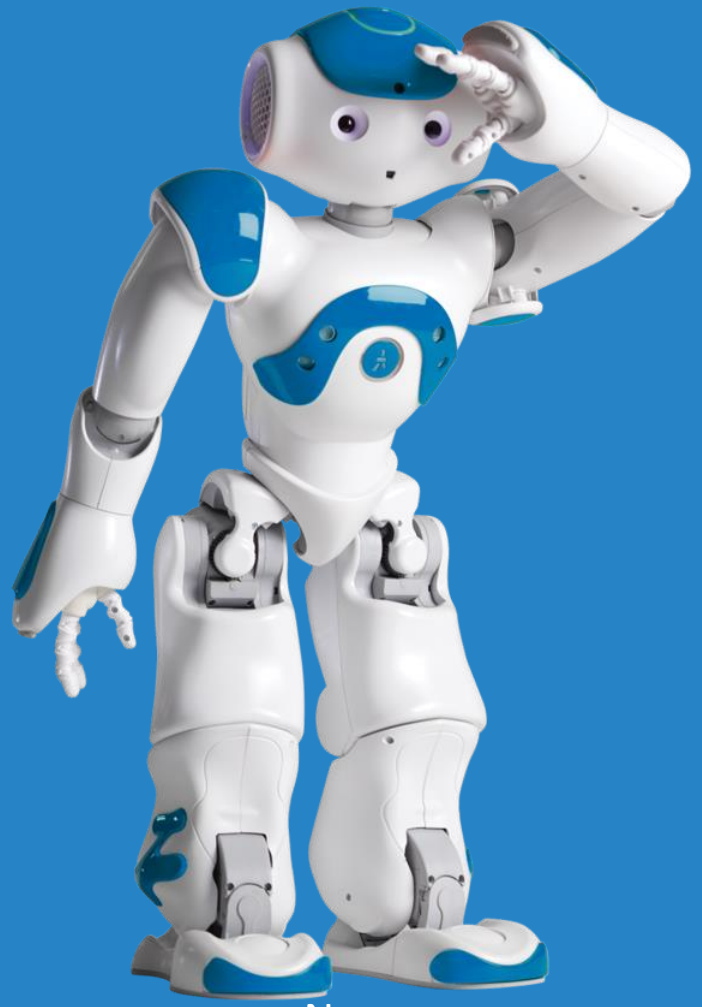
INTRODUCTION TO ROBOTICS

ROBOTICS CLUB

SCIENCE AND TECHNOLOGY COUNCIL, IIT-KANPUR

AUGUST 6TH, 2016

OUTLINE



Nao

- What is a *robot*?
- Classifications of Robots
- What goes behind making a robot?
  - Mechanical
  - Electrical
  - Software
- Role of Robotics Club
- Basics for newbies
- Future prospects

Which of these is a *'robot'*?

What is a *'robot'*?

- ***Freedictionary.com**:*
  "A mechanical device that sometimes resembles a human and is capable of performing a variety of often complex human tasks on command or by being programmed in advance."

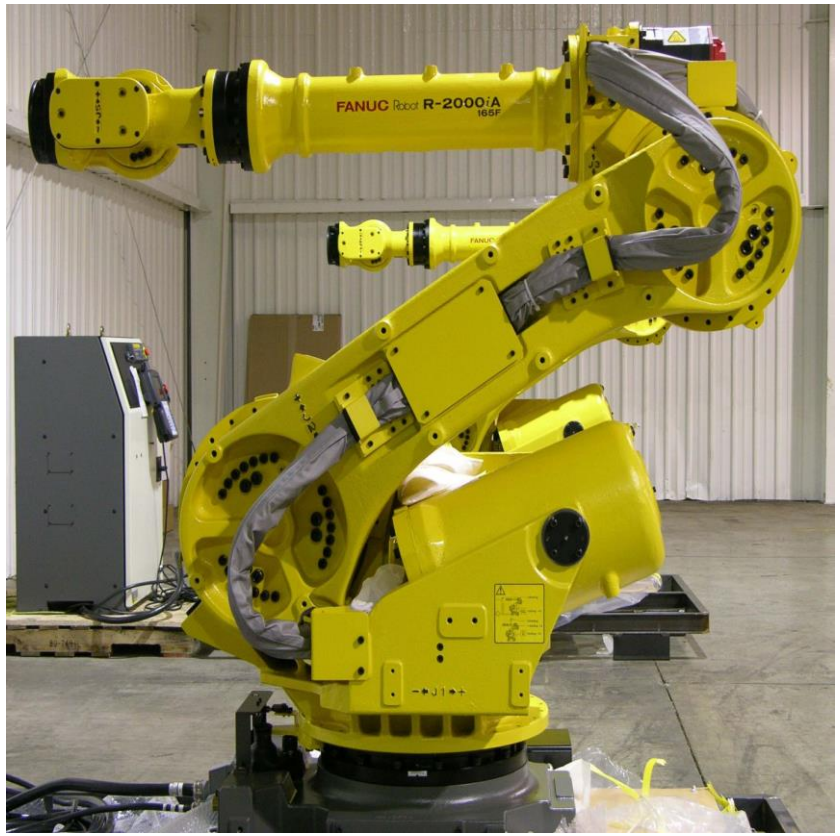
- **whatis.techtarget.com/**
  "A robot is a machine designed to execute one or more tasks automatically with speed and precision. There are as many different types of robots as there are tasks for them to perform."

- **galileo.org/robotics/**
  To be called a robot, a machine must possess some or all of the following essential characteristics:
  - Movement
  - Sensing and manipulating the environment
  - Display some kind of 'intelligence'

Generation of Robot

I

- Comprised of simple robotic arm which could be made to do precise motions at high speed, repeatedly.
- Used widely in industries for automation of processes
- Require constant human supervision



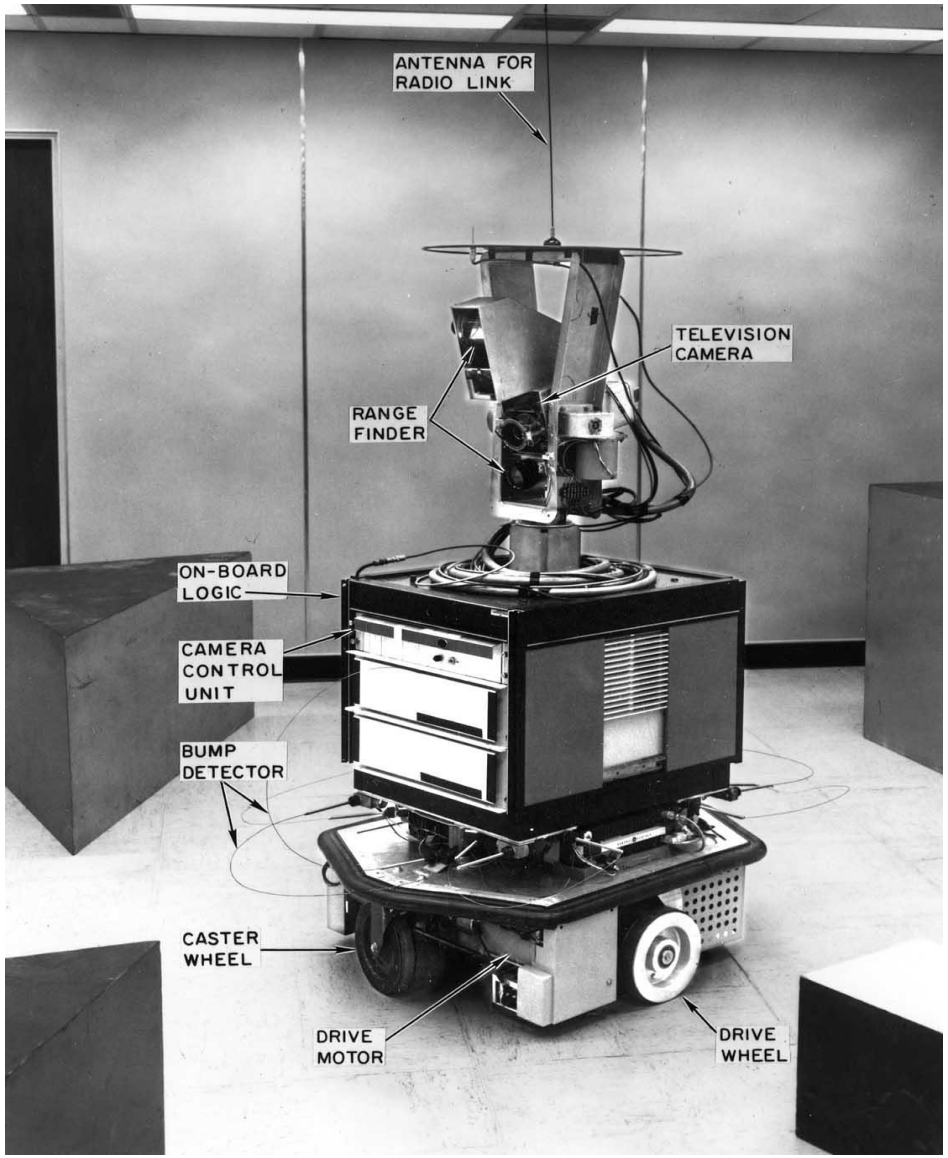
Six-axis Robotic Arm

AIIMS, Maruti Suzuki Plant

Source: http://www.robotpark.com/academy/robot-generations-21118/

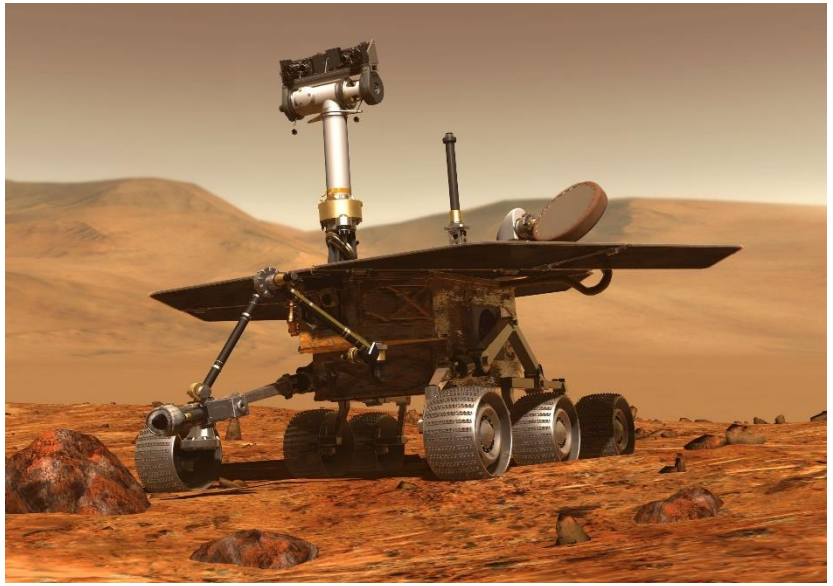
Generation of Robot

II



Shakey, 1968, Stanford

- Possess basic machine intelligence
- Robots equipped with sensors and a controller which processed data from the sensors and take appropriate decisions
- Human intervention minimized but required if robot malfunctions



Mars Exploration Rover (MER)

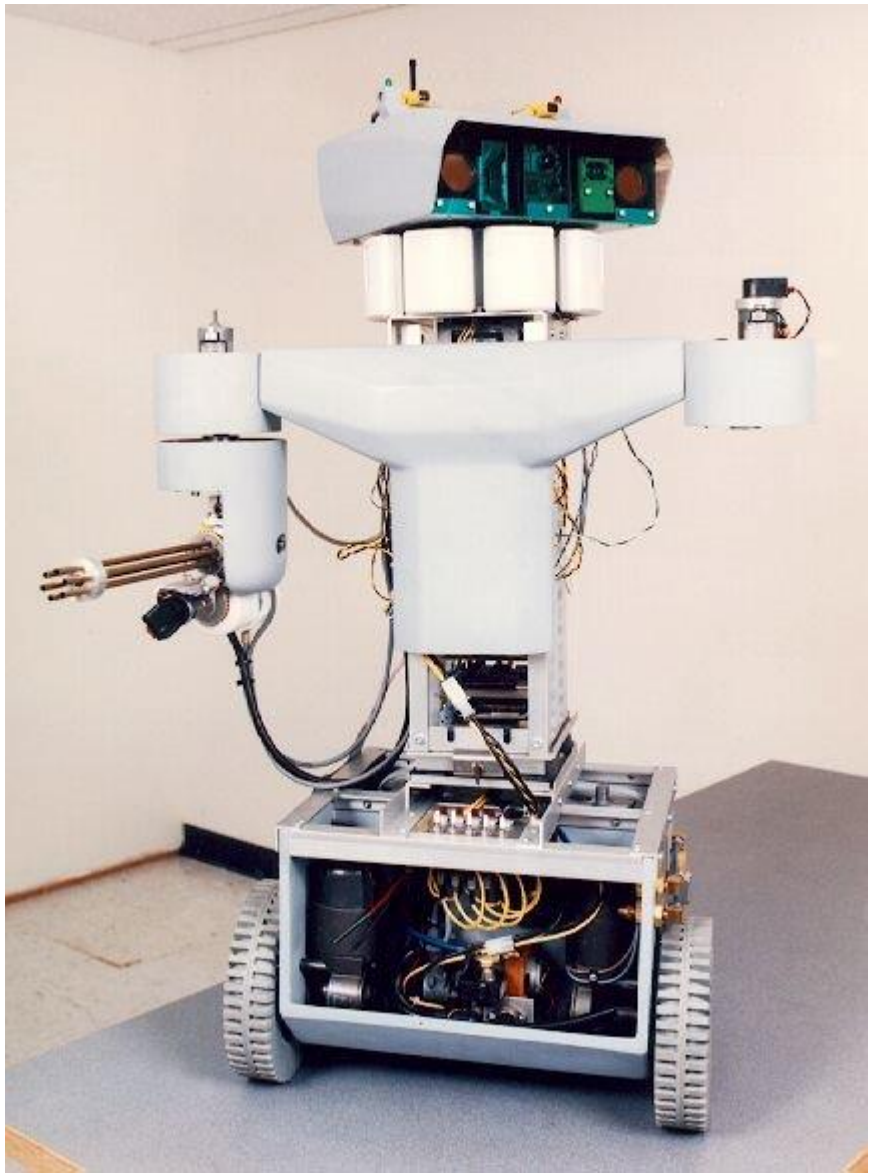
Source: http://www.robotpark.com/academy/robot-generations-21118/

Generation of Robot

III

- Smart Robots which are given generalized information about the tasks needed to be done.
- Able to take decisions on the best way to do a certain task
- Rarely requires human supervision

Self- Driving Car, Tesla

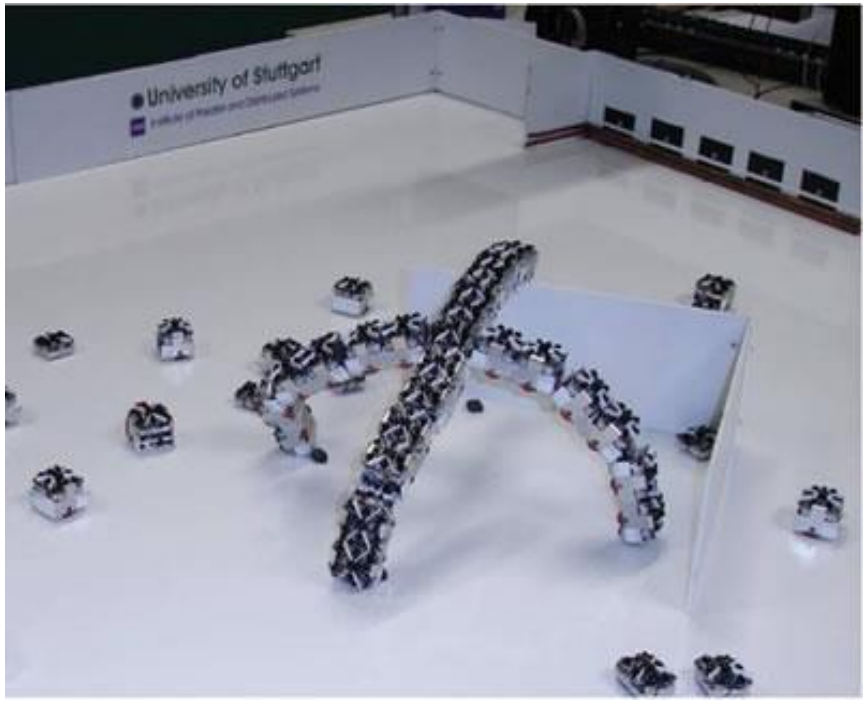


ROBART III

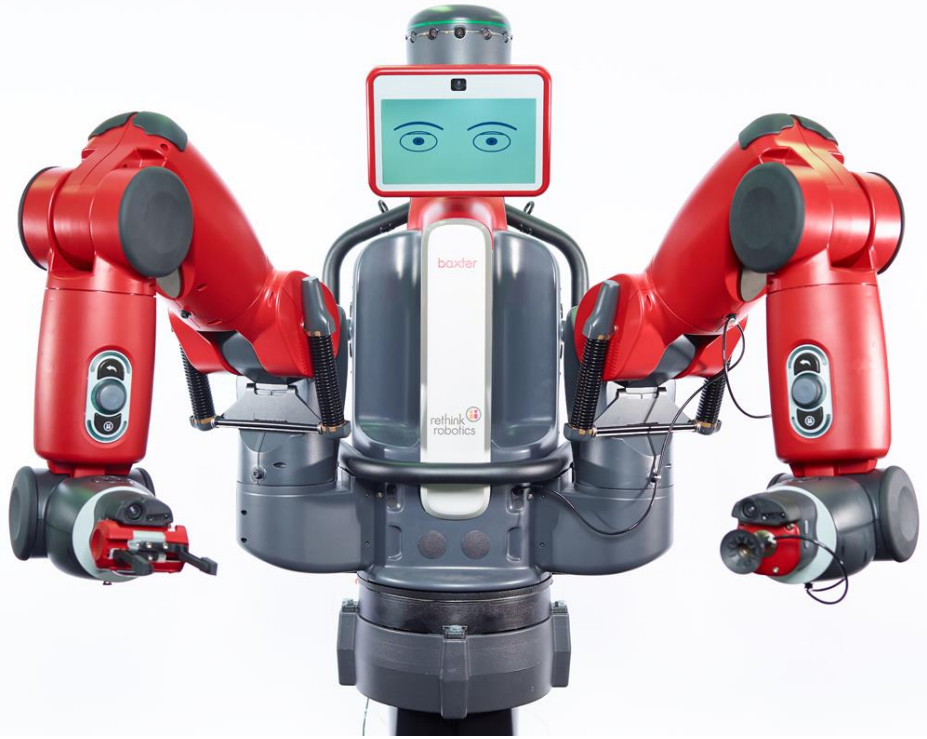
Generation of Robot

IV

- These robots can make real time decisions based on their environment
- Have the ability to work along side humans to form an effective work force



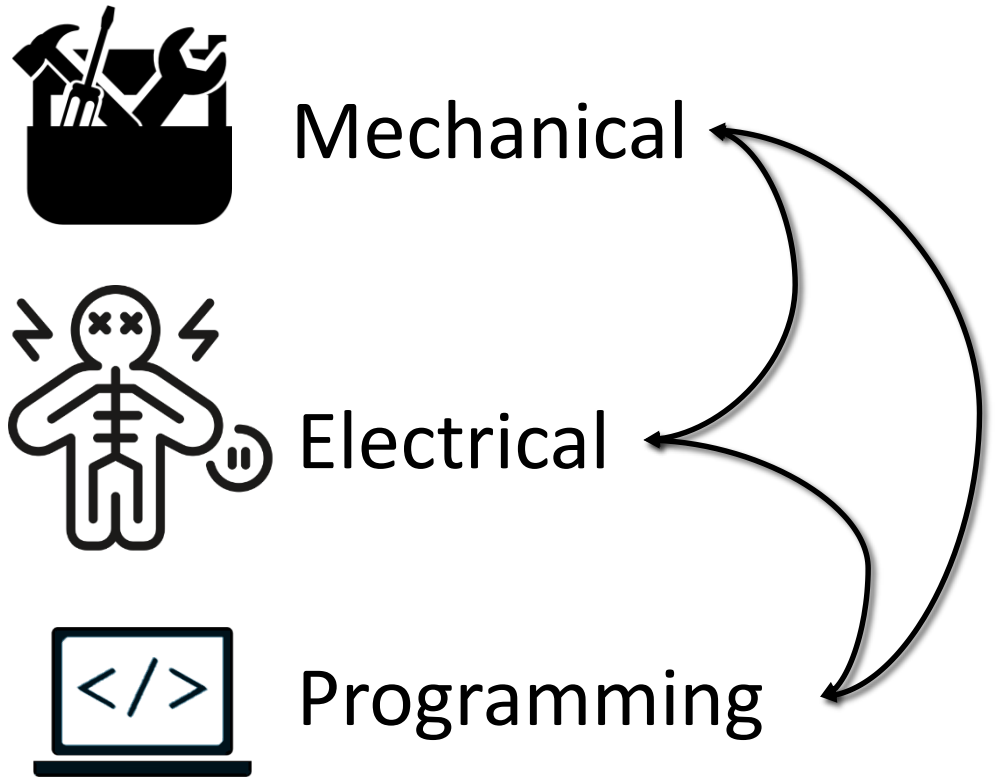
SYMBRION, Bristol Robotics Laboratory



Baxter, Rethink Robotics

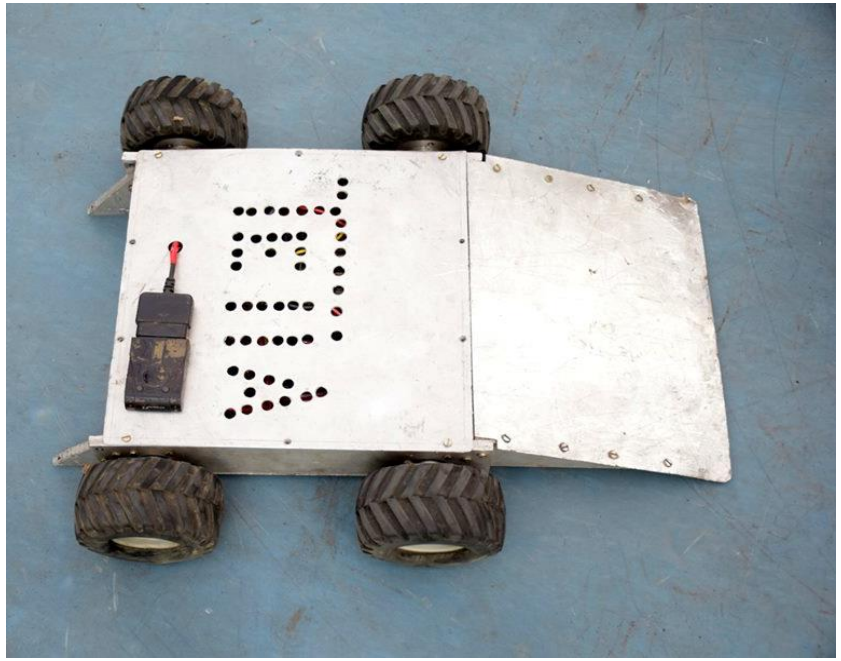
What goes behind making a *robot*?

1. **Defining the Problem** i.e. the purpose of construction and identifying the specific requirements
2. **Researching and Designing** i.e. planning and designing appropriate solutions
3. **Creating a Prototype** i.e. testing and troubleshooting the design
4. **Building** the robot
5. **Programming and Testing** the robot
6. **Evaluating** the Robot i.e. outlining the strengths and weaknesses in the robot



Source: galileo.org/robotics/design.html

Role of Robotics Club



To participate in **events** organized annually by various institutes and organizations

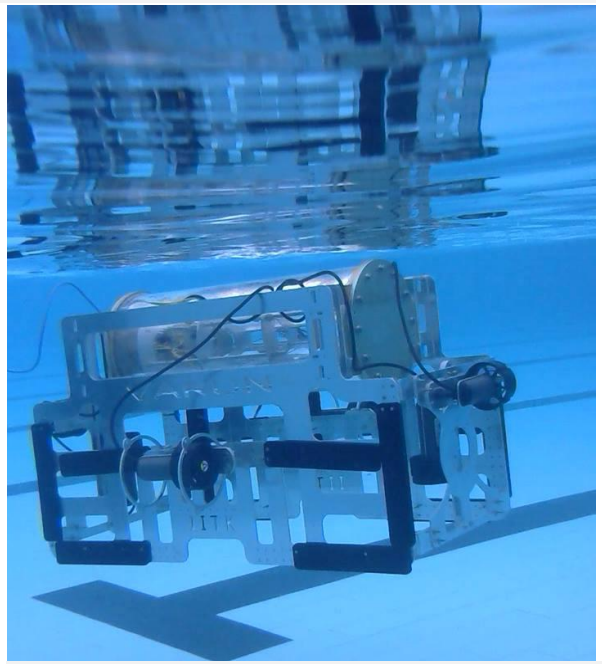
Meet **Gabbar** and **Tella,** Wild Soccer Robots

Role of Robotics Club

Ongoing Projects

WASP

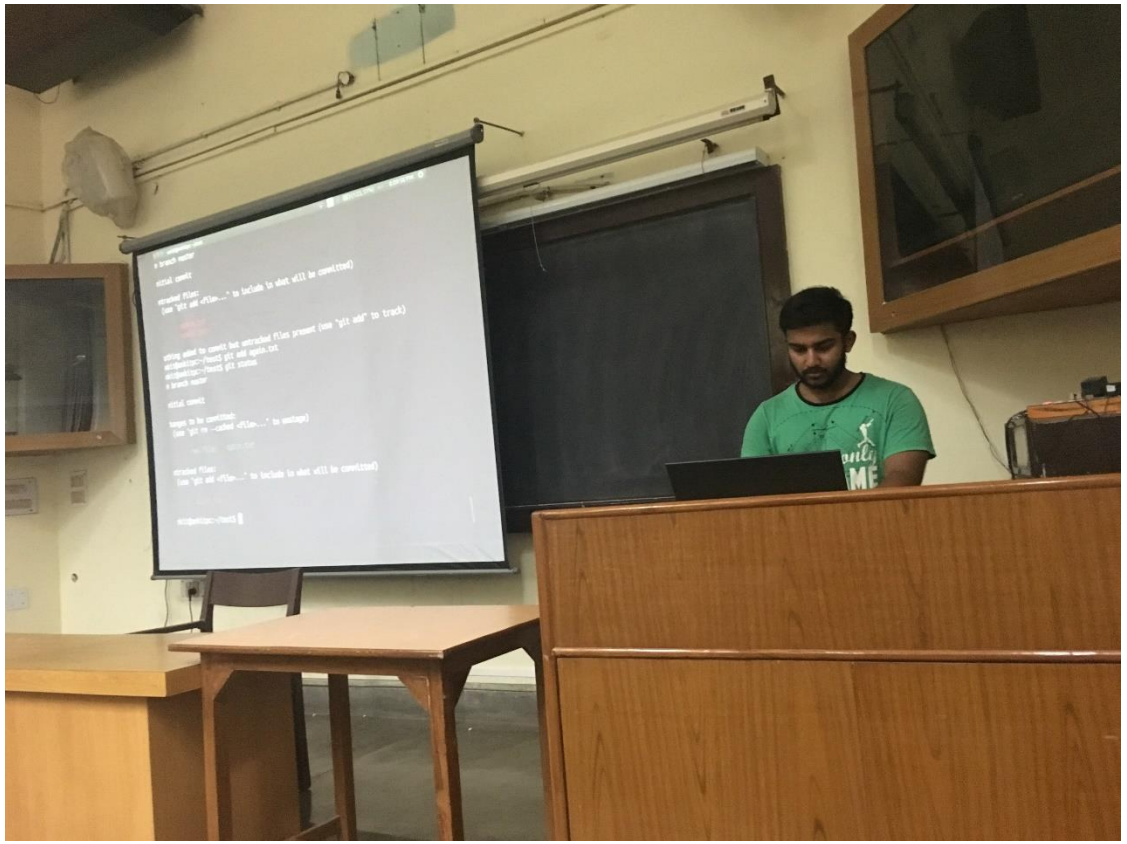
HuRo



AUV

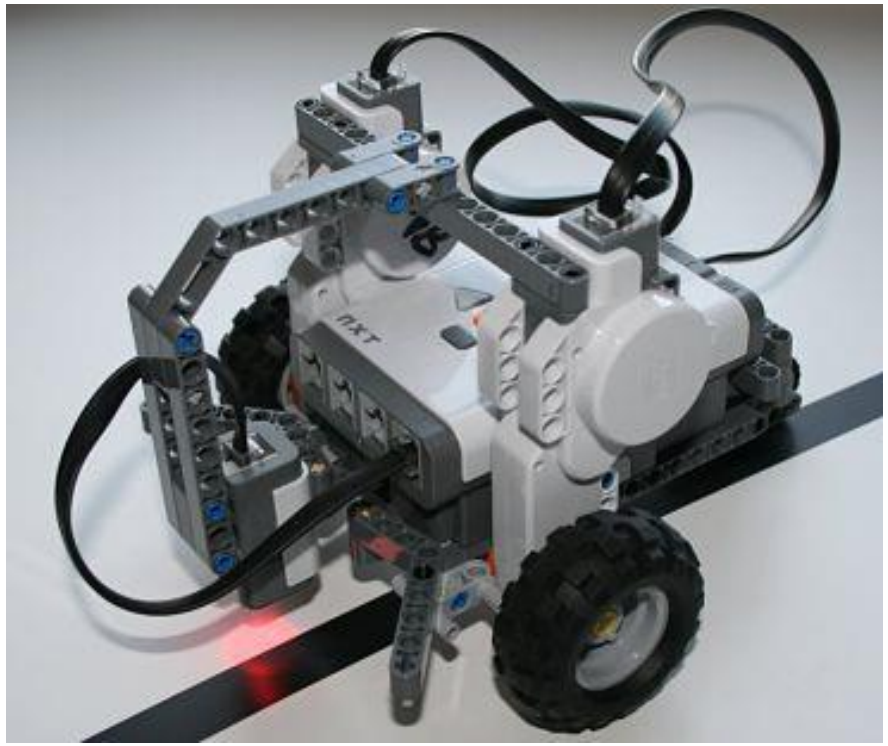
To provide facilities to interested students for practicing **amateur research** in the field of robotics

Role of Robotics Club



To organize **workshops and lectures** for people to learn more about robotics

Hardware: Lego Mindstorms NXT 1.0
Sensor: Lego light sensor
Motor: Lego Servo Motor
Programming: Labview



Vs.

Hardware: Arduino, Odroid XU4
Sensor: Camera
Motor: DC Brushless Motor
Programming: C

Basics for *newbies*

THIS SECTION OF THE LECTURE IS USEFUL FOR THE WORKSHOP TO BE CONDUCTED IN THE FOLLOWING WEEK.

Mayank Mittal, Junior, Dept. of Electrical Engineering, IIT Kanpur

Mechanical

Chassis

It is the base frame of any robot on to which other components are mounted.

Mechanical

DC Motors

- Generally operated at +12V. Negative supply make shaft rotate in opposite direction
- Speed reduces as voltage supplied decreases
- Torque and speed are inter-related

  A 10rpm motor has relatively higher torque than 100rpm or 300rpm motor.

6V, 180 rpm Micro DC Geared Motor

12V, 10-500 rpm DC Geared Motor

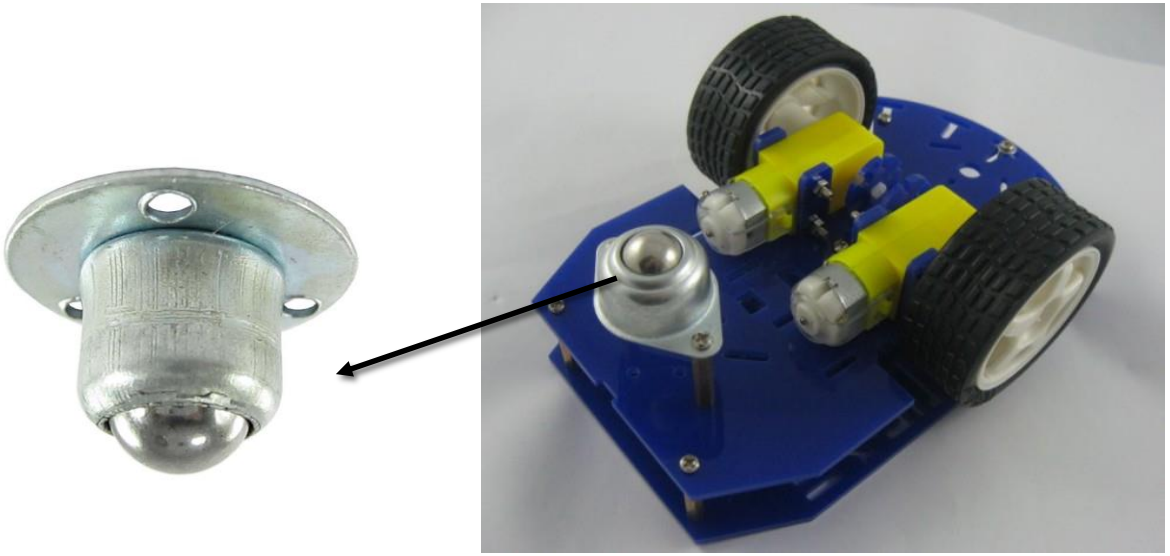
300 RPM Side Shaft DC Gear Motor

Mechanical

Castor

- It is type of wheel mounted at the bottom of the chassis for easy rolling movement.
- Also found in trolleys, hospital bed, desk chairs

Swisvel Castor

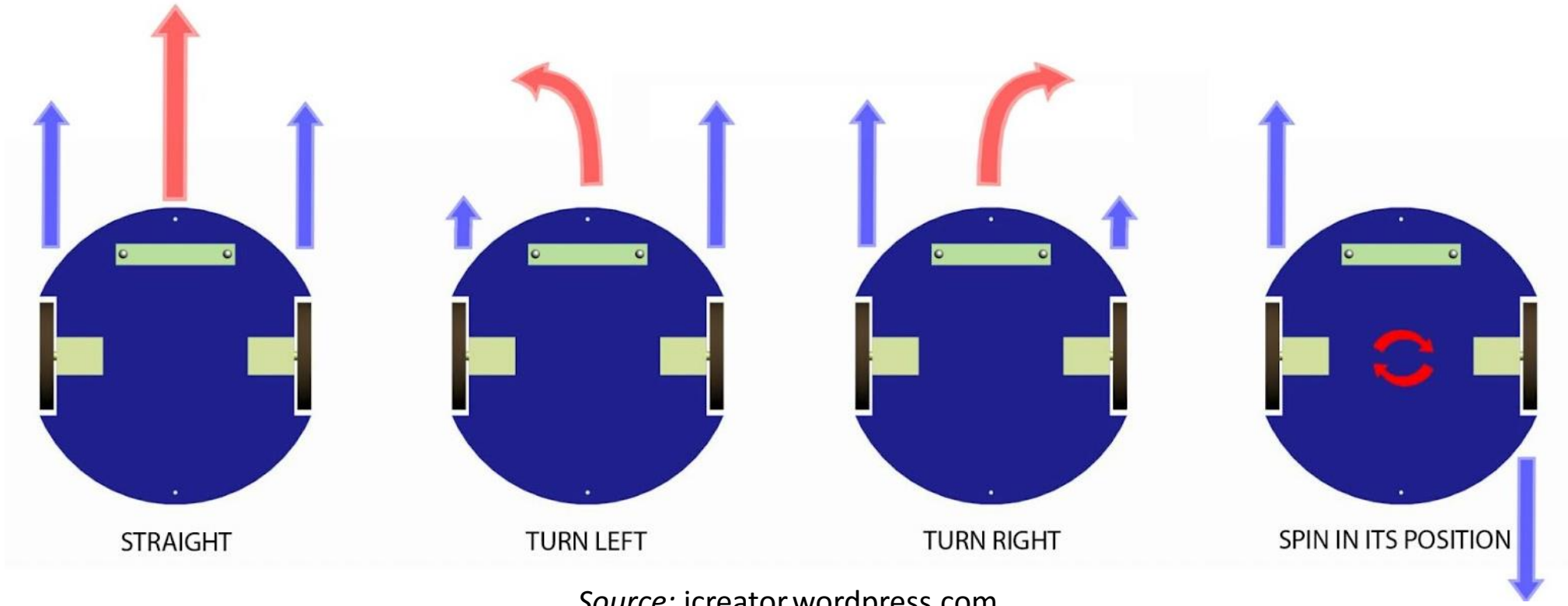


Castor Wheel in robot

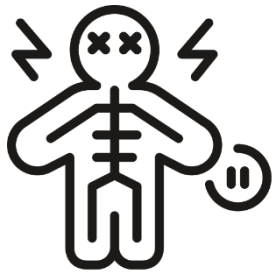
Mechanical

Differential Drive

‘Differential' means that robot turning speed is determined by the speed difference between drive wheels



Source: icreator.wordpress.com



Electrical

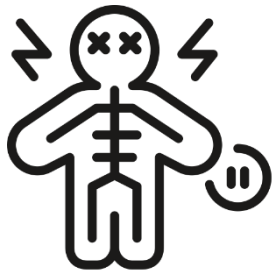
Power Source

- Most of the mobile robots carry on- board batteries.
- The kind of battery chosen depends on the sensors and actuators present in the robot.

Switch Mode Power Supply (SMPS)

Lithium Polymer (LiPo) Battery

Lead- Acetate Battery



Electrical

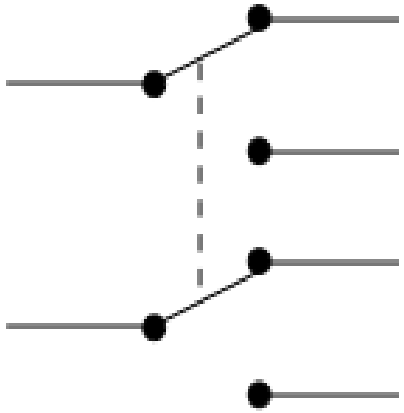
Switches

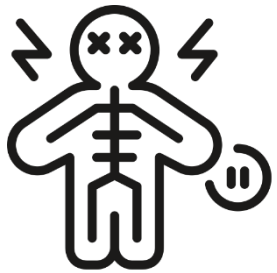
Single Pole Single Throw (SPST)

- A simple on-off switch
- The two terminals are either connected together or disconnected from each other

Double Pole Double Throw (DPDT)

Equivalent to two SPDT switches controlled by a single mechanism.



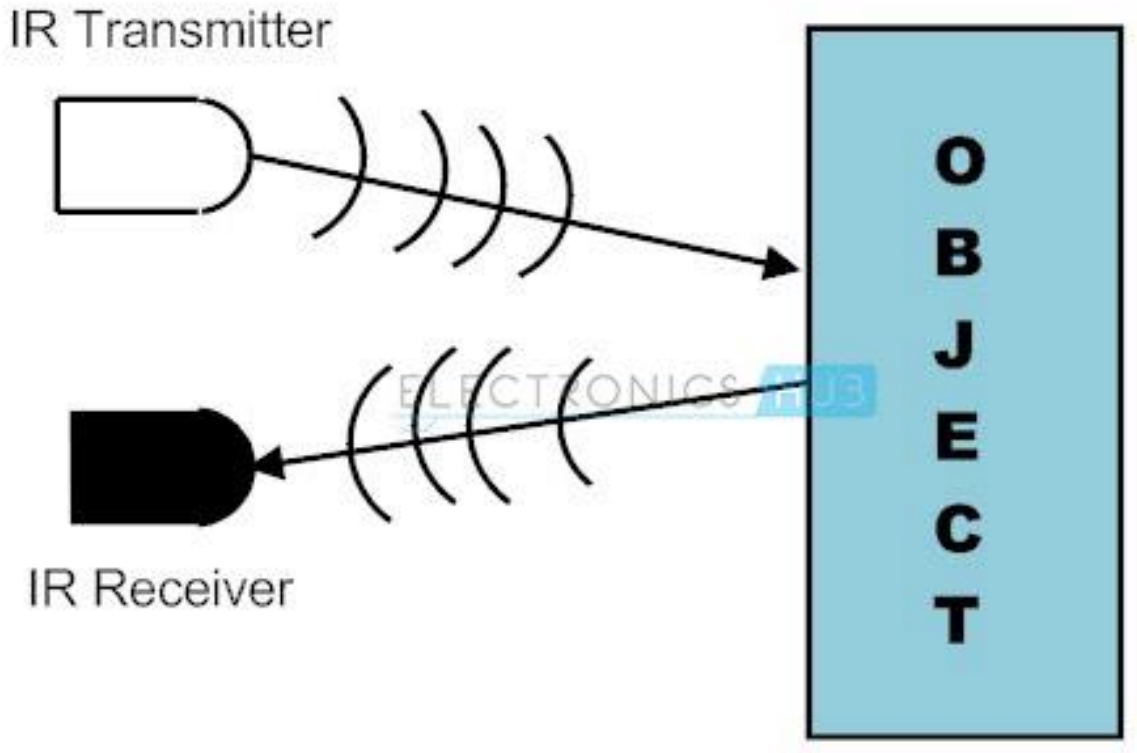


Electrical

Electronics

Infra Red (IR) Sensor

- Can measure the heat of an object as well as detects the motion
- Passive in nature that is doesn't emit IR rays rather just detects them

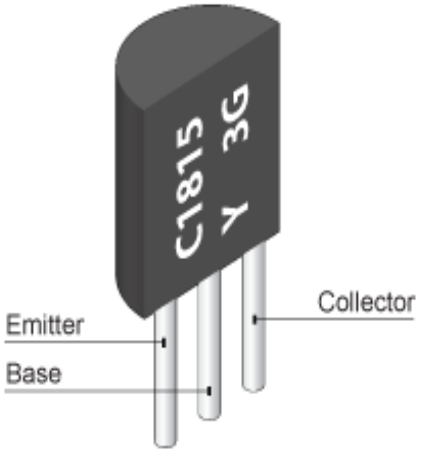


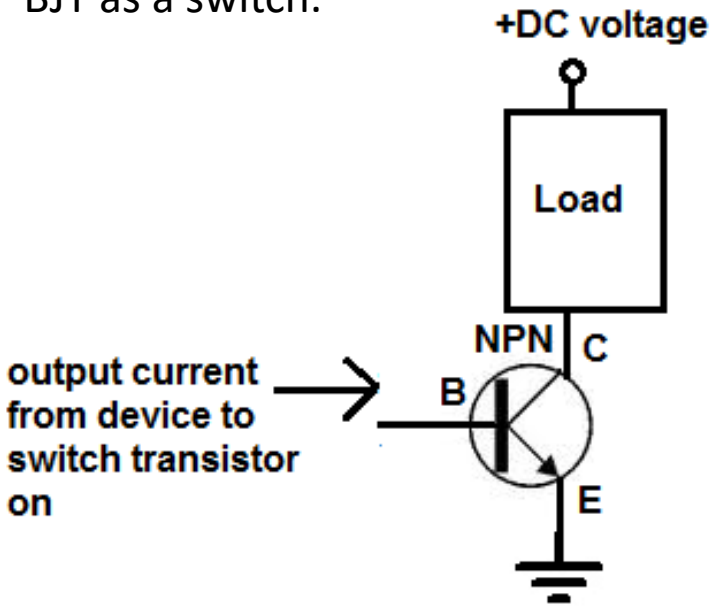
Electrical

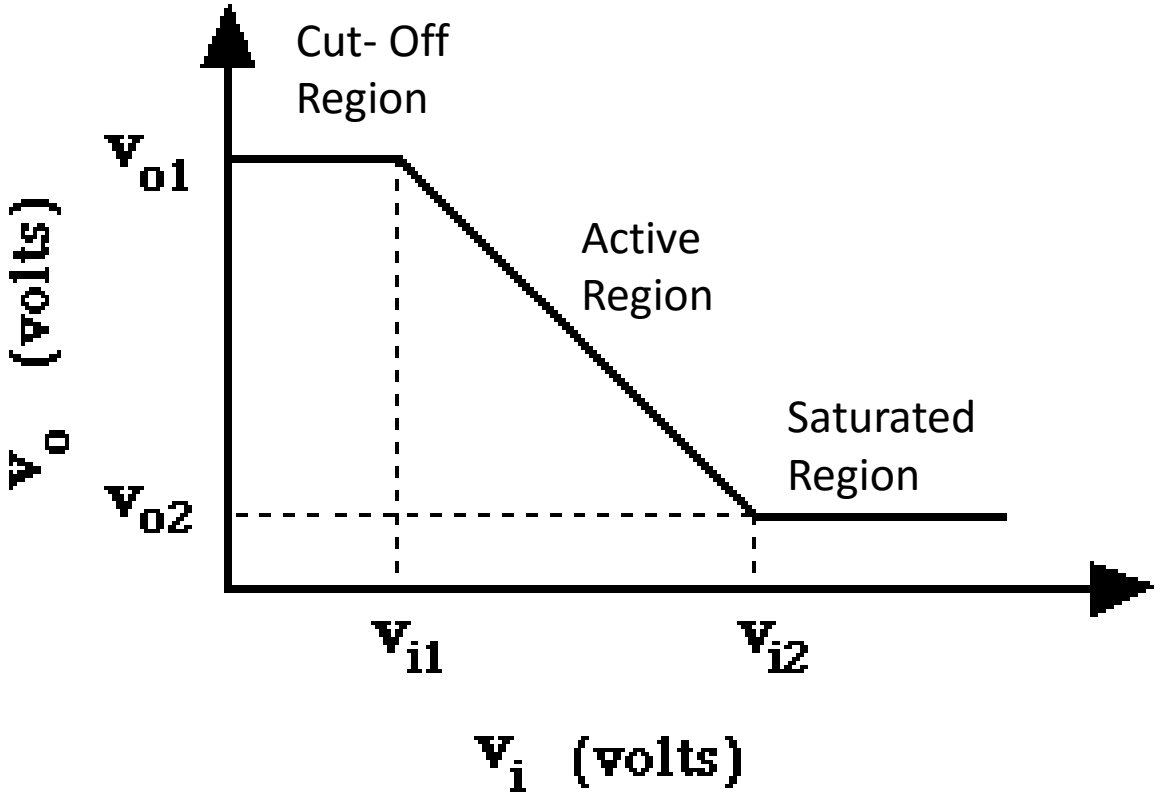
Electronics

Bipolar Junction Transistor (BJT)

We would be using BJT as a switch.







Equipment to be Used

Drilling Machine

Soldering Kit

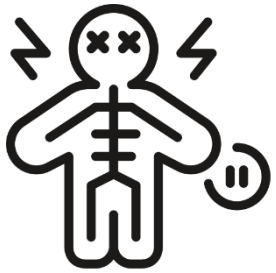
Hacksaw

Breadboard

What else you may learn here?

Mechanical

- Designing Software like Solidworks, Autodesk Inventor, Ansys
- Learning industrial- grade manufacturing methods
- Different types of actuation in robotics using pneumatic, and other kind of motors



Electrical

- Using various other sensors frequently used such as ultrasonic, IMU, camera
- Dealing with microprocessors and microcontrollers
- Designing circuits using simulation tools such as Microcap and physically testing them

Programming

Application of programming skills on hardware and physical systems:

- Feature detection using image processing such as detection of human faces
- Voice recognition
- Designing of low- level intelligence (i.e. controllers)
- Implementing Machine Learning Techniques (MLT)

Upcoming Events in the Semester

Dates: 12th-13th August
Timings and Venue shall be emailed soon

Dates: 1st-4th September
Watch out of Robotics competitions!

THANK YOU!

In case of any queries, contact:

COORDINATORS:

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SECRETARIES:

Every hall has secretaries who can be approached regarding any doubts on robotics.

For more information, visit: **http://students.iitk.ac.in/roboclub/**