Hardware: Locomotions & Mechanical Design (2-ACTUATORS)

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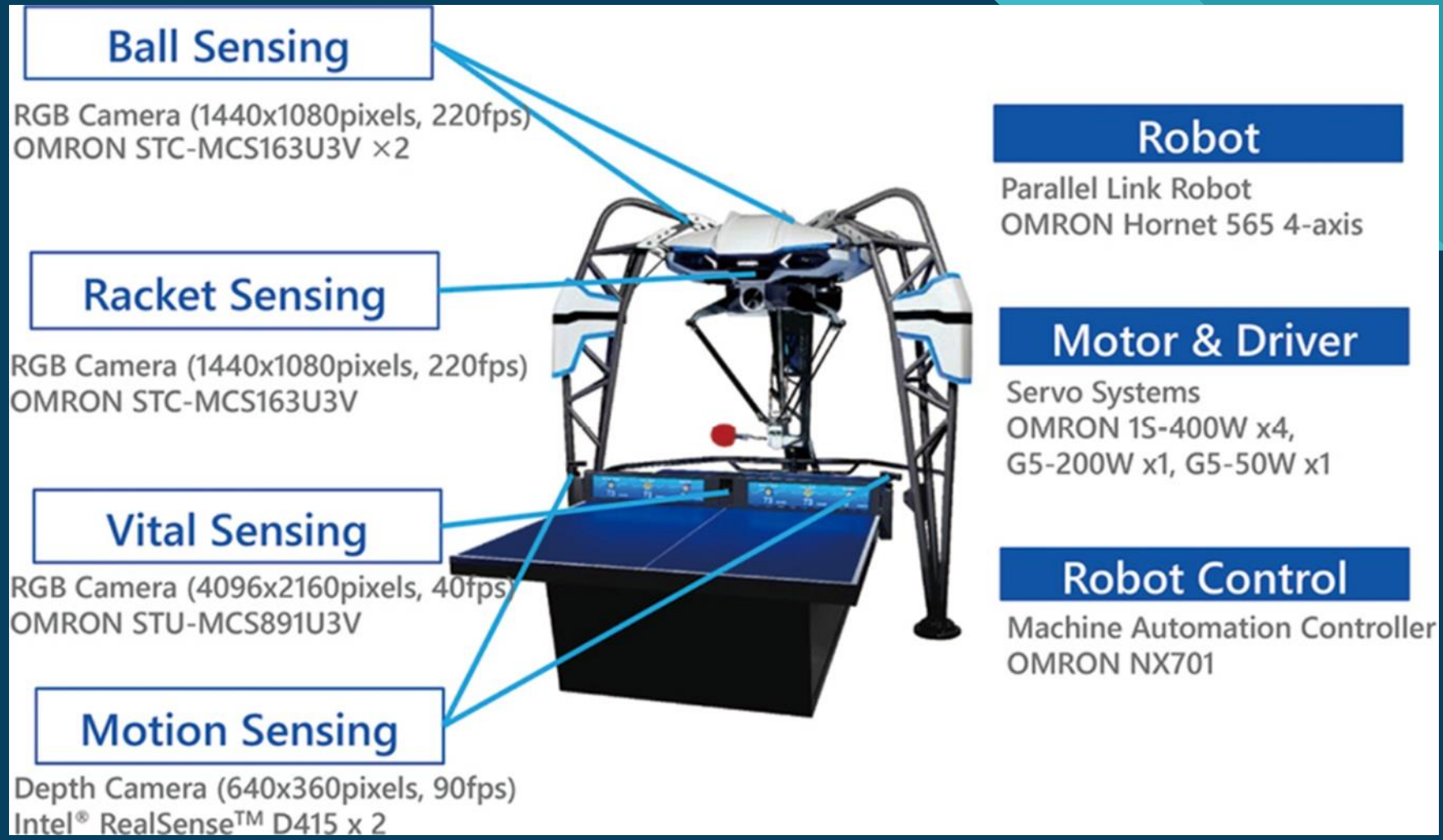
STATIONARY ROBOT

OMRON FORPHEUS ROBOT



MOTION PRINCIPLES

- Parallel link system
- Parallel Robots Hornet 565
- Ethernet capability for robot control
- Programming language: IEC 61131-3 of Machine Automation Controller NJ/NX/NY Series
- High-payload for multi-hand support
- Fast pick & place capability
- Maximum working diameter; 1, 130 mm
- Working height: 425 mm
- Maximum payload: 8 kg

HARDWARE COMPONENTS

- OMRON 1S-400W AC Servo Motor
- Model number: R88M-1M1K520C-S2 679978
- Rated output: 0.4 - 1.5 kW
- Drive supply voltage: 400 VAC
- Rated speed: 2000 rpm
- Rated torque: 7.16 Nm with absolute encoder
- Peak torque : 21.5 Nm
- Price: RM5,802.37

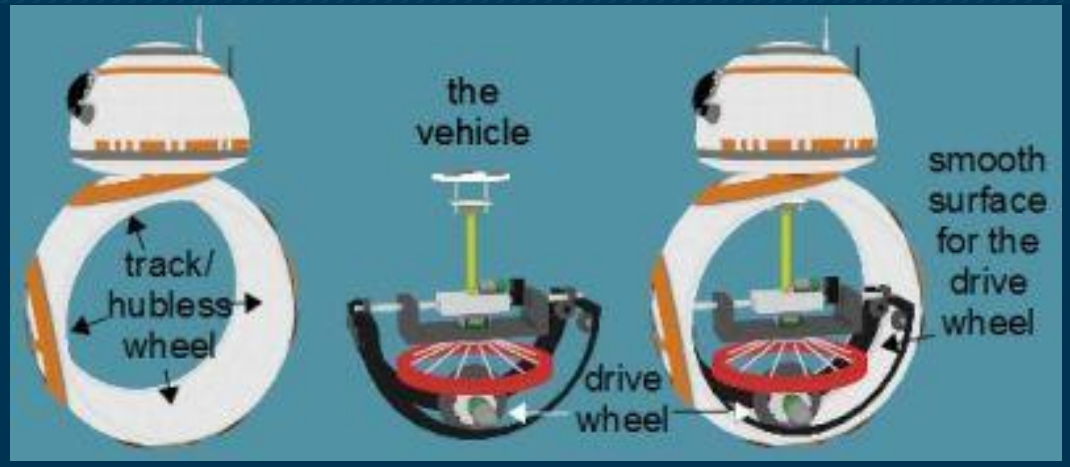
HARDWARE COMPONENTS

- OMRON G5-200W Servo Motor
- Model number: R88M-G20030H-S2
- Rated output: 50 - 200 W
- Drive supply voltage: 200 V
- Rated speed: 3000 rpm
- Peak torque: 0,64 Nm
- Price: RM3, 931.89

WHEELED & TRACKED ROBOT

SINGLE WHEELED BB-8

MOTION PRINCIPLE

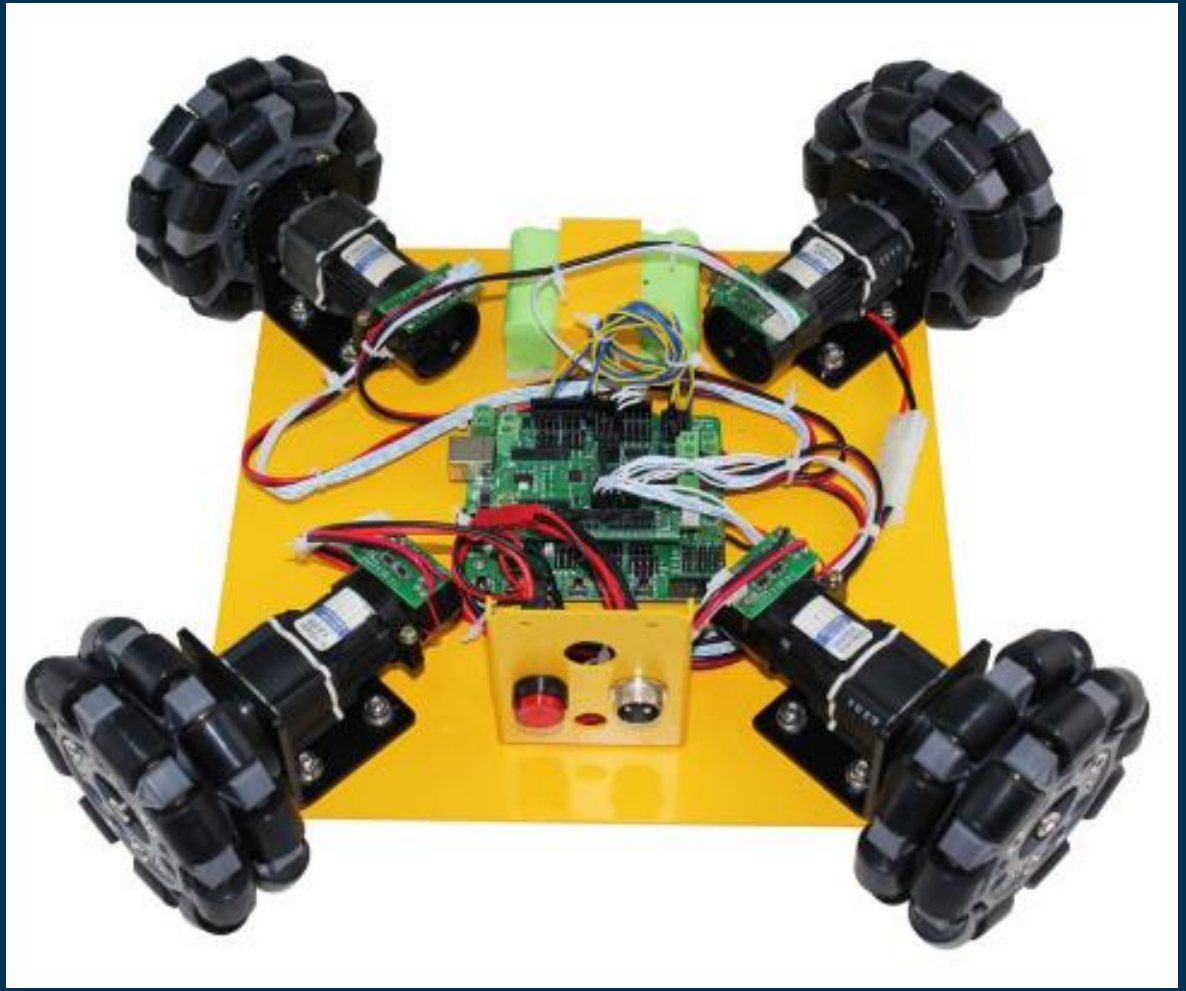


- Hubless Wheel Drive
- Single wheeled BB8 design
- Robot's turn: Uses axle drive as shown below
- Stabily: Combined technique similar to axle and hamster drive
- Back & forth stability: The vehicle in the track moves back and forth to counter wobble
- Side-to-side stability: The suspended mass is moved side-to-side to counter wobble

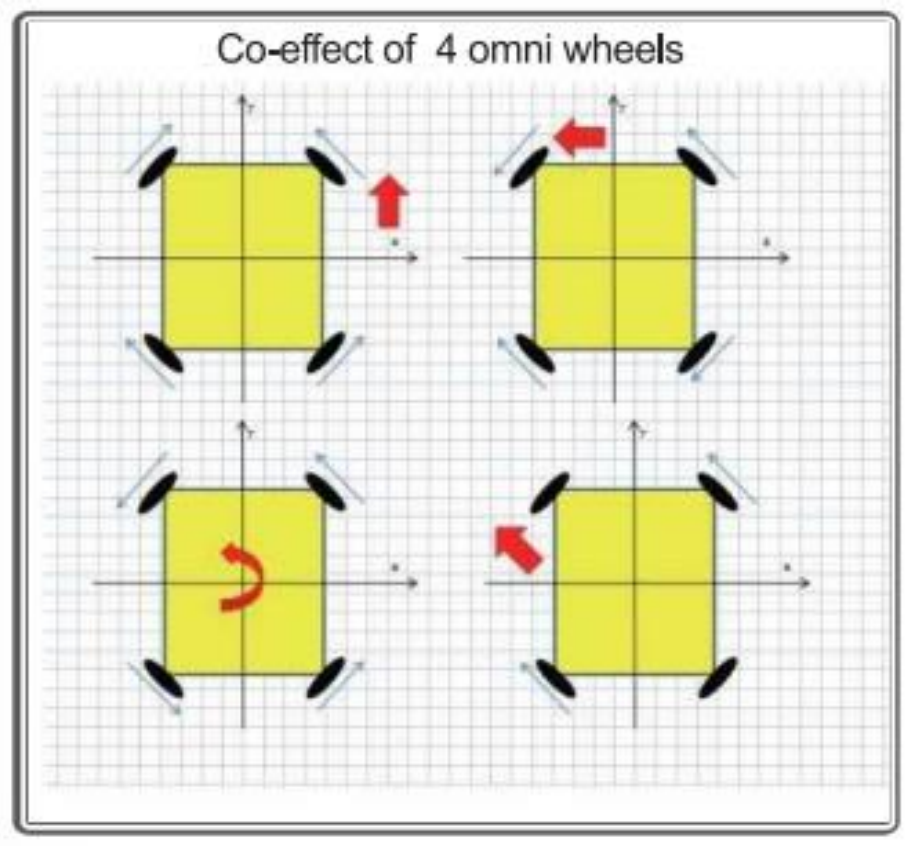
HARDWARE COMPONENTS

- Bipolar Stepper Motor
- Nema 17HS4401 Hybrid Stepping Motor
- Rated voltage: 12 VDC
- Current: 1.2A at 4V
- Step angle: 1.8°
- No. of phases: 4
- Holding torque: 0.31 Nm
- Detent torque: 0.02 Nm
- Price: RM 40.00

4WD OMNI-DIRECTIONAL MOBILE ROBOT



MOTION PRINCIPLE

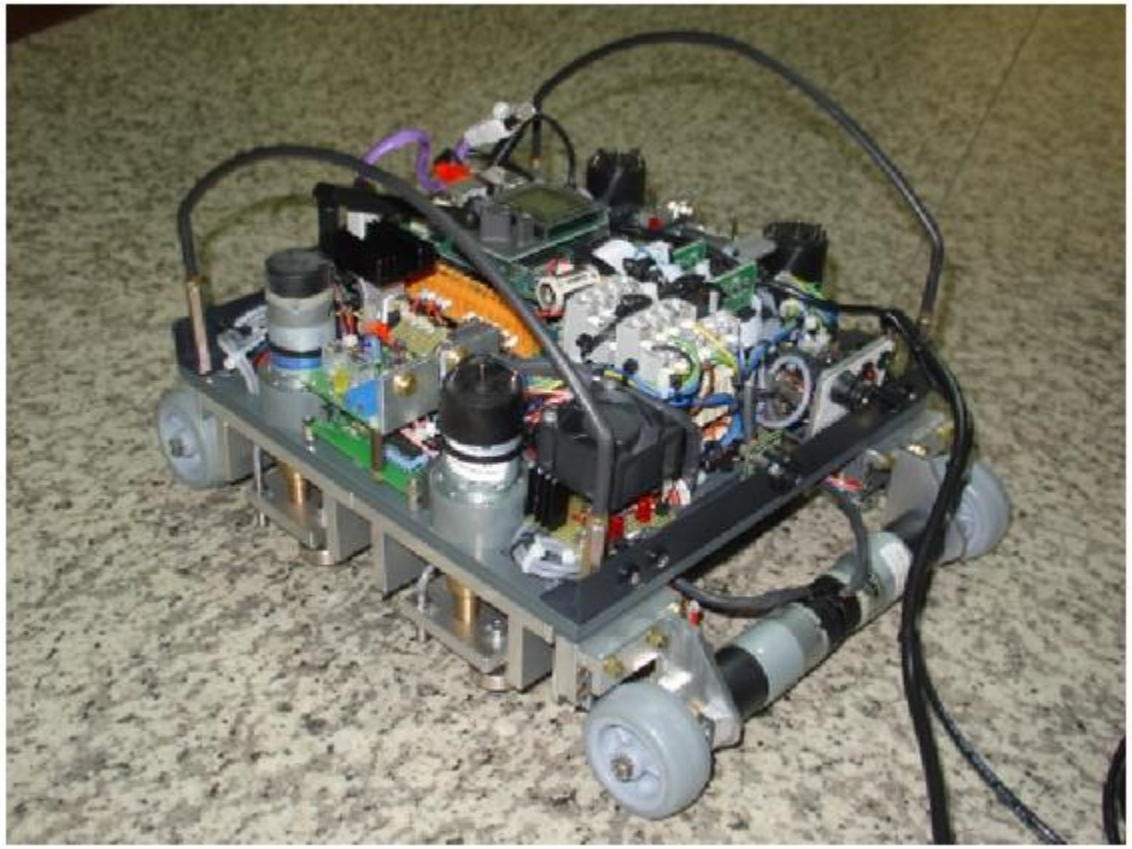


- Holonomic robot system
- Highly maneuverable
- Robot movements at same position:
  - Front and back
  - Slideways
  - Rotates

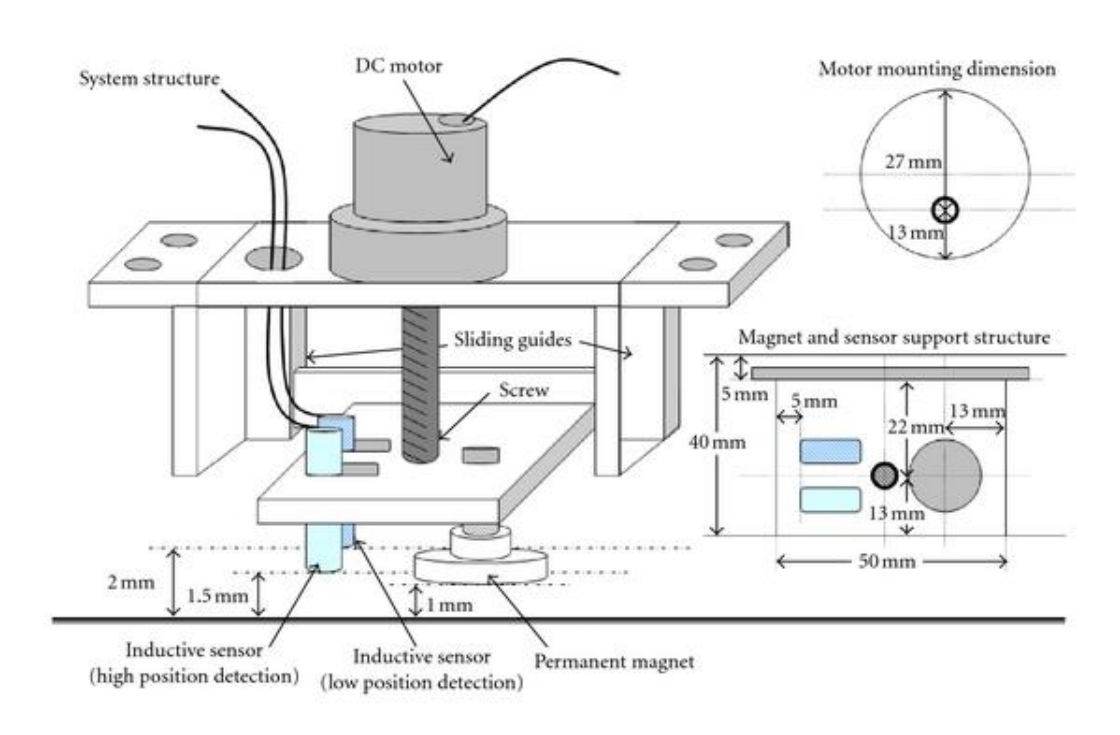
HARDWARE COMPONENTS

- Coreless Motor
- Faulhaber 12V DC Coreless Motor 16002
- Rated voltage: 12 VDC
- Power: 17W
- No load speed: 8100 rpm
- Reduced speed: 120 rpm
- Torsional moment, big torque: 1.72 Nm
- Price: RM 417.65

Wall Climbing Robot (Metal)



MOTION PRINCIPLE



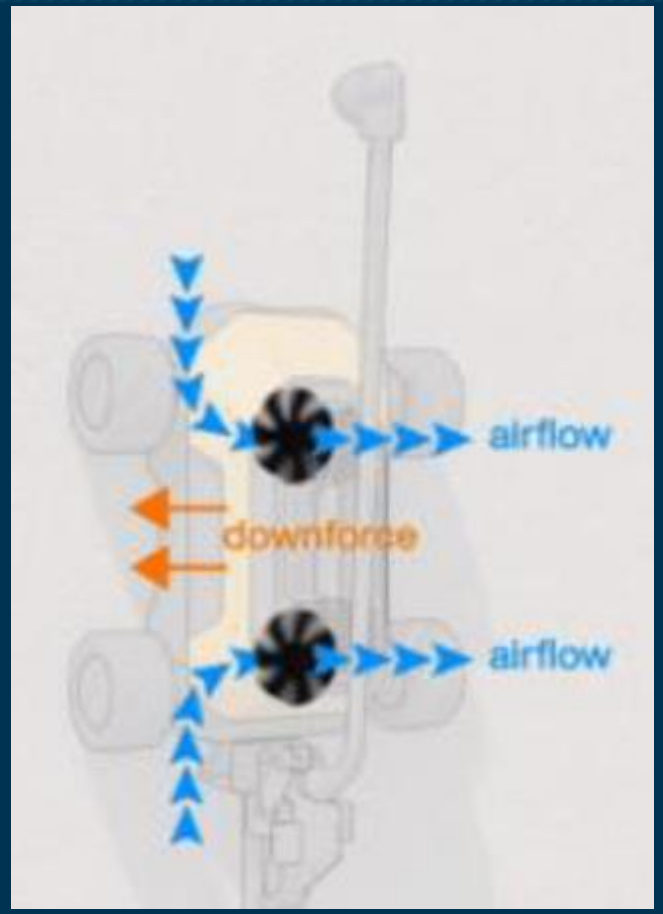
- Magnetic adhesion
- Adopted for the creation of an adhesion force
- Highly reliable, fast but depends on the final weight of the robot
- May involve the use of heavy actuators to obtain the required adhesion force.

HARDWARE COMPONENTS

- High torque turbine worm gear motor
- Walfront DC 12V High Torque Turbine Worm Gear Motor
- Rated voltage: 12 VDC
- Speed: 10, 20, 30, 40 & 100 RPM
- Rated Torque: 1.5 – 22.5 kgcm
- Max.Torque(kg.cm): 6.4 – 25 kgcm
- No. of phase: 2
- Price: RM 84.71

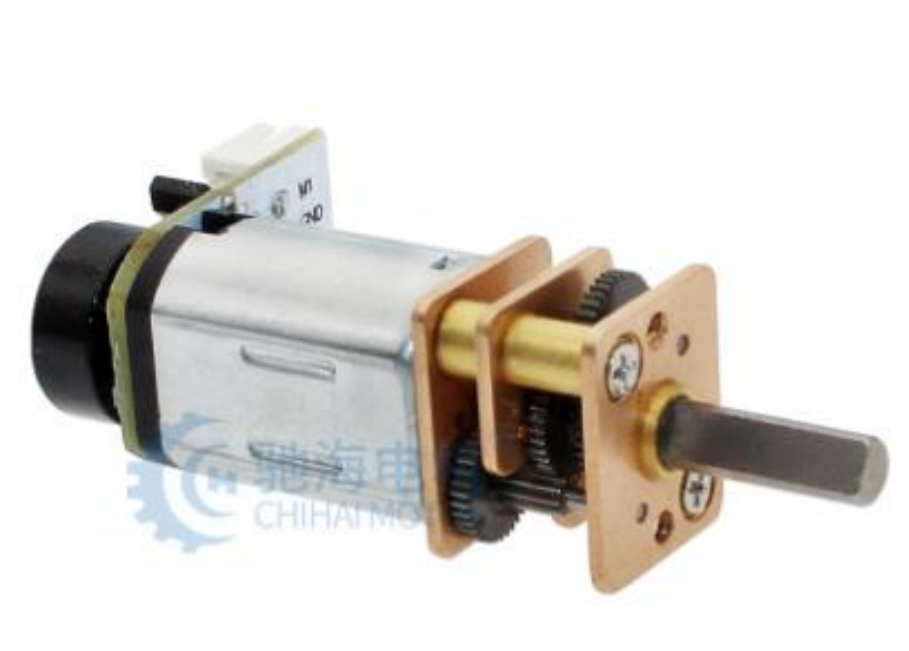
Wall Climbing Robot (Wall)

MOTION PRINCIPLE



- Suction concept, zero-pressure difference(ZPD) method
- Works for rough surfaces, no matter how textured
- Has up to 42 kg of suction force into the surface

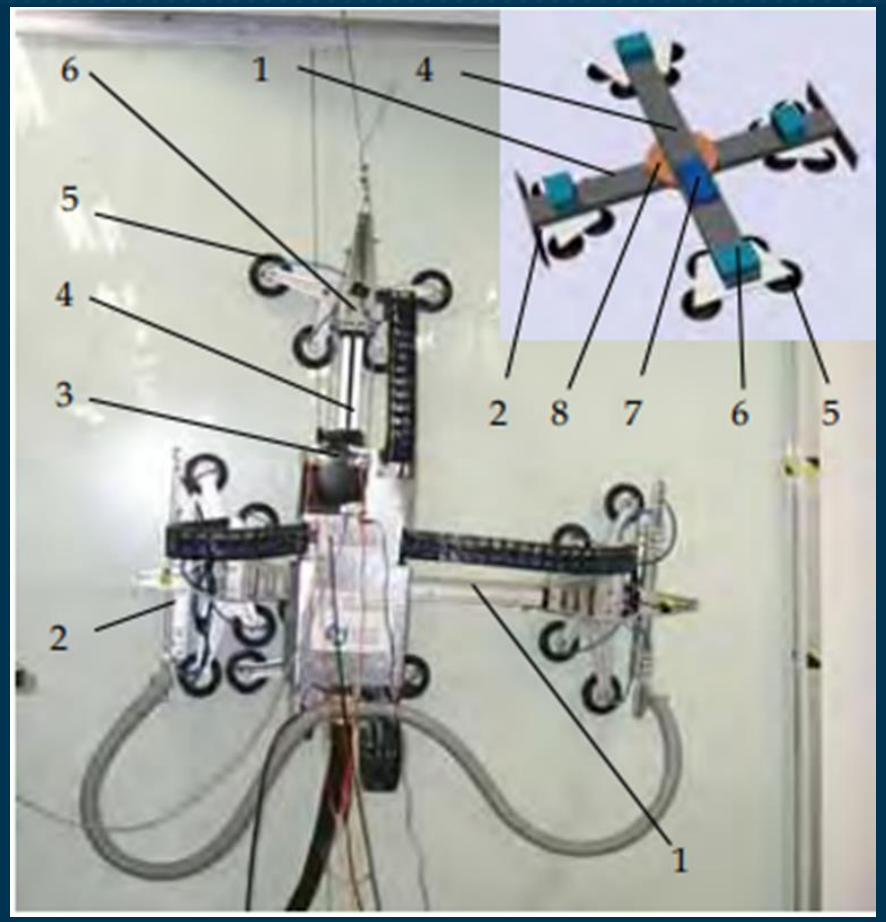
HARDWARE COMPONENTS



- Carbon brush DC Gear Motor
- CHR-GM12-N20K ABHL carbon brush DC reduction motor
- Voltage range:3 – 6 VDC
- Speed range depending on model: 26 – 2200 RPM
- Price: RM 47.20

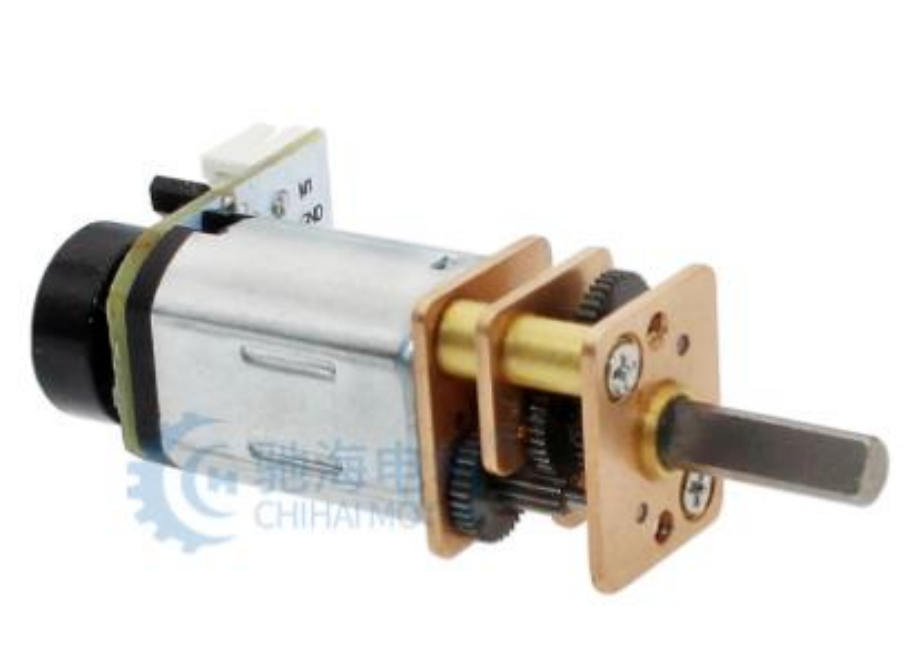
Wall Climbing Robot (Glass)

MOTION PRINCIPLE



- Suction pad adhesion
- Able to withstand 15 kg of payload
- Can complete a series of motions including moving, rotation & crossing obstacles
- movement of the robot is achieved by alternately sucking and releasing the suction cups installed on the horizontal and vertical rodless cylinders

HARDWARE COMPONENTS



- Carbon brush DC Gear Motor
- CHR-GM12-N20K ABHL carbon brush DC reduction motor
- Voltage range:3 – 6 VDC
- Speed range depending on model: 26 – 2200 RPM
- Price: RM 47.20

LEGGED ROBOT

HUMANOID ROBOT: BIOLOID

MOTION PRINCIPLE

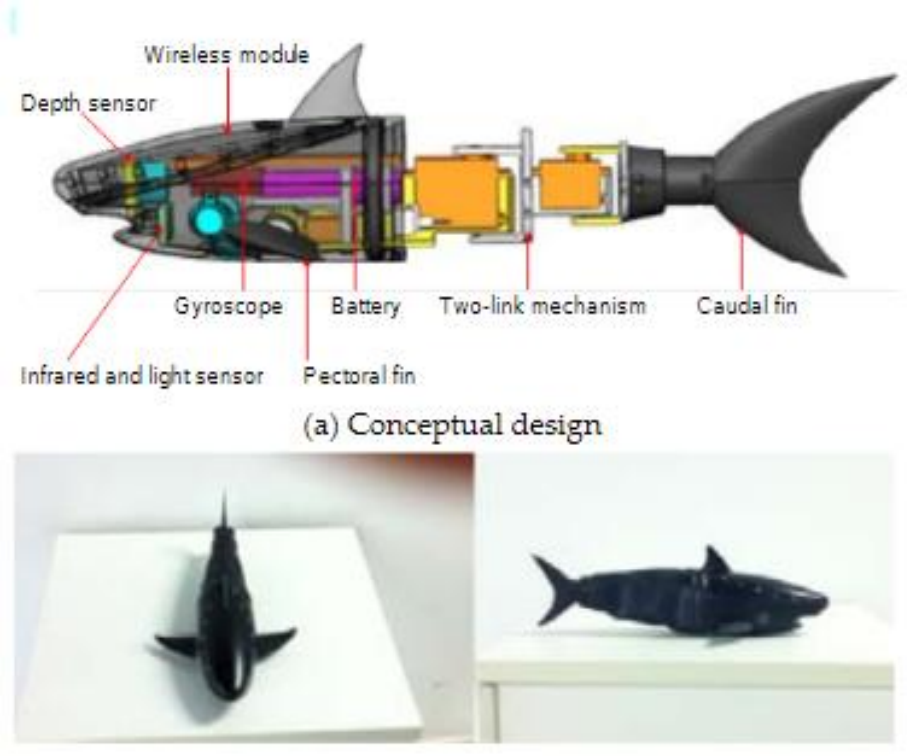
- Bipedal motion
- Mimics human movement
- Walking, running and hopping
- Challenges of bipedal motion robot:
  - stability control (robot's balance)
  - motion control, (robot's ability to move)
- Uses various sensors like accelerometers/gyroscopes to provide dynamic feedback

HARDWARE COMPONENTS

- Servo Motor
- DYNAMIXEL AX-12A Servo Motor
- Operating voltage: 9 - 12 V (11.1 V recommended)
- Baud rate: 7343bps - 1 Mbps
- No load speed: 59 rpm
- Stall torque: 1.5 Nm
- Running degree: 0 - 300°
- Price: RM 207.04

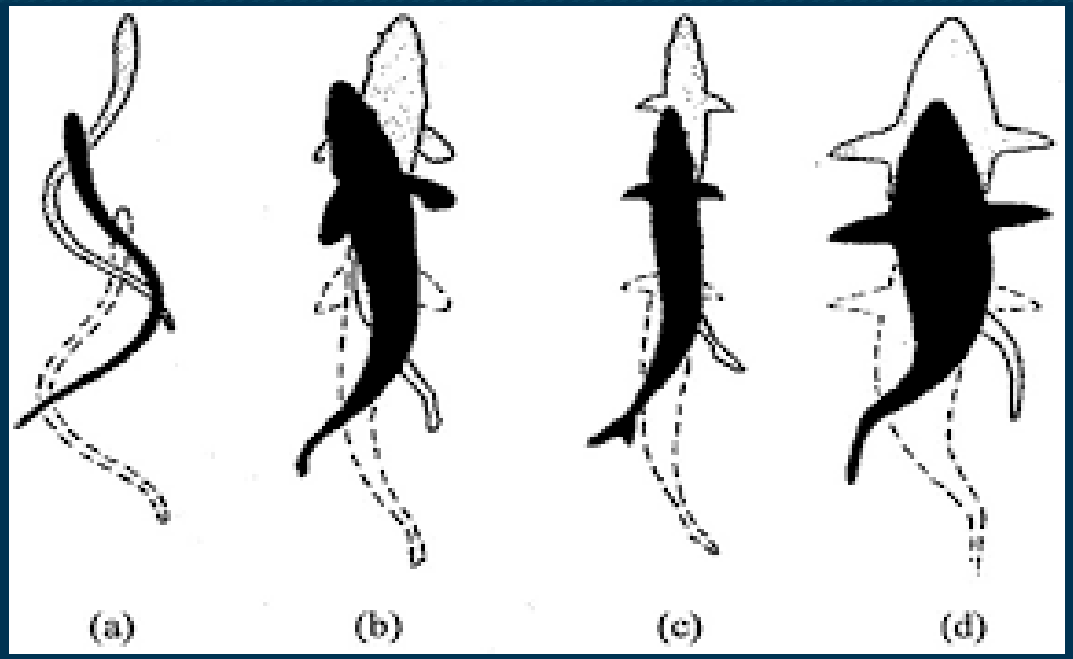
SWIMMING ROBOT

FISH ROBOT



(a) Conceptual design

MOTION PRINCIPLE

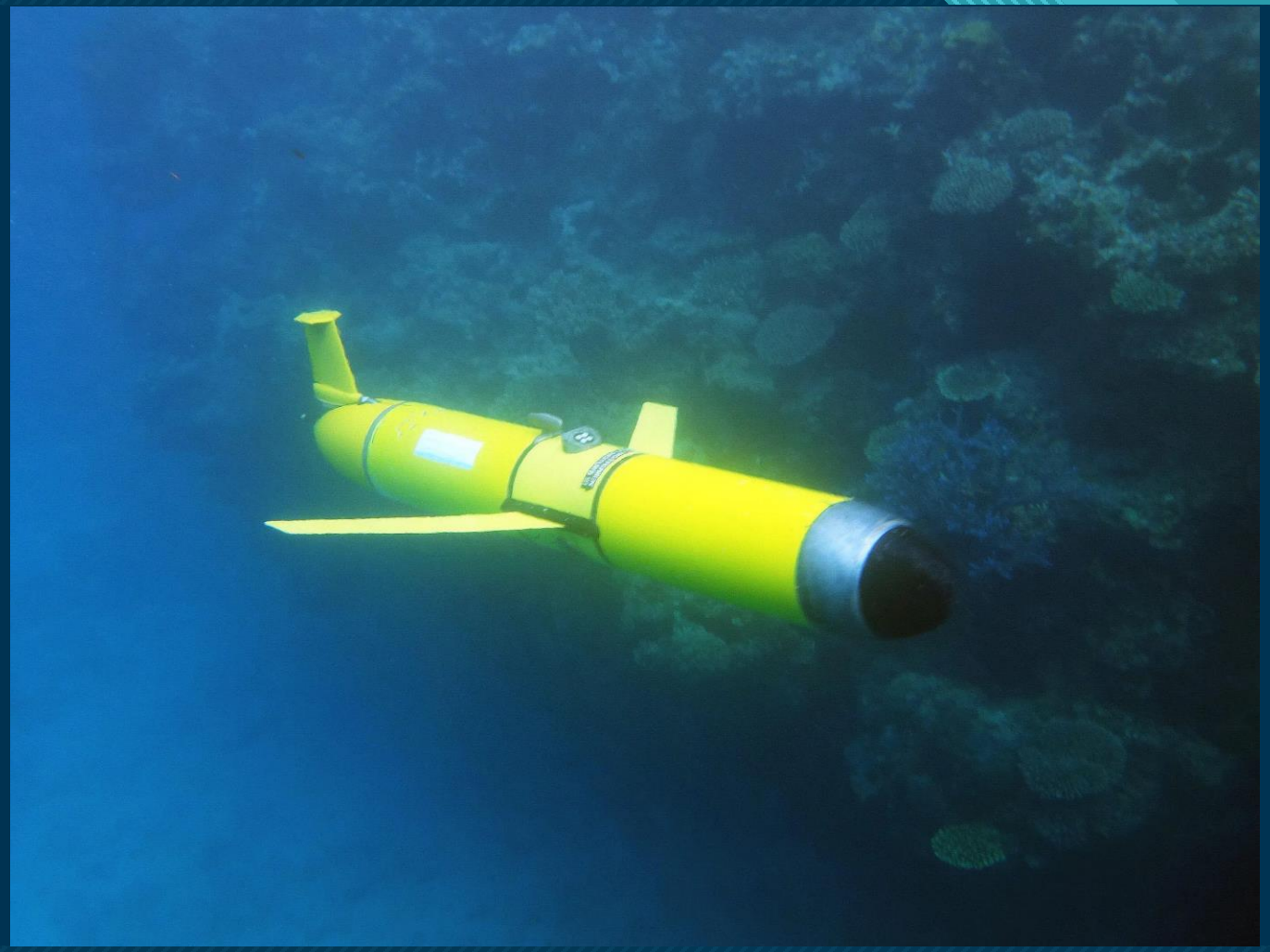


- Body-caudal fin (BCF) propulsion
- Fish swimming method by exerting force against surrounding water
- Types:
  - Anguilliform: Undulate MAJORITY OF THEIR BODY & slow swimmers
  - Subcarangiform/Carangiform/Thunniform: Undulate THE POSTERIOR HALF OF THEIR BODY & are faster than anguilliform swimmers
  - Ostraciiform: Oscillate their CAUDAL REGION & relatively slow swimmers

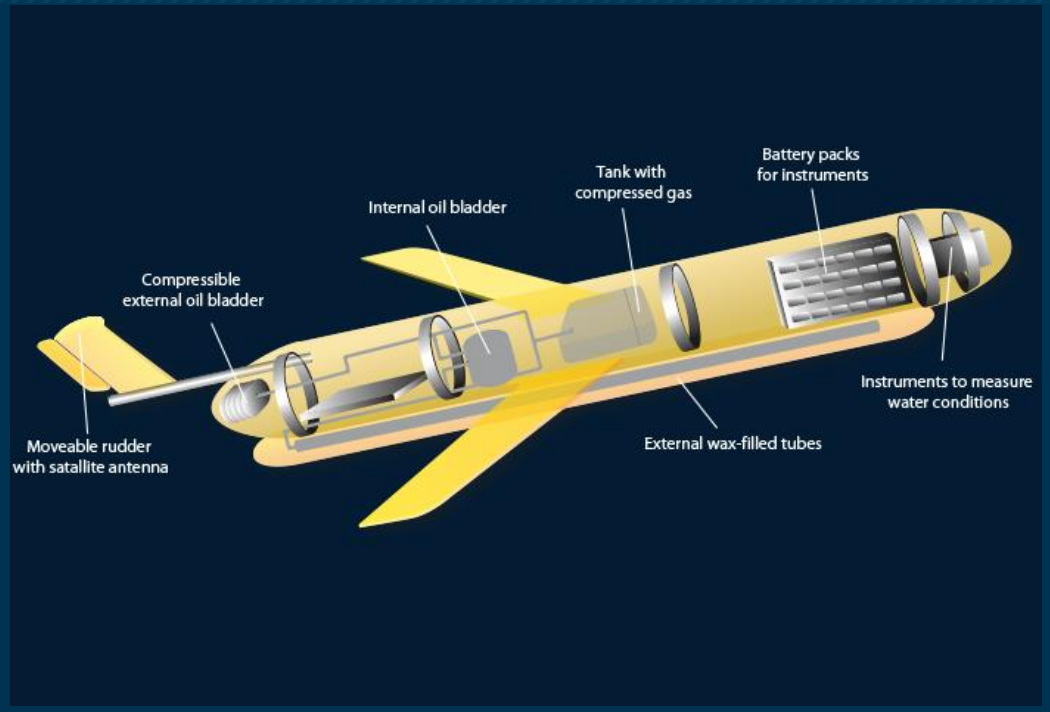
HARDWARE COMPONENT

- Servo Motor
- Hitec HS-5565MH Coreless Servo Motor
- Operating voltage: 6 – 7.4 VDC
- Maximum torque: 108 – 137 Nm
- Price: RM 308.91

UNDERWATER GLIDER ROBOT



MOTION PRINCIPLE



- Variable-buoyancy propulsion
- The ability of a vehicle to change its buoyancy from negative to positive & vice versa
- Buoyancy is adjusted by flooding/evacuating a compartment with seawater allowing it to move up/down the water
- Uses fins sticking out of the sides of the craft to propel it forward.

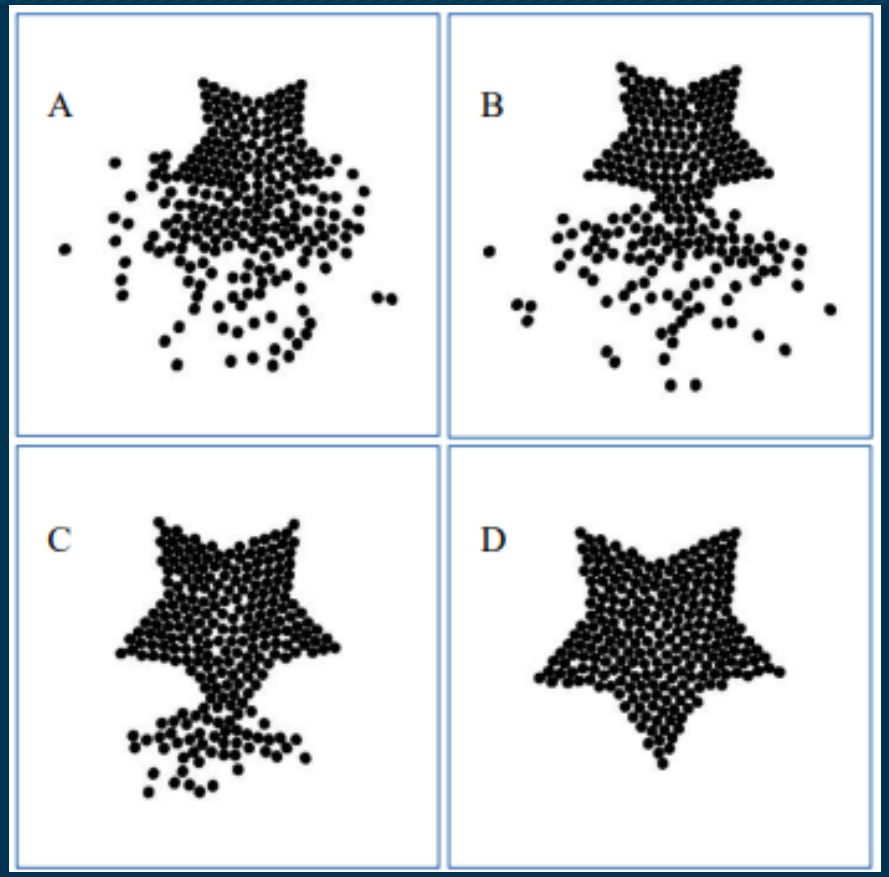
HARDWARE COMPONENT

- Servo with parallel gear rack kit
- Hitec HS-785HB servo with the parallel 785 Gear Rack Kit
- Operating voltage: 4.8 - 6V
- Operating speed (4.8V): 1.68 s/360° at no load
- Operating speed (6V): 1.4 s/360° at no load
- Stall torque at 4.8V: 1.078 Nm
- Stall torque at 6V: 1.30 Nm
- Operating angle: 630° one side pulse travelling 400 µs
- Direction: clockwise/pulse travelling 1500–1900 µsec
- Dead bandwidth: 8 µs
- Price: RM 400.00

OTHERS ROBOT

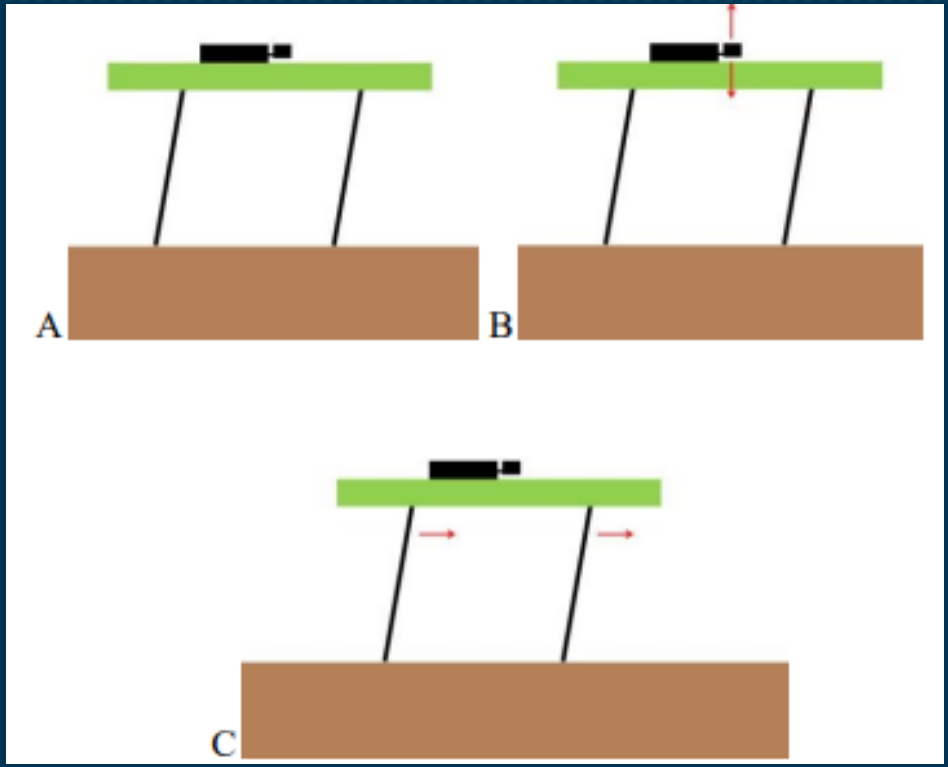
KILOBOT

MOTION PRINCIPLE



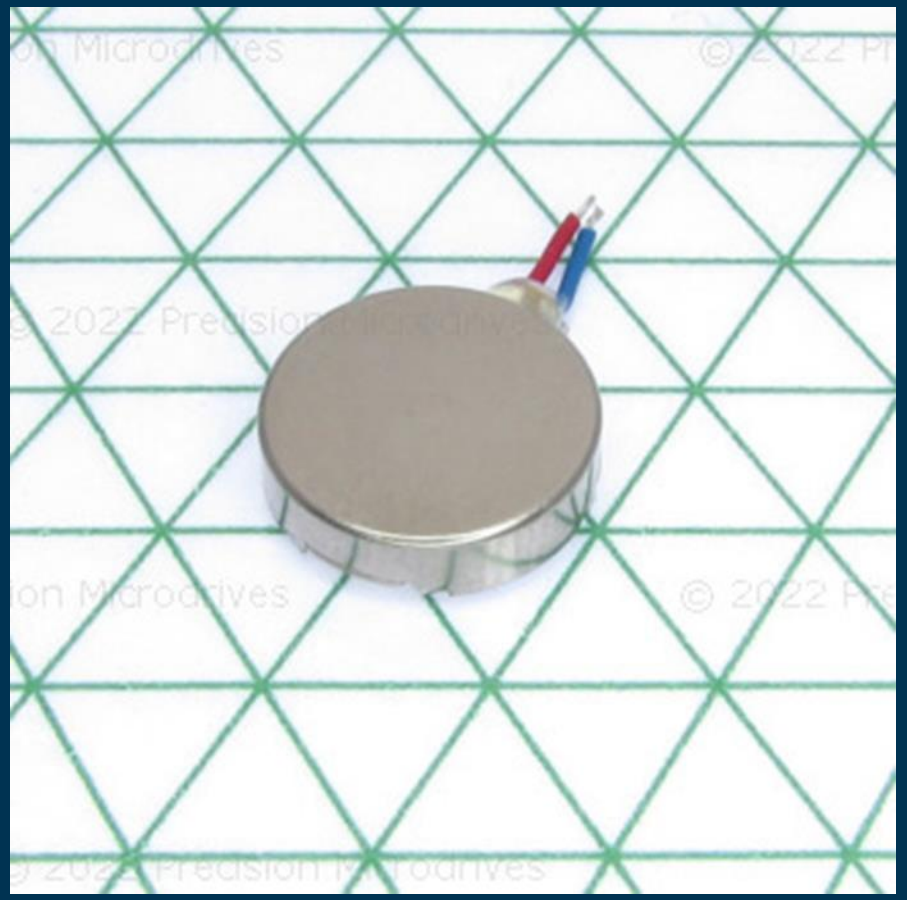
- Swarm based
- Collective behaviour concept
- Individual robot are simple in their capabilities
- Groupwise, they are capable of moving forward, rotating, communicating & measuring distance between each other

MOTION PRINCIPLE



- Individual based
- Vibrational motion
- Low cost locomotion
- One directional leg, slanted to cause a forward force when the motor above it is vibrating
- The forward force generated when a motor is vibrating which cause the chassis to rotate n move forward

HARDWARE COMPONENT



- Vibration motor
- 10mm Vibration Motor - 3mm Type
- Rated Operating Voltage: 3 V
- Rated Vibration Speed: 12,200 rpm [+/- 3,000]
- Typical Rated Operating Current: 58 mA
- Typical Norm. Amplitude : 1.3 G
- RM4.50