Robot

↳ machines → programs → commands → action

Sense → Think → Act } Robots

→ Gathering Info
→ taking decisions
→ physical acting

Sensor
↳ gather data from outside → convert it into signal

↳ Camera
↳ Light, Temp, Humidity
↳ touch
↳ Proximity sensor

Actuators
↳ takes real action based on commands.

↳ motor — servo, step
↳ Hydraulic →

Controllers
↳ brain of robot
↳ process input from sensors
↳ make decision
programes algorithms
↳ AI, GenAI

Robotics.

inter disciplinary field → designids, building, operations.

Core Disciplines / Trades (B.

↳ Mechanical Eng.
↳ build
↳ Kinematics } body

↳ Electrical & Electronics (EEE)
↳ circuit
↳ sensors and actuators

↳ Computer Science (CSE)
↳ AI, prommers (controllers)
↳ Signal processing (EEE & CSE)

↳ RL (Control System Engineering)
↳ ensure accurate behaviour of robots based on programes and interaction

Goal of Robots

↳ Assist → human in their taste,

↳ Augment → increase human capabilities (eg. hydraulic)

↳ Replace → labour intensive, low creative field.

Characteristics of Robots

(1) Perception → sense
camera, LiDAS, promixity (Car parking)

(2) Computation → Understanding perceptions.
(Controllers) ↳ process sensory data, excute algo
↳ Chips (M, i7, i9, AI)

(3) Actuation → real world works →

(4) Autonomy → Level of freedom given to robots to performs
↳ Automatic navigation
↳ Obstacle detection

ADAS
L1 → lanes
L2 → train
⋮
L5 → complete

Types

① Industrial Robots
- ↳ Welding
- ↳ Painting

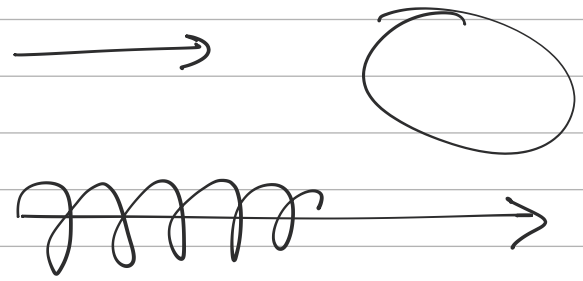
② Medical Robots
- ↳ surgeries

③ Service Robots
- ↳ hotels
- ↳ home chores

④ Defence →

⑤ Exploration → Mars rover, in seawater

⑥ Humanoids → Sophia

Sensors	Actuators
Function → gather real time data Output → signal (digital or analog) Role → perception Motion, temperature, light, force, pressure.	Function → execute actions Linear, Rotation, gripping  Motors — DC servo ↳ steppecter Robotics Arm

Environment → Sensor —Signals→ Controllers —commands→ Actuators —perform→ (back to Environment)

Sensors

External (Exteroceptive)

- Proximity
  - IR
  - LIDAS
  - Ultrasonics
- Vision → Cameras
- Tactile Sensor → touchpads, Force sensor
- Environmental

Internal (Proprioceptives)

IMU → Inertial Measurement Unit

- Gyroscope (Angular)
- Accelerometer (Lin)

Health Monitoring

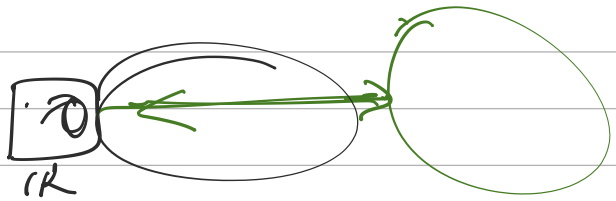
- AC → Auto Cut (27° / 26°)

Proximity

- Range

Infrared (IR)

- Light →



WP

Sensor will emit IR waves.

- Object will Reflect when it strikes
- Distance

Short Range → <100cm (<80 cm)

Cost effective & compact

Environment → sunlight

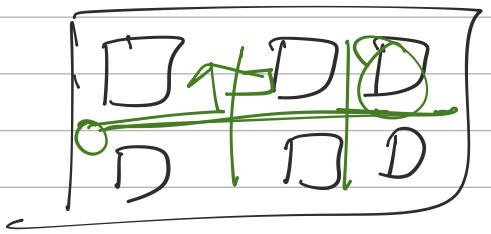
Dark → Absorbs

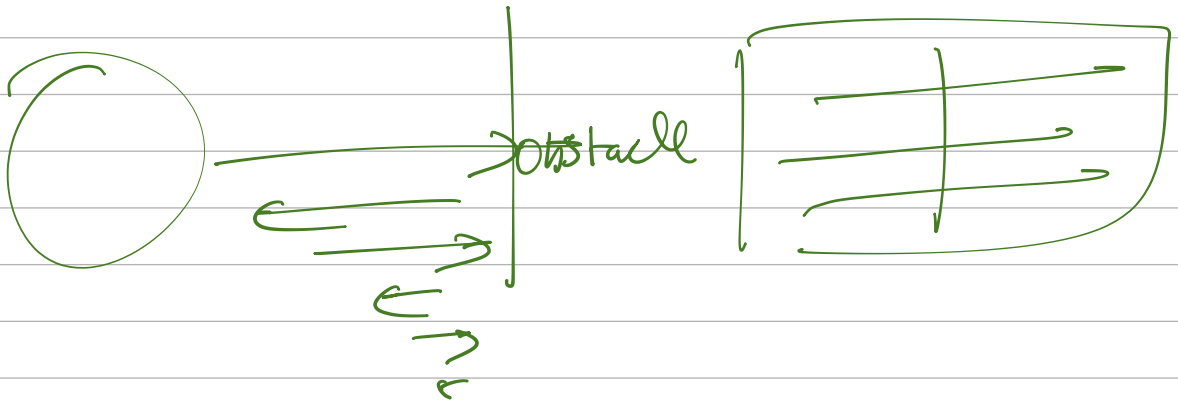
↓

less accurate

Applications

↳ Line following
↳ Cliff or edge
↳ Obstacle avoidance



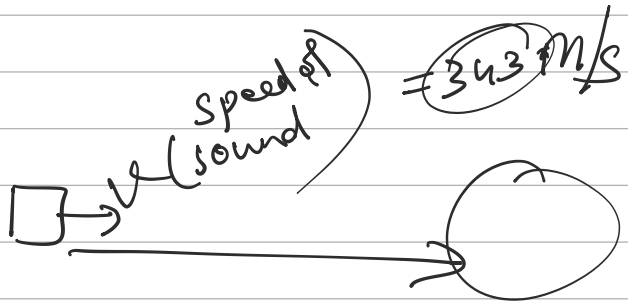


Ultrasonics Proximity

↳ sound waves

WP

↳ High frequency SW (>35KHz) (20KHz)
↳ reflect
↳ Time Measurement.



$$t = \frac{2d}{v}$$

$$d = \frac{v \times t}{2}$$

$$v = \frac{2d}{t}$$

Features
↳ 2cm to 4metres
↳ Light Indepence

Limitation
↳ Soft material

Applical
↳

Controlled Loops in Robotics

RL
↳ feedback → robots → monitor evi
↳ adjust its funch accordin

Sensing →
Decision
Action.

Open-Loop
pre-programmed instruction
↳ no feedback
↳ simple
↳ fastev
No adaption

Closed Loop
↳ real time feedback
Actual — Desired
diff (error)
↳ Accuracy
↳ Adaptibility
Sensors

Command → Controller → Si → Motor → Action →

Controller → Motor → Output
feedback.