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# ROBOTICS PROGRAMMING. I

## Robotics Programming

Is an interdisciplinary branch of science and engineering dedicated to design, construction, operation and use of Robots. It is a multi-disciplinary or interdisciplinary branch of Science and Engineering;

Robots are programmable machines that can perform task autonomously or semi-autonomously often mimicing human actions and capabilities.

(Autonomously → They can do task on their own, semi - they need our help)

## Components of a Robot

① ~~Geensor~~ Sensor

2 Actuator

③ Control system

4 Power Supply

5 End Effector

① Sensors are device that detect danger in an environment and send the information to the Robot Control System Unit.

② Actuators are components that converts energy into motion allowing robots to interact with the

Environment.

3. Control System: This is the brain of the robot which process input from the sensor and send command to the actuators. It can be single micro controller or a complex partial Artificial intelligence system

4. Power Supply: It provides the necessary energy for the robot to function, it can be in form of battery power or any other one form of energy.

5. End Effect: They are tools or devices at the end of the robotics arm that interacts with the object.

## TYPES OF ROBOTS

- Industrial Robots: works in industries like painting and assembling plants
- Service Robot: used for dry cleaning, drugs prescribe
- Mobile Robot: Capable of moving around in an environment autonomously ex. drones
- Humanoid Robot
- Medical Robot used in health care for Surgery etc.

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# APPLICATION OF ROBOTICS

- ① It is used in manufacturing, automation of production processes to ~~refine~~ improve effective and increase productivity.
2. In health care, it assists in Surgeries, rehabilitation and patient care.
3. Exploration: Conduct mission in hardous hazardous or inaccessible environment such as Sea exploration, Space exploration.
4. In Agriculture, perform task like planting, harvesting and monitoring Crop of Crops. Eg. Using of a drone-like device to spray fertiliser on Crops at the same time.
5. In military and defence, enhancing Capabilities in surveillance, bomb disposal and combat.
6. Entertainment and Household

## KEY CONCEPTS IN ROBOTICS

- ① Autonomy: The ability of robot to perform task without human intervention
- ② Artificial Intelligence: The integration of AI tech-

nology to enable robots to learn, and adapt and make decisions.

3. Human Robot Interaction: The study of how human and robot communicate and work together

④ Robotics Perception: The ability of robot to interpret and understand their environment through sensors and algorithms.

⑤ Machine Learning:

⑥ Robotics Kinetic: The study of motion and the movement of Robot part. (Actuators)

# Engineering Definition of Robotics

Robotics is an interdisciplinary field of Engineering and Science that includes ~~mechanical~~ mechanical engineering, electrical engineering, Computer science and ~~among~~ other related ~~dis~~ disciplines.

## ACADEMIC DEFINITION OF ROBOTICS

Robotics is the study of robot and their systems

## INDUSTRIAL DEFINITION OF ROBOTICS

Robotics refers to the use of automated machines known as robots in industrial settings to perform tasks that are highly repetitive; dangerous and requires high precision.

## SENSOR

Sensors are devices that detect change in a environment and provide data to the robot control system (micro controller).

### Types of Sensors

- ① Vision Sensor (e.g. Cameras) which captures video

or image to the of an environment for a task like object recognition, navigation and aspect inspection.

② Proximity Sensors: This detects the presence of near object without physical contact.

3. Motion Sensors: Measure Major movement and acceleration

4. Touch Sensor a type of device that captures and records physical touch or embrace on a device and/or object.

5. Environmental Sensors: Eg (thermometer)

It also measure the environmental conditions of the data center as the temperature and humidity.

## ACTUATORS

These are device that converts energy into motion enabling robots to interact with its environment

### TYPES OF ACTUATORS

Electric actuators, hydrolic actuators, pneumatic actuators, Hydraulic actuators

## Able

① Electrical Actuators: Converts electrical energy into mechanical energy. (A blender, electric motors)

② Hydrostatic

② Hydraulic And Actuators uses pressurized fluid to create motion. They are known for their high force and power, output making them suitable for heavy-duty tasks in robotics.

3. <sup>Pneumatic</sup> Pneumatic Actuators: This uses compressed air to produce motion.

## CONTROL SYSTEMS (Micro Controllers)

This can be embedded systems (not visible, rather hidden). It is the brain of the robot which processes input from the sensor and send signal to the actuators.

## POWER SUPPLY

Use of battery, solar to power the robot.

1998

Lego - Programming language  
MIT meaning  
RIS

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## HISTORICAL ACCOUNT / BACKGROUND OF ROBOTS

- ① Lego® Mind Storm has a fascinating

### LEGO® SPIKE

#### Component Of Lego Spike

- ① Programmable hub
- ② motor
- ③ Sensor
- ④ Building element
- ⑤ Connectivity and Power
- ⑥ Software and Programmable environment
- ⑦ Expansion Set

Advantages of Lego Spike over Lego Mindstorms

- Easy to use (since it has programmable hub).
- User friendly.
- Educational focus (developed by group of people).
- Uses software like python.

Components of Programmable Hub

- CPU (Central Processing Unit) ~~& memory~~
- Memory (Rom & RAM)
- Input/Output Port
- Timers and Counters
- Communication interface
- Analog to Digital Converters.

Lego Mindstorms → First Generation

Started in 1980 (late 1980's). Lego began a partnership with MIT media lab.

(MIT → Massachusetts Institute of Technology.)

The collaboration aims to provide a programmable brick and to bring Lego connection to life.

NB] Lego are just building blocks.

In 1998, lego introduced Robot

## EV3 (Evolution 3, or Third Evolution)

In 1998, Lego introduced Robotics Invention System (RIS) featuring the lego commands. Lego became a programming language in 1998.

The RIS enable users to build and programme their own robot using lego technique.

Second Generation started in 2006 Called Lego MIST Lego MSI (Lego Mine Storm).

Third Generation was Mine Storm EV3 Started in JEB 2013 featuring a very powerful processor, addition section and improve connectivity option. At the stage, Sensor, micro controller were added to the production. EV3 was designed to be more friendly, versatile for both beginners and advanced.

In 2022 precisely in October, Lego announced the disconnection of mine storm lines while continuing to support Strach and lego Spike.

In 2022, they stopped the usage of lego Mine Storm.

Lego mine storm had a significant milestone in

Promoting Technology, Science, Engineering and Mathematics. (STEM).

## APPLICATIONS/USES of LEGO MINDSTORM

- ① Education: LEGO Mindstorms is widely used in schools and educational institutions to teach science, engineering, and mathematics technology. It provides solid experience that helps students understand programming, robotics, and problem-solving.
- ② ~~also helps~~ Hobby
- ③ Research and development
- ④ Entertainment and game
- ⑤ Competition and challenges.

### LEGO SPIKE

LEGO Spike is an educational robotics kit designed to educate students, learning through hands-on activities.

#### Components of a LEGO Spike

- 1) Programmable hub

Hub is where other things are connected, hub is like a heart in the LEGO Spike. This is the heart of the prime set featuring five M-Motors, six input and output. It has sensors and batteries. It has Motor, Bluetooth, Connectivity and a rechargeable battery, hydro sensor.

- 2) Motor (Large Motor) - This provides the working, touch for driving

The Motor is used as a Micro Controller that Converts Electrical Energy/Mechanical to Motion Energy.

3) Sensors - We have Color sensor, Distance and fire Sensor, Detect color and Measure Deflects → Color sensor - It receives stimuli when close to a specified distance, Distance Sensor Measures the amount of pressure applied.

4) Building elements - It has over 500 pieces Including Axels, Beams, Connection, gears, Pannels etc.

5) Connectivity and power - it has bluetooth and rechargeable batteries.

6) Software and Programmable Environment -

Expansion set: He added additional over size hundred elements including libraries, Makers splines, gears, Integrated These are what you will see inside it.

Advantages of lego Mind Over Spike.

1) User friendly - It is very easy to use. In lego, you pick it one by one and build a programmable hub. but In spike, you are given a programmable hub.

2) Educational focus - It enhances collaboration more

3) Programming - lego doesn't support python but spike support python.

Key features in Programmable hub-

- 1) Central Processing Unit - codes are stored there before execution.
- 2) Memory - Rom. and Ram, Flash Memory -
- 3) Timers and Counters
- 4) Inputs and Output hubs -
- 5) Analog and Digital Signals - Communication Interface

A

Micro Controller are applied in Washing machine, Home appliances, Automobile operation, Microwave, Consumers electronics (Games Controller).

### Types of Micro Controller

Arduino → An open source platform base on an ease use of Software and Hardware.

Peripheral Interface Controller (PIC); Widely used in Industrial Application for it's versatility and Reliability -

AVR - Known for it's performance and efficiency, commonly used in Embedded software.

Development Environment : Install necessary Integrated Development Environment that suit what you want to develop. Write Code<sup>(2)</sup> and upload using C/C++, then test<sup>(4)</sup> and debug, install necessary software tools such as IDE; Compilers; Consider the Micro Controller to use and the development environment.

### Adv

Arduino is designed to make electronics more accessible to all from hobbyist to students, engineers and professionals. Core component of Arduino.

2) Arduino Board - Various types of Arduino boards are available each have different features and capabilities.

- 2) Arduino Uno
- 3) Arduino mega
- 4) Arduino Nano
- Arduino Uno

### Robotics programming language

Robotics Programming Language involves writing code to control robots and enable them to perform specific tasks - Several programming languages are commonly used in robotics. Each has its strength and associated weaknesses -

## ROBOTICS PROGRAMMING LANGUAGES

RP involves writing codes to control robot and enable them to perform specific tasks.

Several programming languages are used in robotics. Each has its strength and weakness.

### Assignment I

Python, C++, Java, MATLAB, LISP

With respect to Robotics Programming, explain or write the strength and weaknesses of the above programming languages.

## ASSIGNMENT II

10 APPLICATIONS OF ROBOTICS PROGRAMMING  
IN COMPUTER AND ROBOTICS EDUCATION,  
In teaching and learning.