Hassan El Mehdi Boufares

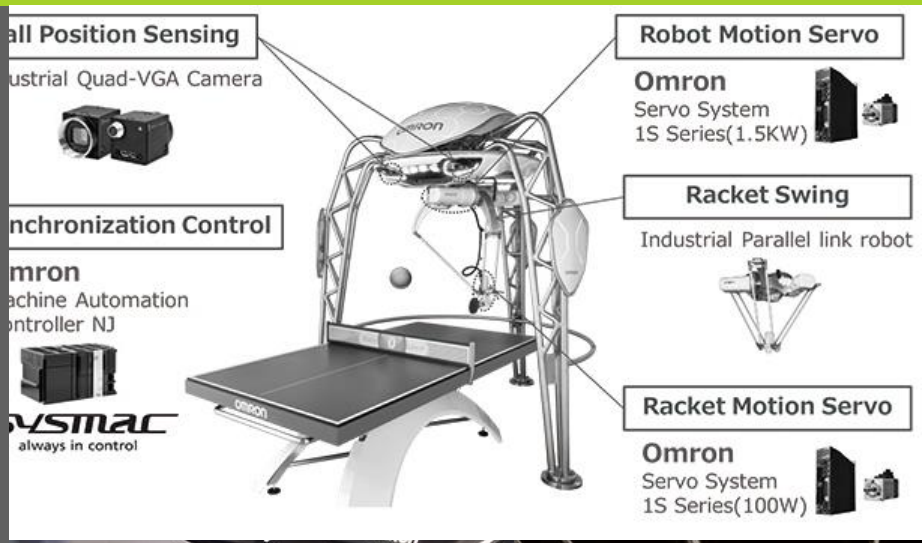
HARDWARE: LOCOMOTIONS & MECHANICAL DESIGN (2-ACTUATORS)

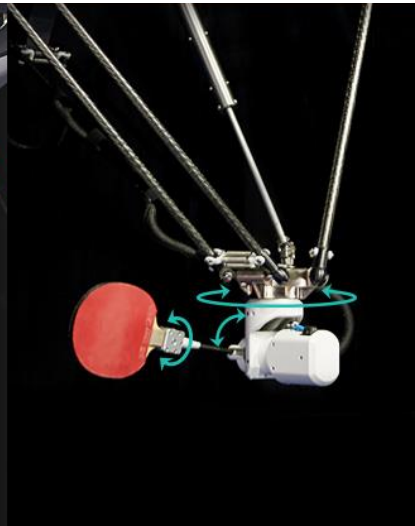
HARDWARE COMPONENTS THAT MOVE THE ROBOTS
I) BASIC MOTION PRINCIPLE
II)HARDWARE COMPONENTS (SPECIFICATION, BRANDS AND PRICE)

1) Stationary Robots
   a) Omron forpheus robot
2) Wheeled Robots & Tracked Robots
   a) Single wheel BB-8
   b) 4WD Omni-Directional Mobile Robot
   c) Wall Climbing Robot (Metal vs Wall vs Glass)
3) Legged
   a) Humanoid Robot (BIOLOID)
4) Swimming
   a) Fish robot
   b) Underwater glider robot
5) Others
   a) Kilobot

1) STATIONARY ROBOTS
A) OMRON FORPHEUS ROBOT

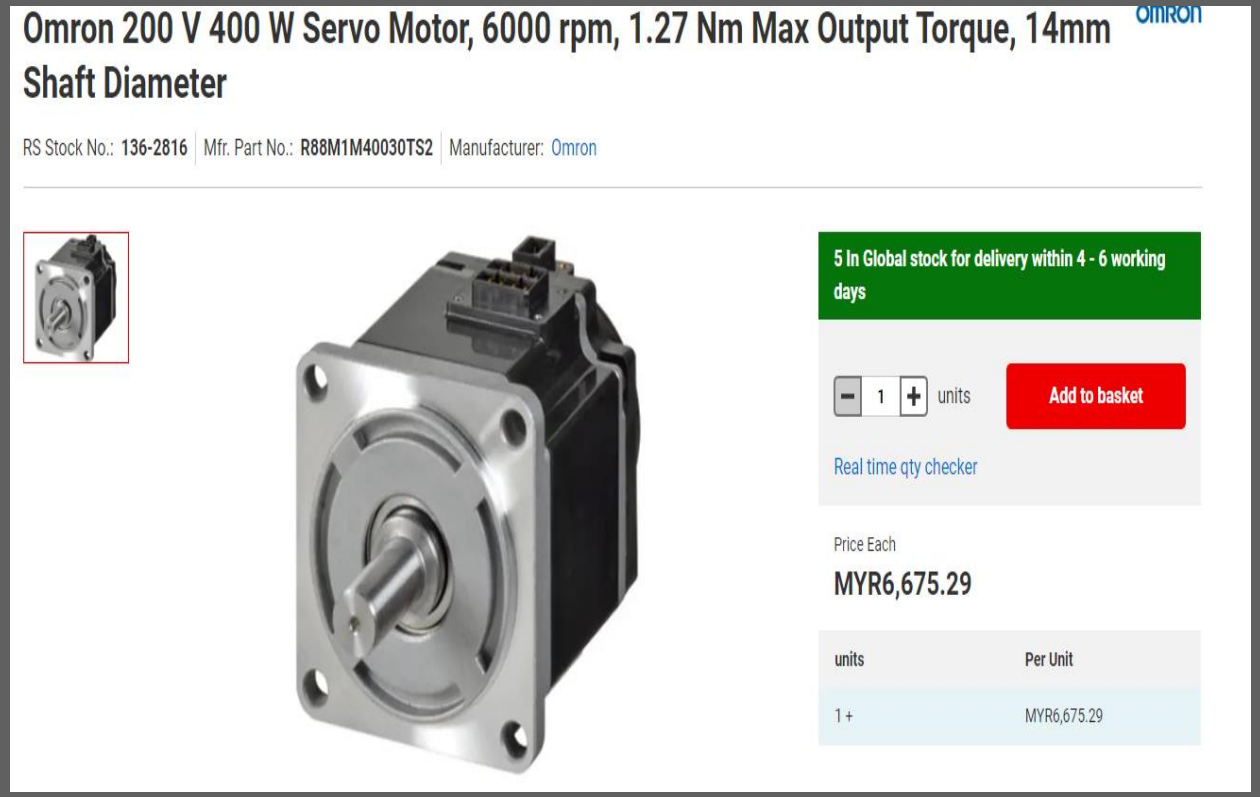
- The Omron Forpheus robot contains 6-axis that adapts based on the movement of the player's body and the ball's trajectory. Expecting the position of the ball and moves based on that.
- The motion system can be divided to two parts. An end effector that is made from 3 servo motors and a an omeron delta motion servo system.





1) STATIONARY ROBOTS
A) OMRON FORPHEUS ROBOT

- The end effector contains three 1S series servo motor.



1) STATIONARY ROBOTS
A) OMRON FORPHEUS ROBOT

- The three-axis delta robot. Is an industrial robot that are mostly used in food production.

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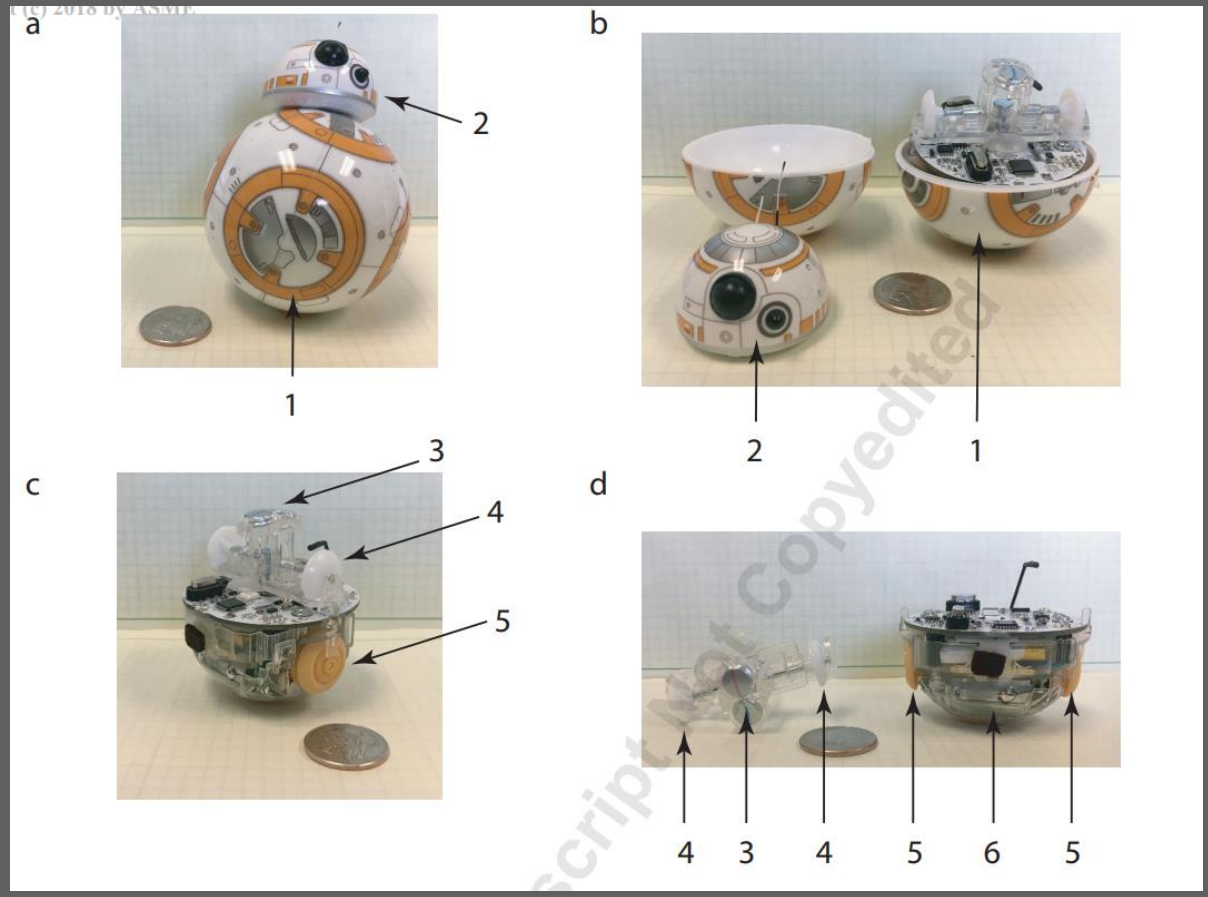
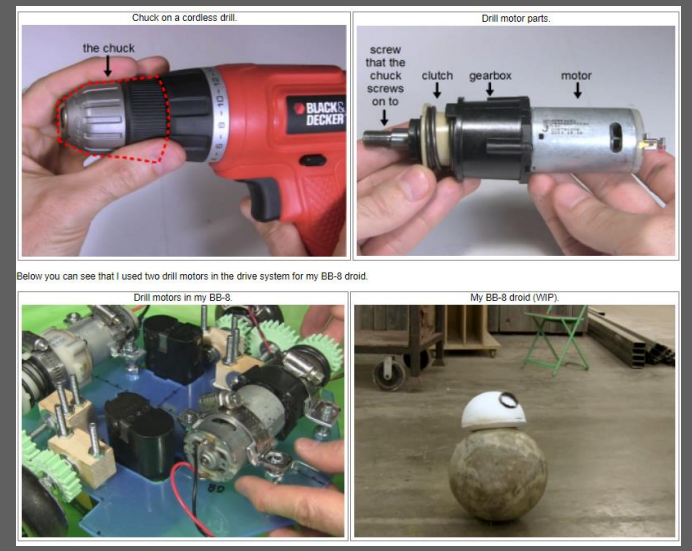
2) WHEELED ROBOTS & TRACKED ROBOTS
A) SINGLE WHEEL BB-8

- The robot in motion showing the spherical shell and the spherical cap. Deconstructed robot following cutting of the spherical shell into hemispheres and removal of cap. the inner mechanism of the robot showing one of the two wheels used to locomote the spherical shell and the pair of wheels used to help maintain contact. The pendular mechanism which actuates the spherical cap with the help of magnets is labelled. Image of the inner mechanism showing the pair of wheels used to locomote the spherical shell and the pendular mechanism. By way of scale, the coin in the images is a US quarter dollar. The induction coil used to charge the batteries for the rotors is located at the bottom of the inner mechanism and serves to help keep the center of mass of the robot below the geometric center of the spherical shell



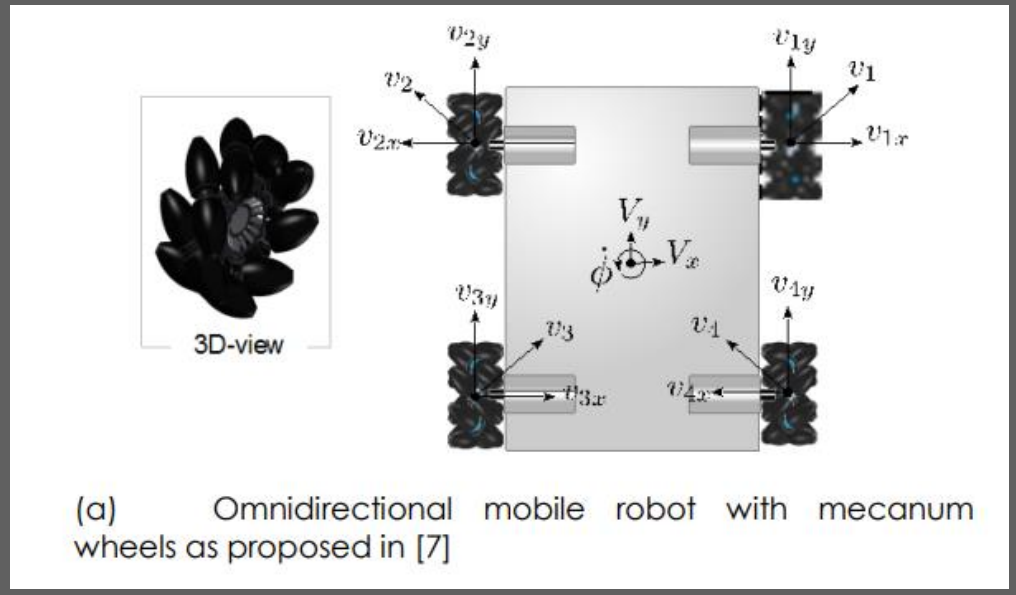
2) WHEELED ROBOTS & TRACKED ROBOTS
A) SINGLE WHEEL BB-8

- One of the designs have used drill's motors to move the robot.



2) WHEELED ROBOTS & TRACKED ROBOTS
B) 4WD OMNI-DIRECTIONAL MOBILE ROBOT

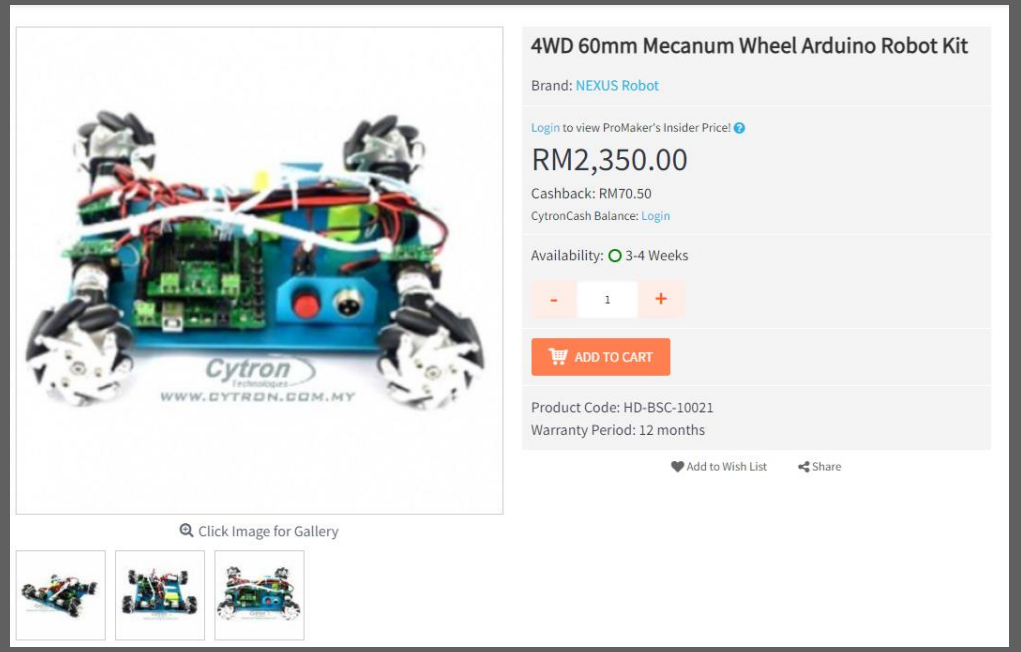
- The omnidirectional locomotion system can be classified into holonomic or nonholonomic systems. In general, a holonomic mobile robot is described as a mobile robot without any kinematic constraints. The holonomic mobile robots capable to move at any arbitrary direction with 3-DOFs capability without any kinematical restriction. Conversely, the nonholonomic mobile robots may have one or more kinematic constraints.



(a) Omnidirectional mobile robot with mecanum wheels as proposed in [7]

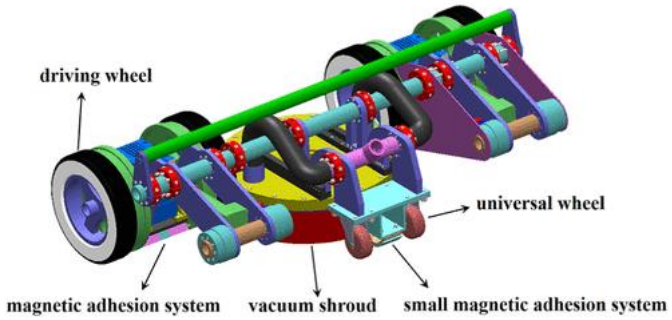
2) WHEELED ROBOTS & TRACKED ROBOTS
B) 4WD OMNI-DIRECTIONAL MOBILE ROBOT

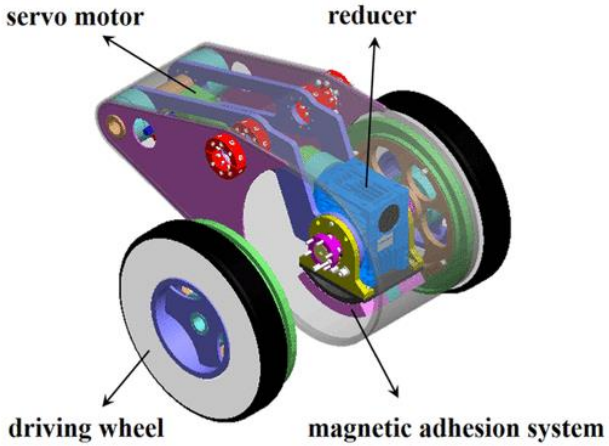
- 60mm Aluminum Mecanum wheels X 4
- 12V DC coreless motors X 4
- Arduino 328 controller X 1
- Arduino IO expansion X 1
- 12V Ni-Mh battery X1
- 12V charger X1



2) WHEELED ROBOTS & TRACKED ROBOTS
C) WALL CLIMBING ROBOT (METAL VS WALL VS GLASS)

- The water-jetting wall-climbing robot has two adhesion-locomotion systems of the same structure, which includes two wheels and a permanent magnetic adhesion system attached to the wheel support, distributed on both sides and two universal wheels amounted at the front. There is a small permanent magnetic adhesion system amounted between the universal wheels, which has function of avoiding overturning from the surface. And a vacuum shroud is mounted in the center of the robot and completes an enclosed environment-friendly cleaning process with the help of water-jet nozzles inside, which has a inclination angle of 15° and vacuum pump located on the ground. As demonstrated, two coaxial driving wheels are arranged outside and encloses a space containing servo motor, reducer, and magnetic adhesion system inside. This arrangement has a compact volume and is helpful to protect motor, reducer, and magnetic components from dust and collision.



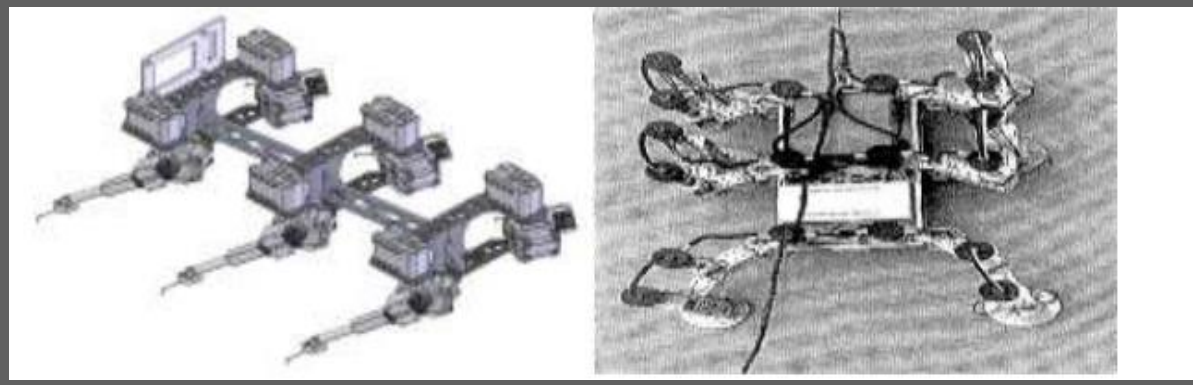


2) WHEELED ROBOTS & TRACKED ROBOTS C) WALL CLIMBING ROBOT (METAL VS WALL VS GLASS)

- The moving process of the robot can be described as follows, firstly the robot is attached to a wall by pushing of the crawler belts makes suction cups contact and attach to the wall at the front pulleys. Then the guide shafts slide into a guide rail as shown .When a suction cup reaches the rear pulley, it is detached from the wall by the rotation of the belts. A sequence of this progress makes the robot move on the wall to keep adhesion

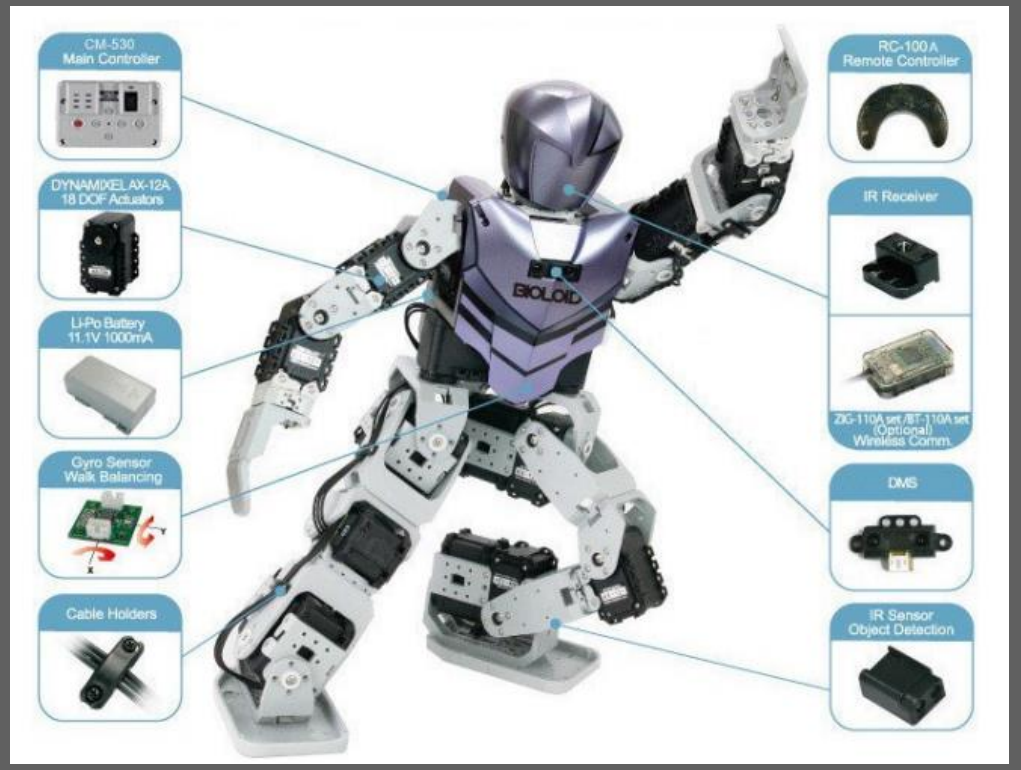
2) WHEELED ROBOTS & TRACKED ROBOTS C) WALL CLIMBING ROBOT (METAL VS WALL VS GLASS)

- The basic function of inspired climbing caterpillar include following aspects. The climbing caterpillar has to be safely attached to the slope with different material and has to overcome gravity. The mechanical structure for safe and reliable attachment to the vertical surface is needed. Now our research is focusing on the realization of new passive suckers which will save considerable power. Because of the unique vibrating adsorbing principle, the passive suckers can attach not only to glass, but also to a wall with maximum tiles.



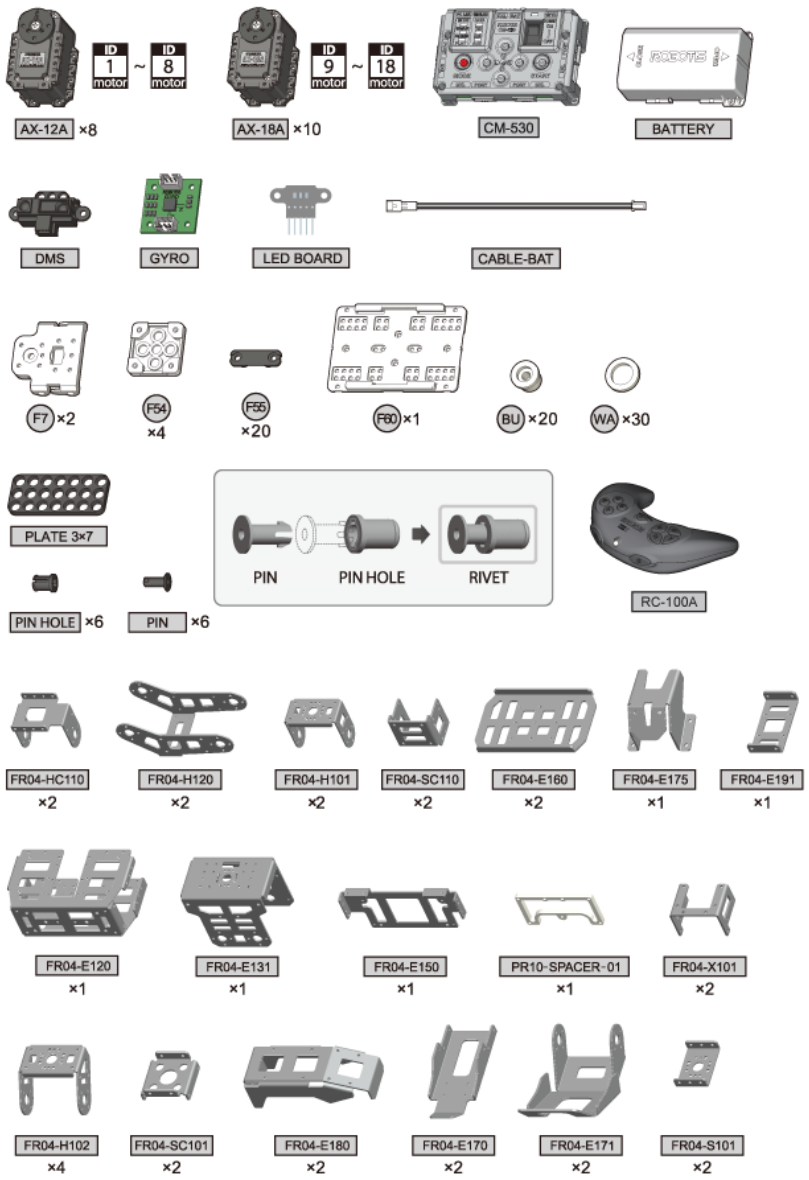
3) LEGGED
A) HUMANOID ROBOT (BIOLOID)

- As for the dynamic mode, where the servomotors are in motion, the trial will run either on single and multiple Dynamixel AX-12 servomotors. First, only one of 18 units of servomotors will be tested its power consumption and afterwards Bioloid robot will execute a motion, which is bow motion lasting for 20 seconds. During the bow motion, there are 3 motions are involved which are stand up position to bow motion and back to stand up position.



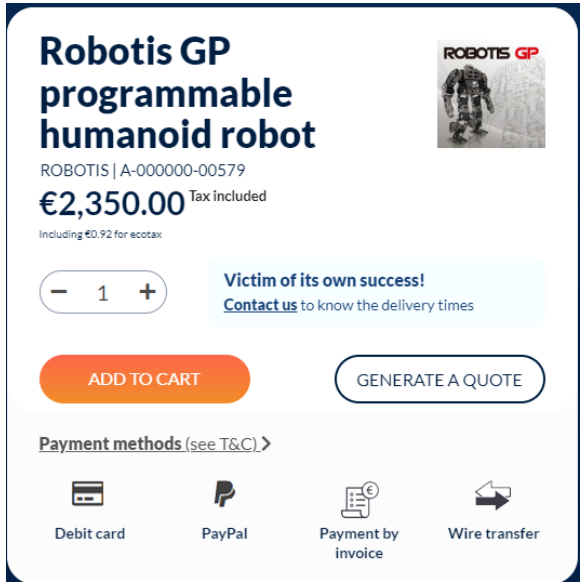
3) LEGGED
A) HUMANOID ROBOT (BIOLOID)

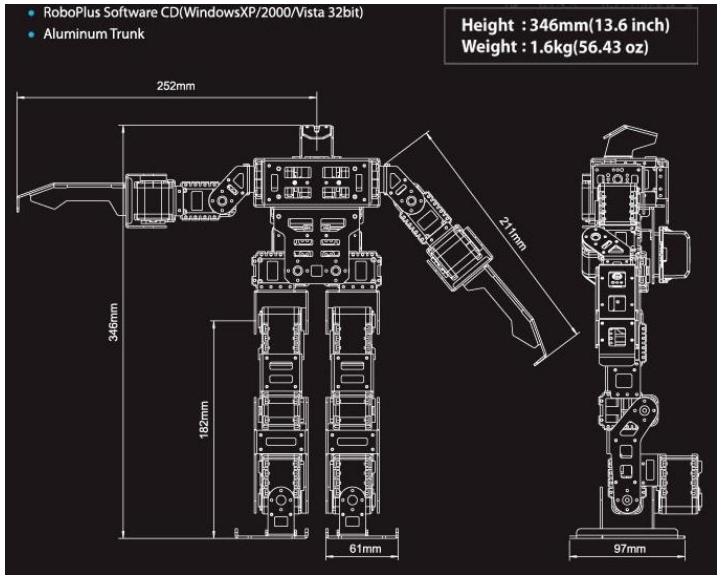
- The Bioloid GP programmable humanoid robot has 8 AX-12A Dynamixel servomotors to move its arms. It has two degrees of freedom in each shoulder, one in the elbow and you can choose to use the lasts motors in the grippers or to allow a waist twist. The AX-12A servomotors are the ones used in the whole Bioloid range.



3) LEGGED
A) HUMANOID ROBOT (BIOLOID)

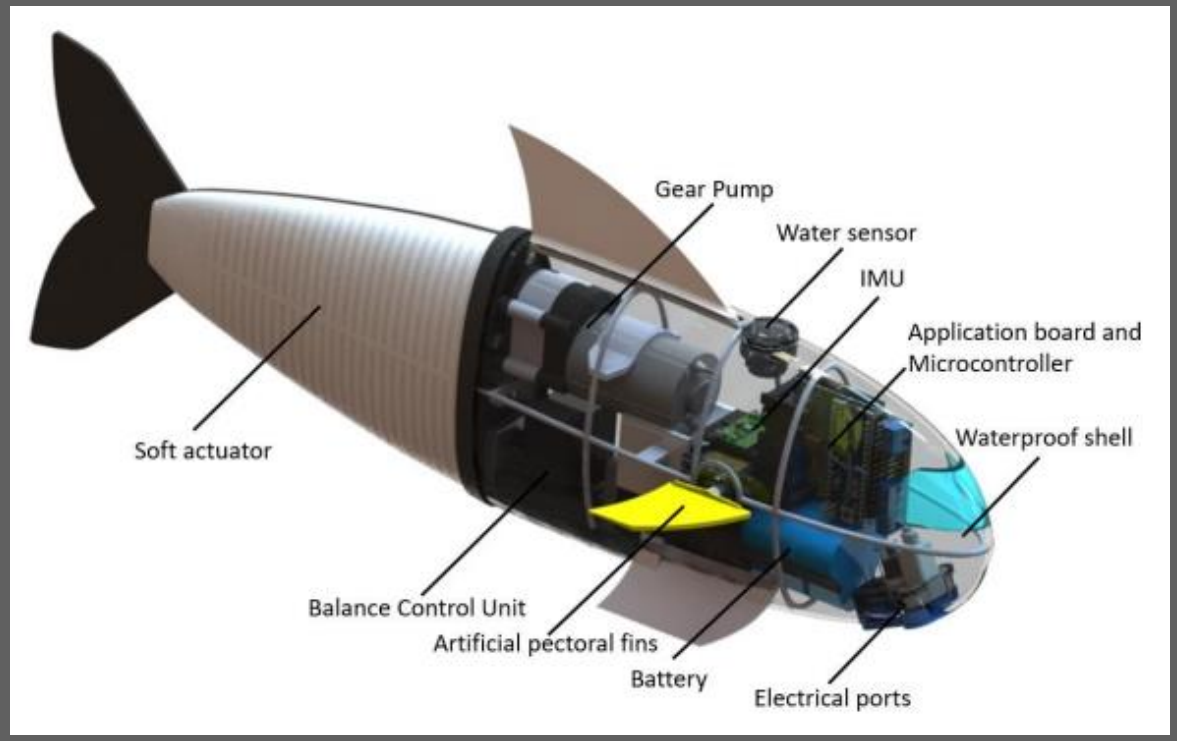
- The legs of the Bioloid GP programmable humanoid robot are actuated by AX-18A Dynamixel servomotors, that are bit bit more powerful and mainly quicker. The robot has 5 degrees of freedom in each leg, so 10 AX-18A Dynamixel servomotors in all.





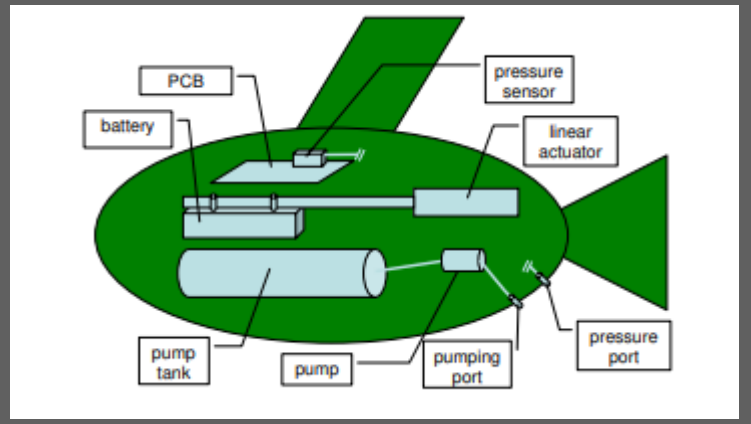
4) SWIMMING
A) FISH ROBOT

- The soft actuator functions by pressurising and depressurising the soft actuators with liquid by a gear pump, the fluidic channels within the actuator will be expanded and compressed, and the constrain layer will be bent as it is inextensible in length. By cycling the fluid between left and right actuators, they are pressurised and depressurised separately; the constrain layer will be bent in both directions. Through such a mechanism, the fishtailing behaviour can be imitated.



4) SWIMMING
B) UNDERWATER GLIDER ROBOT

- The fish-like miniature underwater glider as a rigid-body system, which has an external force and a moment exerted by an internal movable mass. This is a simplification with respect to the two-rigid-body system as in which is partly justified by the fact that, the dynamics of the movable mass actuated by a closed-loop controlled linear slider is very fast relative to the dynamics of the gliding body.



5) OTHERS
A) KILOBOT

- By maintaining communication with each other, Kilobots possess a virtual bearing sensor that gives each one a realistic sense of its position in the group. Instead of using hardware to achieve this, Kilobots make do with basic software and more advanced algorithms. Performing complex behaviors with as little hardware as possible encompasses the spirit of Kilobots.