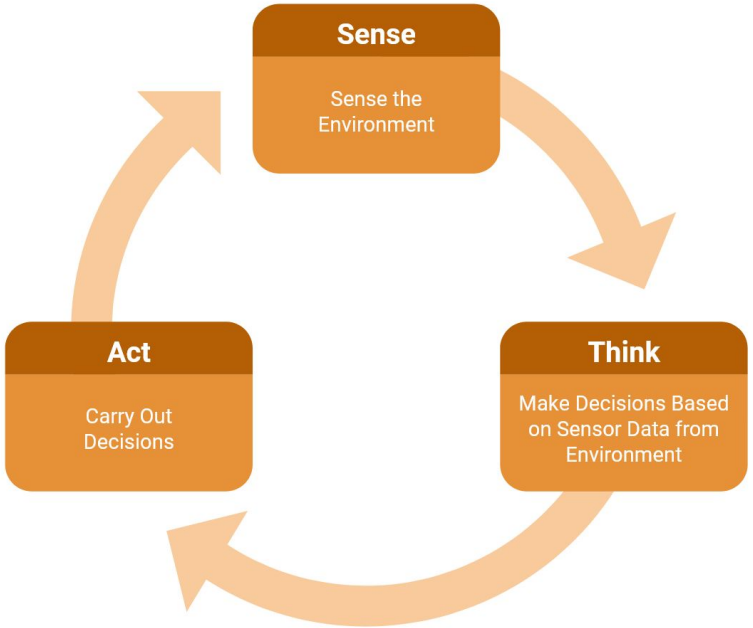
Autonomy: the more the system is able to operate automatically without supervision, the more likely is a robot

Autonomous Mobile Robot [Amazon]

Definition based on actions

SENSE, THINK and **ACT**:

If a system is able to do the three actions aboved, it is considered a robot

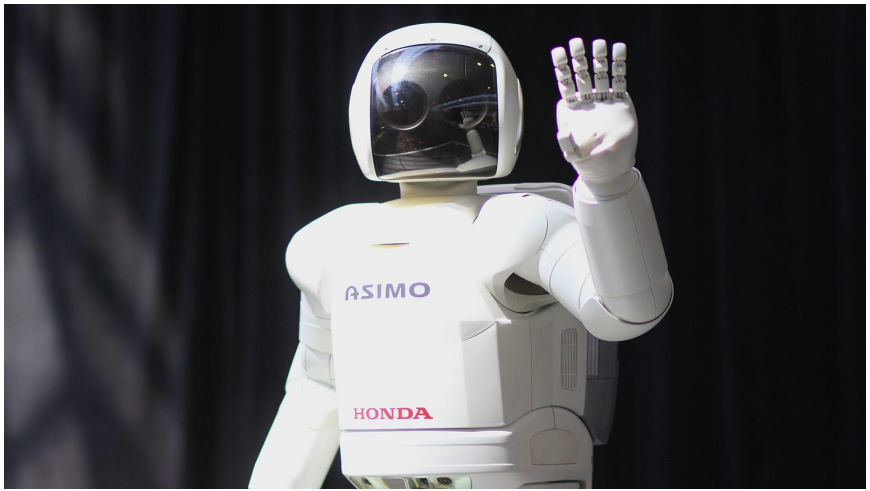


Is a smart washing machine a robot?

Smart washing machine is not considered as a robot because it is not

REPROGRAMMABLE

Summary



AUTONOMY

=

SENSE, THINK and ACT

REPROGRAMMABLE

Types of Robot

Classification of Robots

There are many different ways to classify a robot, based on

- Period of its development
- Budget
- Tasks
- Applications

In this course, we will classify the robot based on Tasks and Applications

Why do we create Robot?

4D

Dirty

Dangerous

Dull

Difficult

Task: Dirty

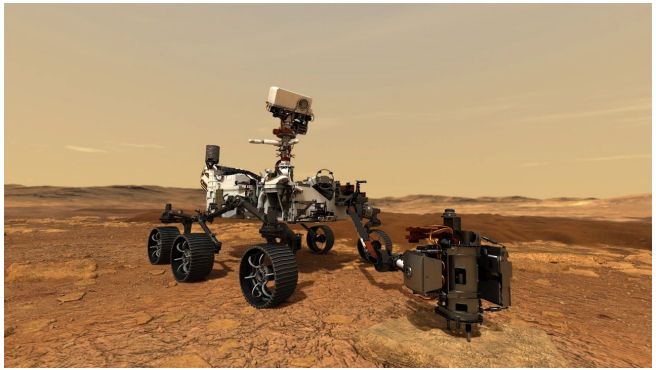
Refer to the tasks which there's a risk of contamination or is harmful to the human body, a robot should be used to perform such task

Pipe inspection crawler robot

Task: Dangerous

Refer to the tasks that are too dangerous or a risk to one's life

Skyscraper window cleaning robot



Mars exploration rover

Task: Dull (repetitive)

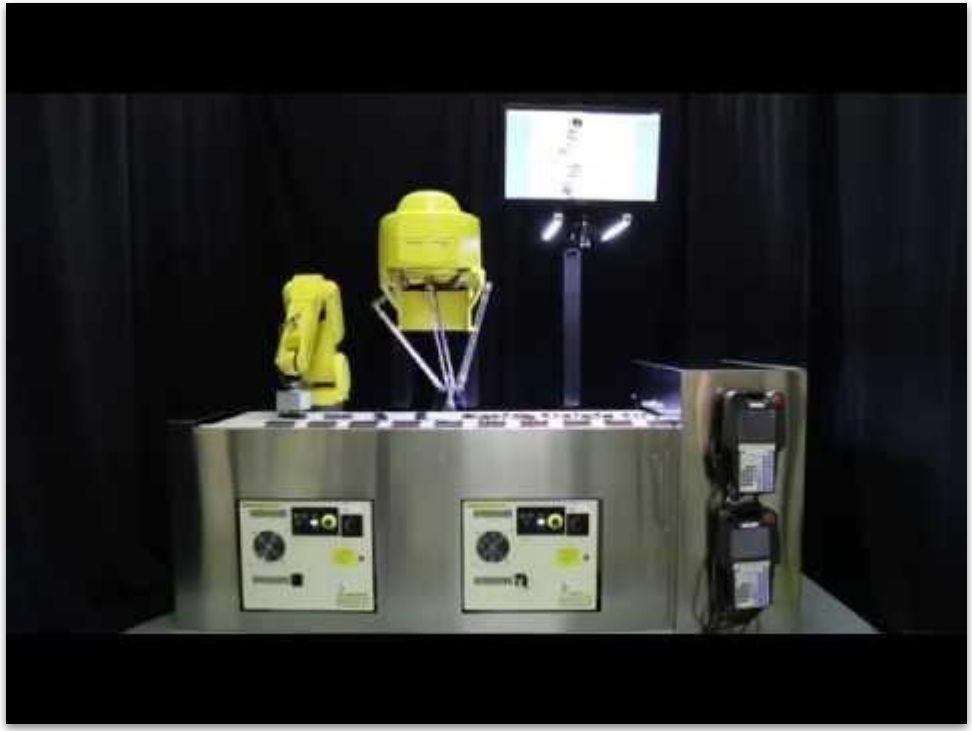
Refer to the tasks that are repetitive and boring, frequently seen in the manufacturing process

Charlie Chaplin, Modern Time (1930s)

Assembly robot

Task: Difficult

Refer to the tasks that are impossible for human to use one's hands or brain and hands together to perform



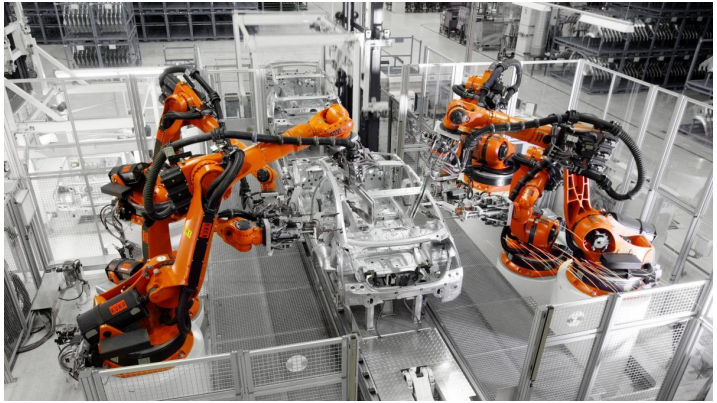
Application: Manufacturing

- standardized result
- repetitive
- produce in huge quantity

Certain process:

- high temperature
- dangerous chemical substances

These tasks are Dull & Dangerous



Kuka Robot

Application: Logistic

Transport products in warehouses, hospital, etc.

Autonomous Mobile Robot [Amazon]

Recent technology: Drone

- Pickup package
- Detect barcode for inventory checking

Delivery drone [DHL]

Application: Transportation

Transport human

- Example: autonomous driving, buses, taxis

[Google]

Advantages

- Help with traffic congestion
- Reduce traffic accidents

Application: Exploration

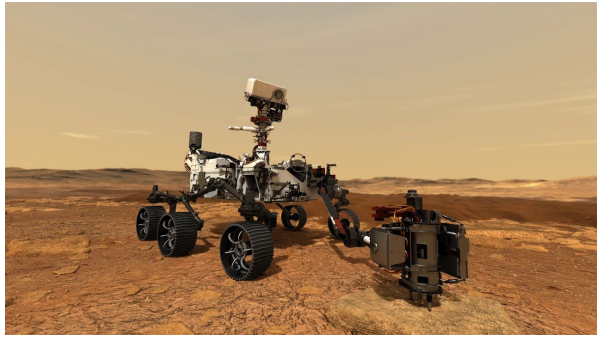
We explore:

- Natural resources
- Inaccessible by human (sea, sky, outerspace, etc)

Using a robot to perform such task is more efficient than human

It can also be used for:

- Security checking
- Rescuing disaster victims



Mars Rover [NASA JPL]

Searching & Rescue Robot [Tohoku Uni.]

Application: Medical

1.Provide assistance (Telemedicine)

Example: Surgical operation, diagnosis

2.Assist patient with disability

Example: Helping out with therapy (physical & mental)

Application: Entertainments

Various advertisements and filming: create interesting camera angle by using robot

Commercial drones
[DJI]

Stuntronics [Disney]

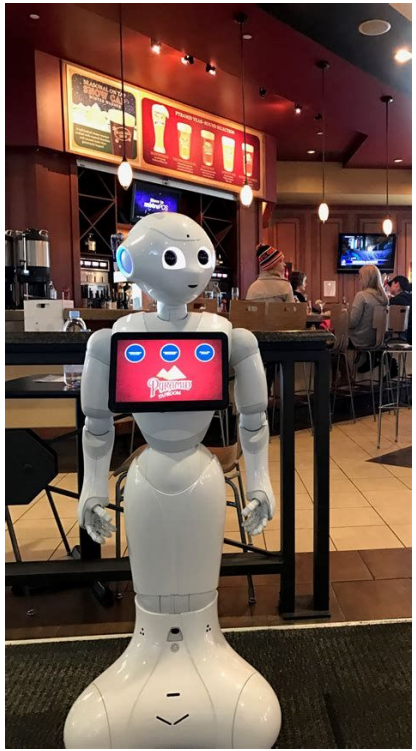
Stuntman is replaced by robot to perform dangerous tasks

Other applications

Service & Social Relation

- Help out with household chores (vacuuming)
- Welcoming guests at a shop or hotel

Roomba (Vacuum Cleaner)



Pepper [Softbank]

Morning Session: Scan for Presence

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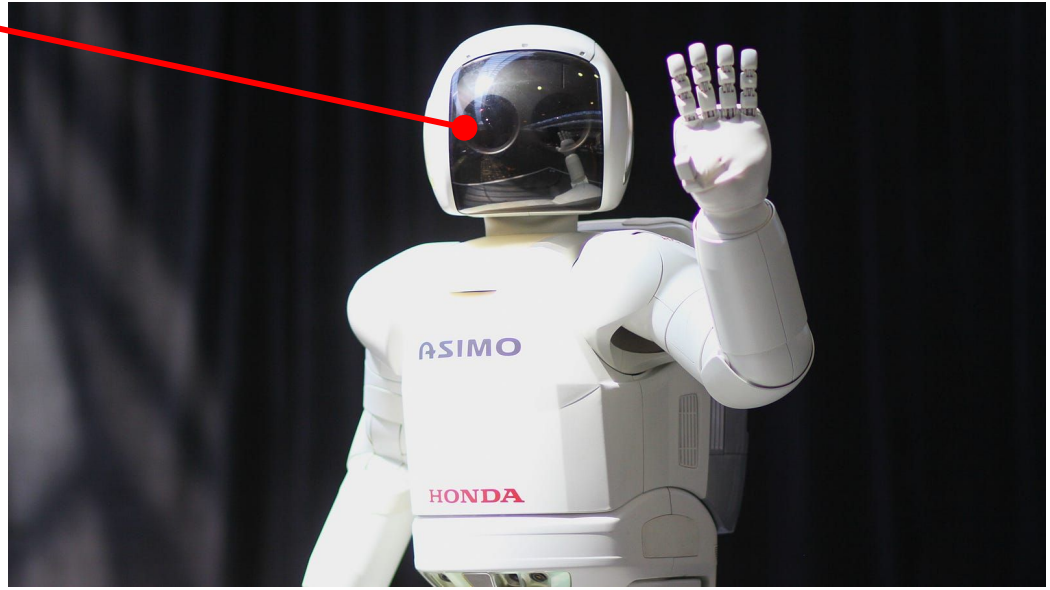
Components of a Robot

Five basic components of a Robot

Sensor

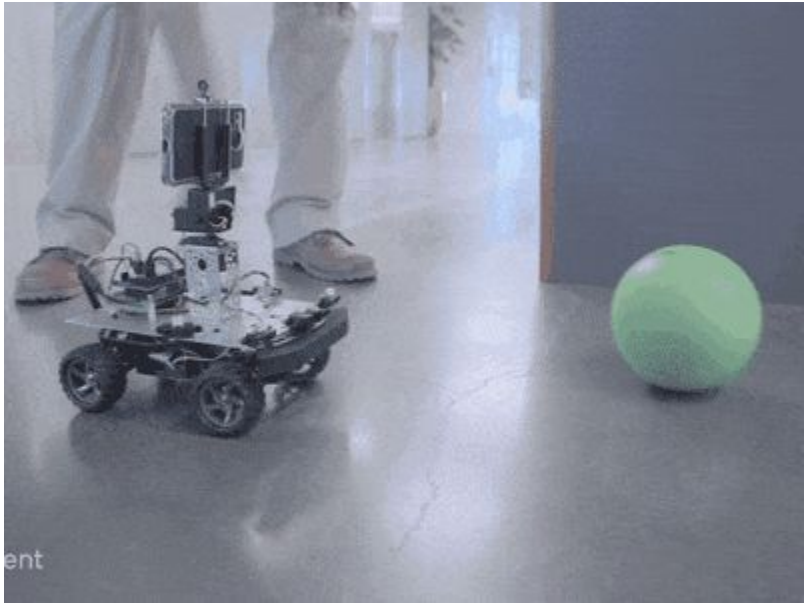


Sensor

Vision: light, color sensor, camera

Touch: bump sensor

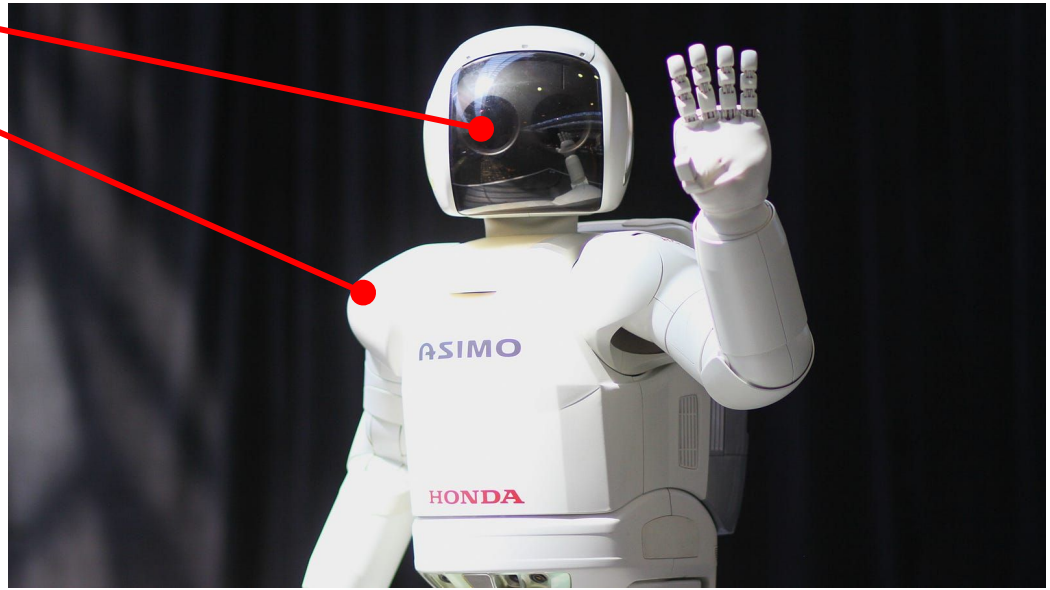
Sound, etc



Five basic components of a Robot

Sensor

Actuator



Actuator

Wheels

Propellers/Wings

Arm

Legs

In a form of

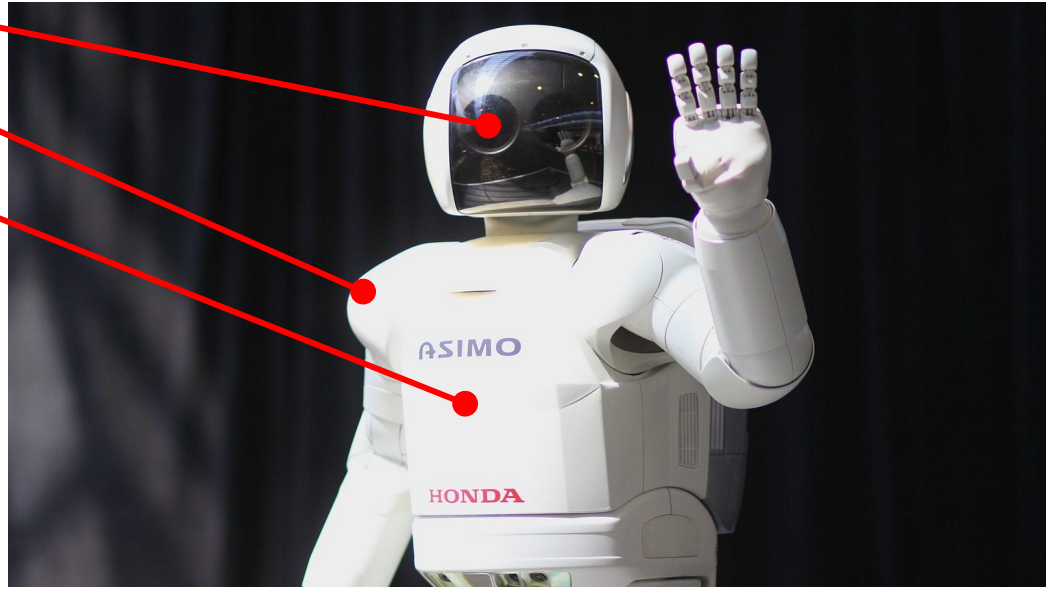
- electrical motors
- hydraulics

Five basic components of a Robot

Sensor

Actuator

Structure

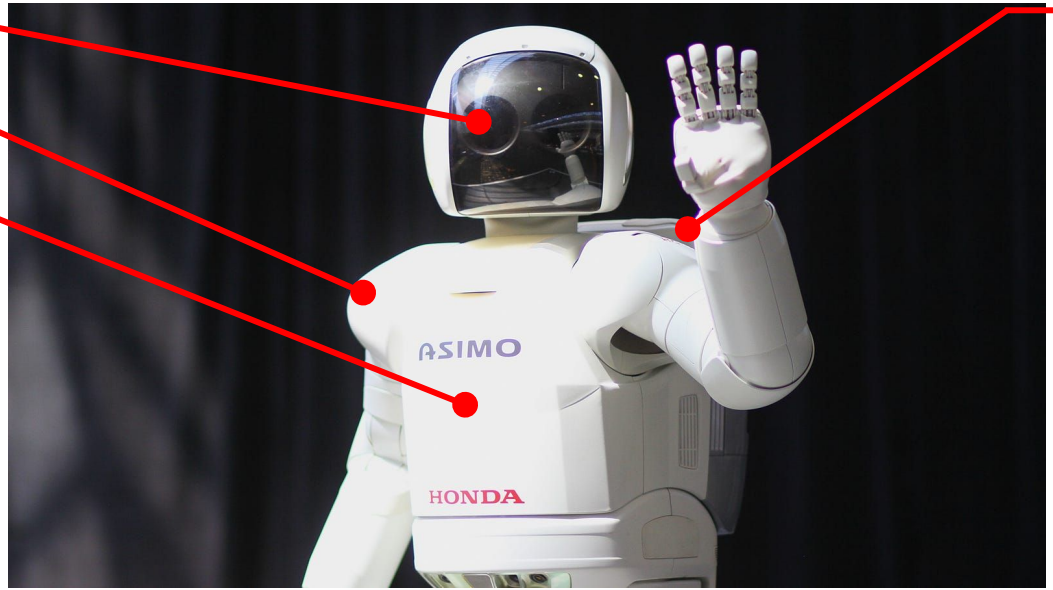


Five basic components of a Robot

Sensor

Actuator

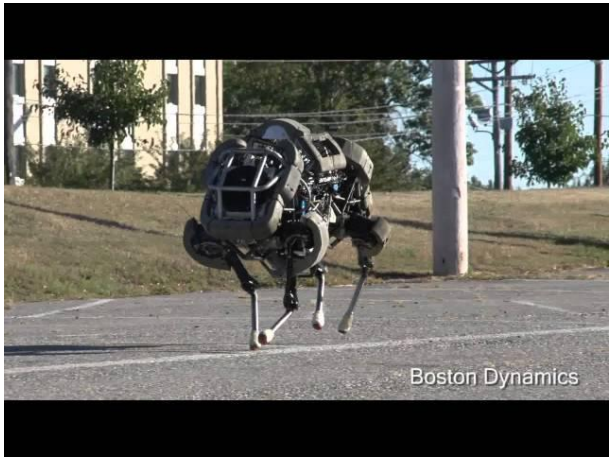
Structure

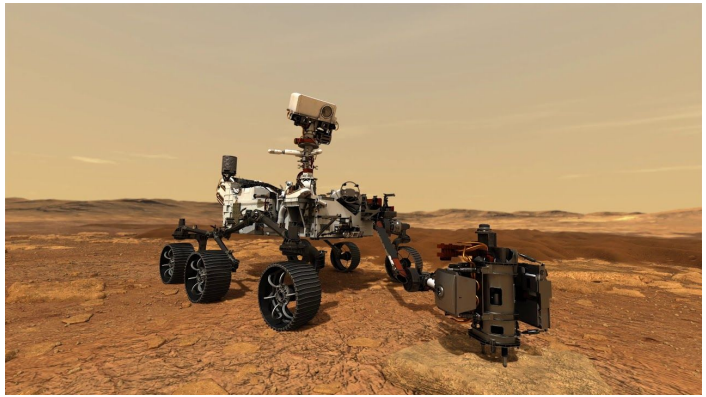


Power source

Power

- Battery
- Solar
- Internal Combustion
- Radioisotope Thermoelectric Generator (RTG)



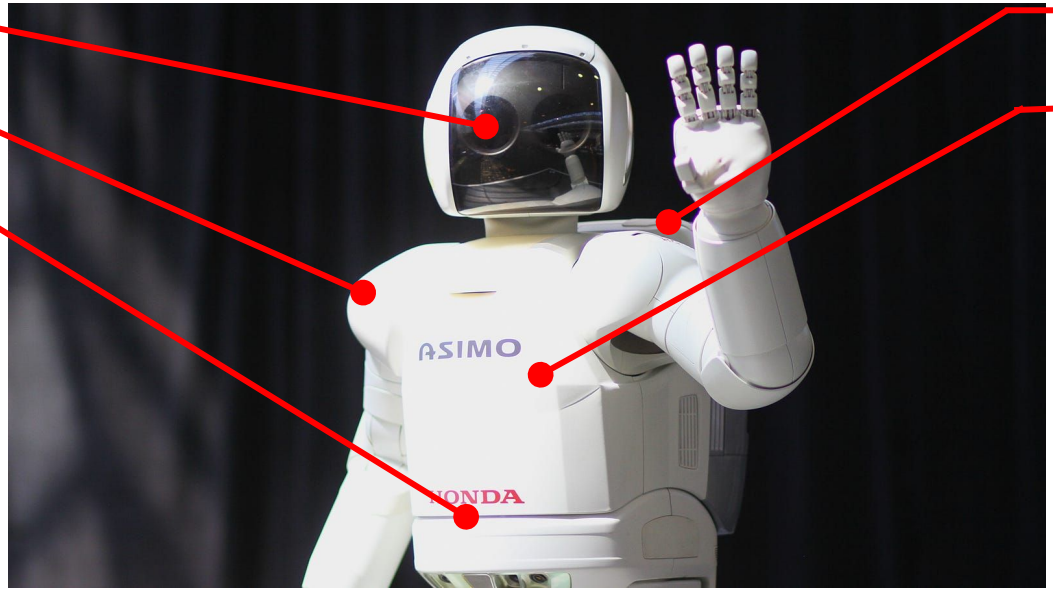


Five basic components of a Robot

Sensor

Actuator

Structure



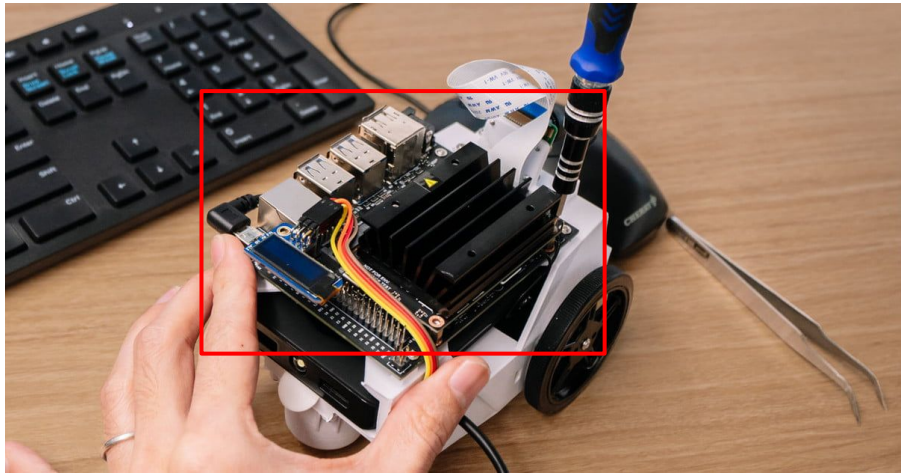
Power source

Controller
(+Software)

Controller (+Software)

An electrical circuit

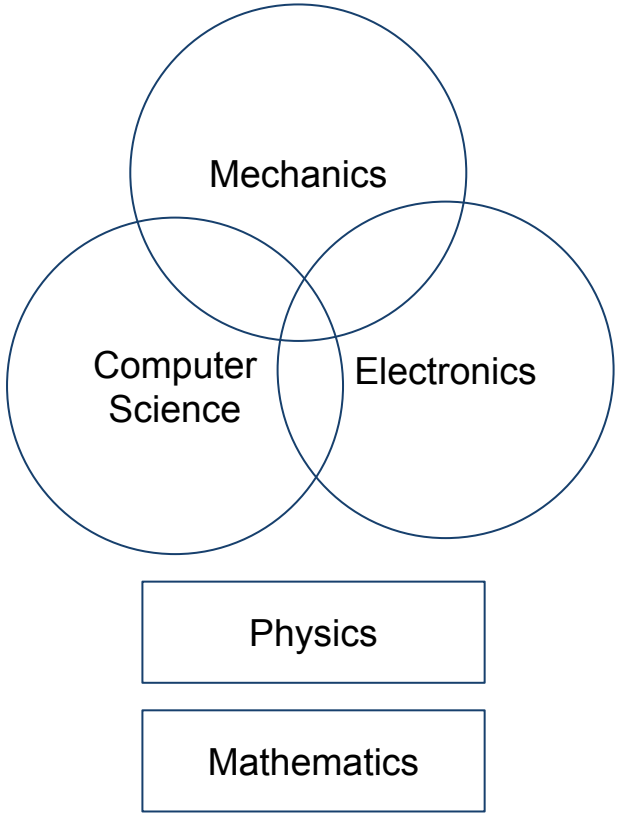
- Brain of robot
- Sensor data processing
- Control the movement/actions of a robot
- Power management



Pathway to learn robotics

Skills needed

Robotics =



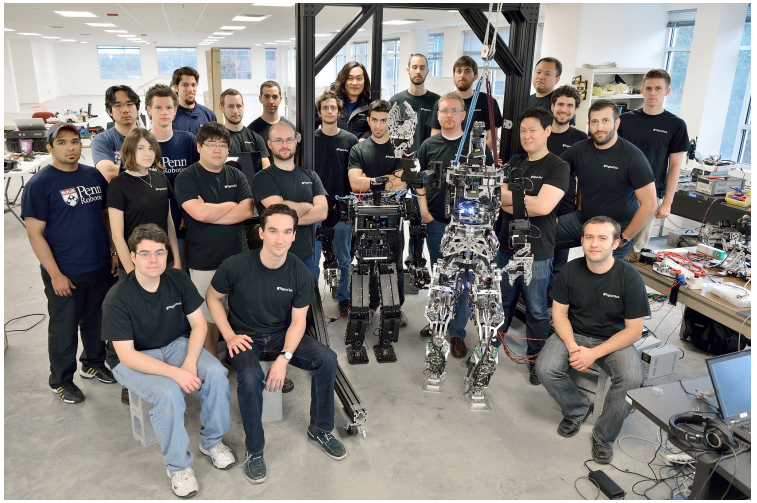
How to become a roboticist

Fiction

Iron Man [Marvel]

He is working alone :))

Reality

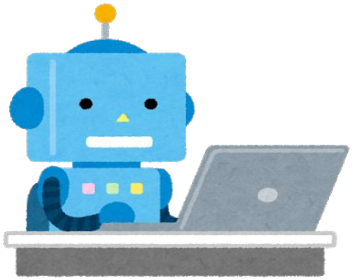


An University Robotics team

You need a team to build a robot

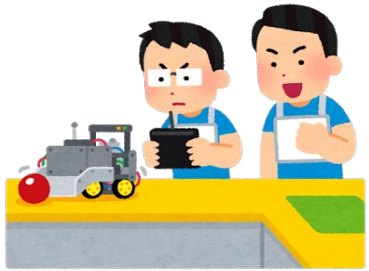
Approaches to learn Robotics

1. Build your **first robot** using a kit or on your own



2. Take **robotics course online** to strengthen your skills

3. Join a **robotics club** to share your passion with others and receive advices



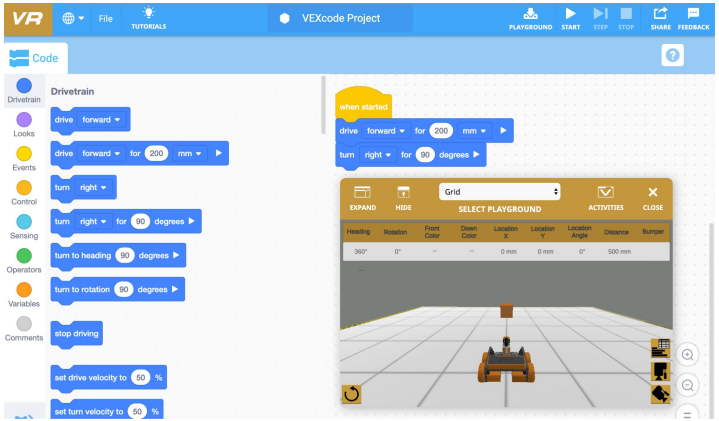
4. Enter **robotics competitions** when you're ready to showcase your projects.

https://www.wikihow.com/Learn-Robotics

1: Build your own first robot

- Start with simple robots, and as you gain experience, move on to complex models over time.
- Using online platform to learn robotics coding.

Hardware-based [makeBlock]

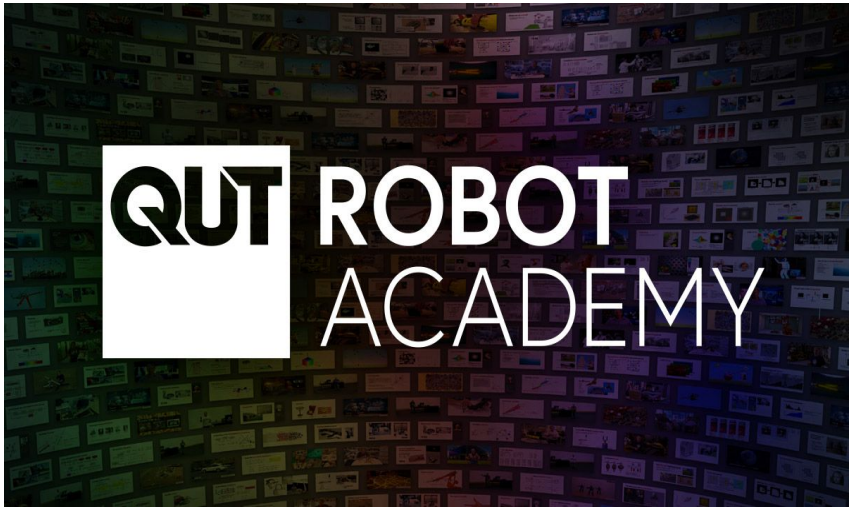


Simulator [VEX Robotics]

https://www.wikihow.com/Learn-Robotics

2: Take robotics course online (Coursera, Udacity, Edx, etc)

Robotics course that can teach you advanced techniques



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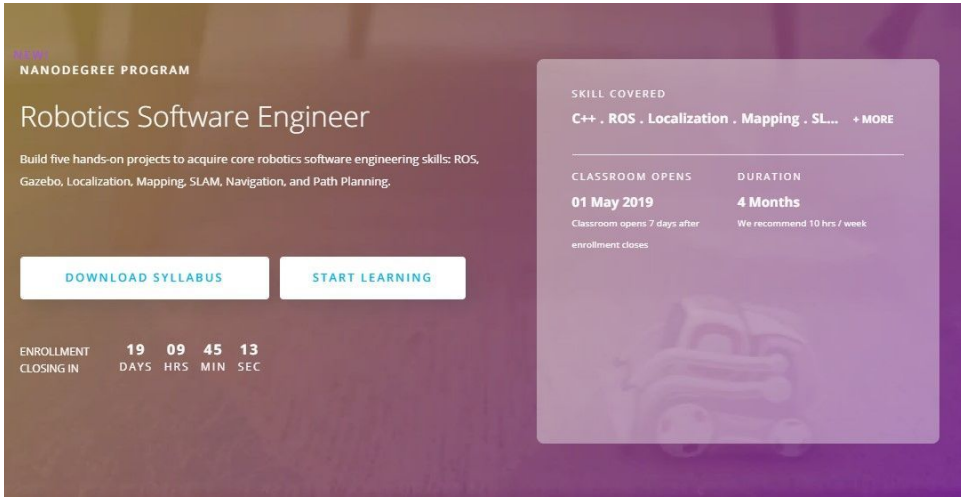


Robotics course [Udacity]

Robotics course [Coursera]

https://www.wikihow.com/Learn-Robotics

3: Join a Robotics club

Join a **robotics club** at your school or friends who share the same passion, to share your hobby with other people and learn new ways to build robots.

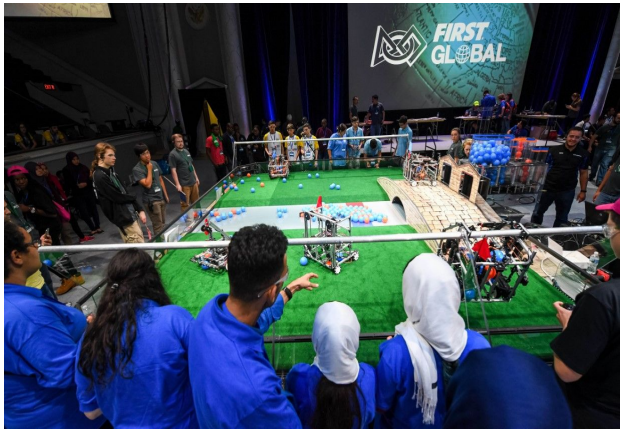
Note: If you can't find any robotics clubs in your area, consider starting your own instead.

https://www.wikihow.com/Learn-Robotics

4: Enter robotics competition

No matter how you do, robotics competitions can be a great way to test your robots and learn ways to make them better.

National competition



International competition

https://www.wikihow.com/Learn-Robotics

Competition: RoboMasters

Similar to Dota or Mobile Legend

Engineer = Superstar

Advanced your study in the university

Currently, there is no existing university in Cambodia that offers major in Robotics.
Choose amongst the following:

- Information and Communications Technology
- Electrical and Electronics Engineering
- Mechanical Engineering

[Boston Dynamics]

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