LET'S DESIGN THE FUTURE TOGETHER

pepper

Génération ROBOTS

SoftBank Robotics
Pepper is a high performance robotic platform designed for a wide range of multimodal expressive gestures and behaviors, making it ideal for researchers and educators.

FOR RESEARCHERS

HRI, perception, cognition, navigation and localization are some of the fields that can be explored with Pepper.

Pepper was selected to become the standard platform for the RoboCup@Home league [http://www.robocupathome.org/]. A dozen of teams from all around the world will use Pepper’s set of skills and compete in the next two RoboCup events.

FOR EDUCATORS

Studying robotics-related fields with Pepper has already proven its relevance to educators with clear benefits for students. Using a robotic platform like Pepper:

- Enhances creative problem-solving techniques.
- Promotes active learning.
- Encourages a multidisciplinary approach.
20 degrees of freedom for natural movement and gestures.

A tablet to facilitate human-robot interactions.

Speech Synthesis and Speech–to-Text available in 12 languages*.

People Perception modules to recognize and track humans.

Various tactile areas, LEDs, sensors and microphones for multi-modal interactions.

Infrared sensors, bumpers, an inertial unit, 2D and 3D cameras and sonar sensors for omnidirectional navigating capability.

* Arabic, Chinese, Dutch, English, Finnish, French, German, Italian, Japanese, Korean, Spanish and Polish.
Pepper comes with all the foundational software required for researchers and educators.

**NAOqi OS**

Pepper -like the other SoftBank Robotics’ robots NAO & Romeo- runs on NAOqi OS, a Unix based proprietary OS. The NAOqi Framework provides a programming base to develop applications on the robot. It corresponds to common robotics needs including: parallelism, resources, synchronization, events, etc.

**Pepper is fully open and programmable.** Several SDKs are provided to control and develop with Pepper:

- C++
- Python
- Java
- Libqi C++ & Python
- Android
- ROS bridge

A dedicated Simulator SDK package is also provided to simulate with any 3D simulator. It includes libraries, data, assets and examples.

We offer API with:

- **Low level methods** enabling sensor reading and precise piloting of any motor;
- **High level methods** giving access to a list of services like automatic detection of humans, obstacles avoidance, vocal synthesis.

**CHOREGAPHE©**

Choregraphe is a graphical robotics programming software created by SoftBank Robotics, that allows developers to:

- Develop and package complete applications,
- Design animation in interactive mode, without the need to pilot the robot’s motors one by one,
- Design verbal interaction with QiChat, our human-robot dialogue design language.

Several tutorials are available on Choregraphe for a quick and effective understanding of the tool.

**DOCUMENTATION**

To assist users in their application development and research, several resources are available online at www.doc.aldebaran.com.
## FEATURES

### PHYSICAL CHARACTERISTICS

**CONSTRUCTION**

- Dimension: 1208.5 x 477.2 x 424 mm
- Weight: 28 kg
- Standby mode autonomy: 19 hours
- Intensive use autonomy: 12 hours

### BRAIN SYSTEM

**MOTHERBOARD**

- Processor: ATOM E3845
- CPU: Quad core
- Clock Speed: 1.91 GHz
- RAM: 4 GB DDR3
- Flash Memory: 32 GB eMMC (of which 24 GB available for users)
- GPU: Intel HD graphics up to 792 MHz

### HUMAN INTERACTION

**TABLET**

- Model: LG CNS Tablet
- Dimensions: 246 x 175 x 14.5 mm
- Bluetooth: 4.0

**VISION**

- 2D cameras: Location 1 in the mouth + 1 in the forehead
- Model: OV5640
- 3D Cameras: Location 1 in the eyes
- Model: ASUS XTION

**IR SENSORS**

- Number: 2
- Position: 1 on both sides
- Wavelength: 808 nm
- Range: 0 - 50 cm at 27 cm above the ground
- Angle: 2°

**AUDIO**

- Loudspeakers: Location 1 in each ear
  - Sensitivity: 78 dB 1w/1m @1kHz
  - Frequency response (-10 dB): 70 Hz / 7.2 kHz
- Microphone: Location 4 on the head
  - Sensitivity: 300 mV/Pa +/- 3dB at 1 kHz
  - Frequency range: 100 Hz - 10 kHz (1-10 dB relative to 1 kHz)

**LEDS**

- Eyes, ears and shoulders

### ENVIRONMENT SENSORS

**INERTIAL UNIT**

- 1 inertial unit composed of: 3-axis gyrometer with an angular speed of ~500°/s
- 3-axis accelerometer with an acceleration of ~2g

**POSITION SENSORS**

- MRE (Magnetic Rotary Encoder)
  - 30 using Hall effect sensor technology
  - Precision: 0.1°

**SONARS**

- Position: 1 in front and 1 at the back on the base
- Frequency: 42 kHz
- Sensitivity: -86 dB
- Resolution: 0.03 m
- Detection range: 0° - 5m depending on object type* Closer than 0.3m will range as 0.3m
- Effective cone: 60° depending on the object type

**LASERS**

- Number: 3 horizontal lasers: 1 in the front and 1 on both sides
- 3 others in the base front casing
- Class: 1M
- Wavelenght: 808 nm
- Mode of Operation: Pulsed
- Framerate: 6.25 Hz per laser
- Global shutter camera: Auto-exposure control
- Emission: 15 dots projected at 60°
- Detection range: 20 cm to 2.8 m at 3 cm above the ground

**CONNECTIVITY**

**WI-FI**

- 802.11 a/b/g/n

**SECURITY**

- 64/128 bit: WEP, WPA/WPA2

**ETHERNET**

- 1xRJ45 – 10/100/1000 base T

### ENERGY

**BATTERY**

- Type: Lithium-Ion
- Nominal Voltage: 26.66 V
- Battery robot protection: 22.5V-24.2 V [depending on temperature]
- Battery under voltage protection: 17.5 V
- Battery voltage lockout: 11.9 V
- Max. charge voltage: 29.4 V
- Max. charge current: 8 A
MOTION

POSITION OF MOTORS

- HeadYaw
- HeadPitch
- ShoulderPitch
- ShoulderRoll
- ElbowYaw
- ElbowRoll
- WristYaw
- Hand
- HipRoll
- HipPitch
- KneePitch
- WheelB
- WheelFR
- WheelFL

MOTORS POWER

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motion speed</td>
<td>Up to 2 km/h</td>
</tr>
<tr>
<td>Climbing</td>
<td>Up to 1,5 cm</td>
</tr>
<tr>
<td>Max. slope</td>
<td>5°</td>
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</tbody>
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Génération ROBOTS

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