NAO⁶

CATALOG

SoftBank Robotics

ROBOPRENEUR
EMPOWERING INNOVATION

About Robopreneur Sdn Bhd

ROBOPRENEUR aims to be the pioneer in service robotics development, prototyping, manufacturing & solutions providers based on customized user's requirements. Our key sectors include academic & research, healthcare, business and services industry applications. ROBOPRENEUR core values covering R&D and prototyping of customized service robotics, Artificial Intelligent solutions, Additive Manufacturing (3D printing & services), and digital media solutions.

For more information :
www.robopreneur.com

Contact :   sales@robopreneur.com
               +603 2726 2476

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The 6th Generation of Humanoid Robot NAO

Attractive programmable platform: create a unique human-robot interaction experience and leverage it to a new level

COMPUTING
CPU ATOM E3845
Quad core 1.91 GHz
4 GB DDR3 RAM
32 GB SSD

DETECTION
Two 5-megapixels cameras

CONNECTIVITY
Bluetooth – Ethernet - Wi-Fi

● **SPEECH RECOGNITION**
More than 20 Languages

● **FALL MANAGER**
Detects falls & trigger the protection

● **FALL RECOVERY**
Able to stand up alone

ACOUSTIC
4 omnidirectional microphones
2 loudspeakers

EXPLORATION
4 sonars to detect obstacles

GRACEFUL BODY MOVEMENTS
25 degrees of freedom

ADAPTIVE WALK
8x Force Sensitive Resistors

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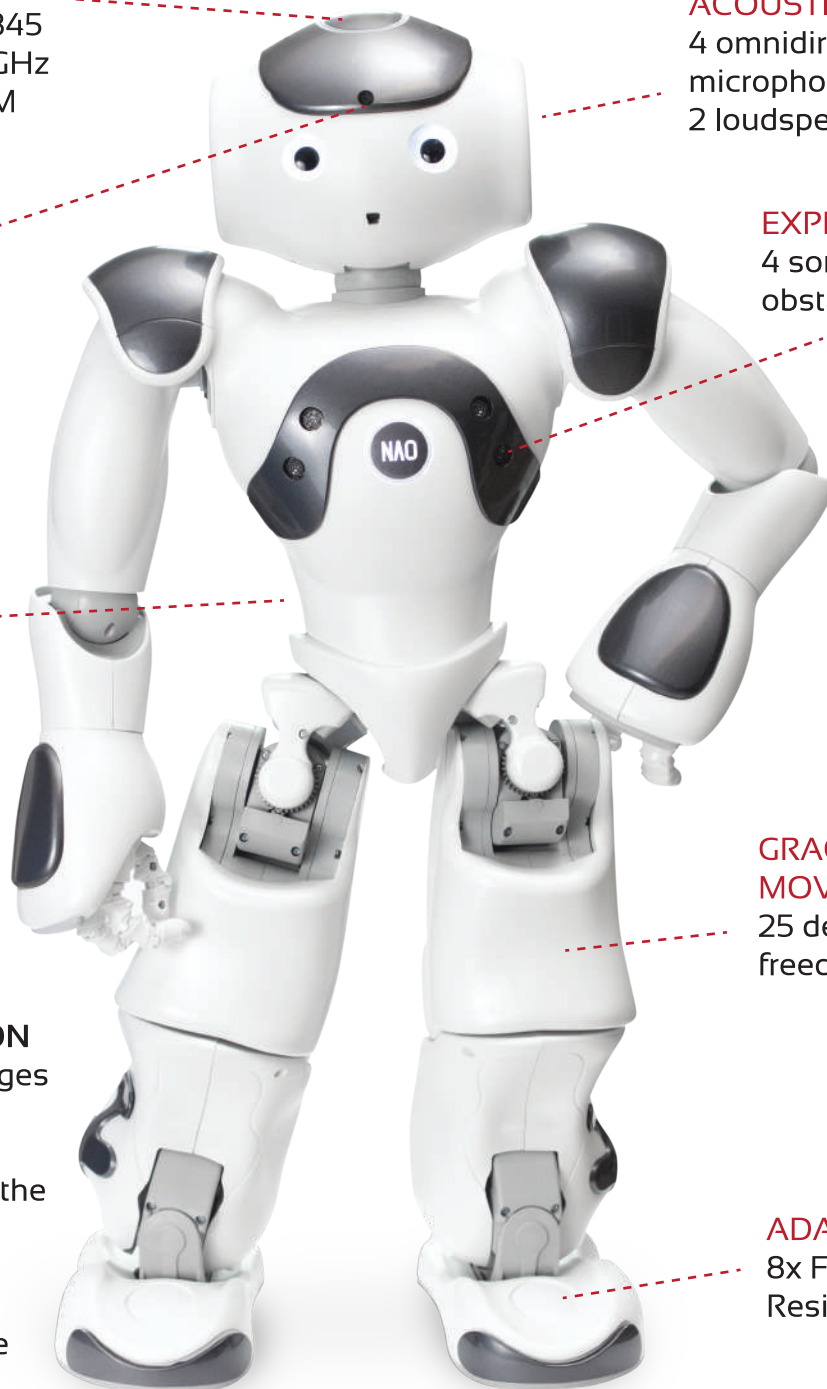
6 Major Areas of Hardware Improvement

A continuous augmentation of robot performance:
enriched package for a greater product

1 - POWER
CPU – ATOM Z530 -> E3845
Memory: 8GB SDCard -> 32GB SSD

2 - VISION
Camera – Aptina MT114 1.3Mpix -> Omnivision 5640 5Mpix

3 – AUDIO
Cardioid mic -> Omnidirectional mic +
Audio codec

4 – MOTION
Motors - PortEscape 16 GT -> PortEscape 16 GT MP

5 – ROBUSTNESS
Finger - Robustness Improvement

6 – CONNECTIVITY
Bluetooth
New Wi-Fi
Better Ethernet

1 - POWER
NAO6 benefits from the progress made on Pepper which makes it more powerful.

2 - VISION
With its new cameras, NAO6 better detects people. Dual stream of the top and bottom cameras is now supported.

3 - AUDIO
NAO6 hears and understands a lot better making dialog a full part of the interactions.
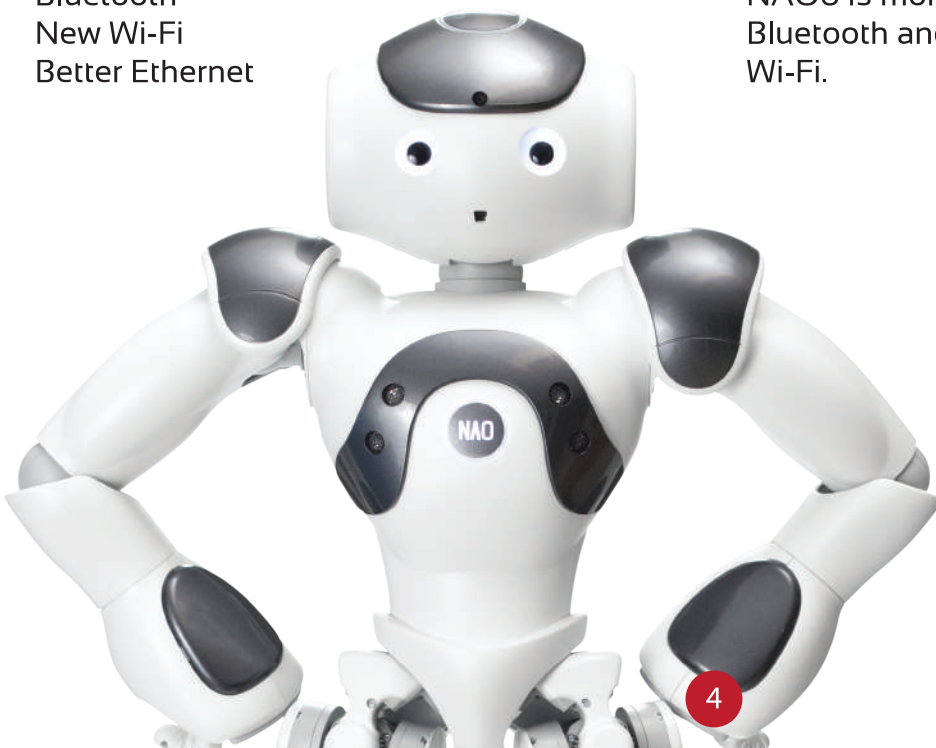
4 - MOTION
Thanks to its new motors, NAO6 can move longer without overheating.

5 - ROBUSTNESS
NAO6 benefits from many robustness improvements on motors and fingers providing an extended lifetime.

6 - CONNECTIVITY
NAO6 is more connected than ever with Bluetooth and a more efficient and faster Wi-Fi.
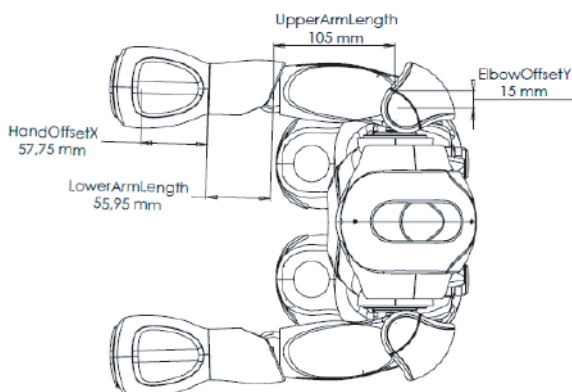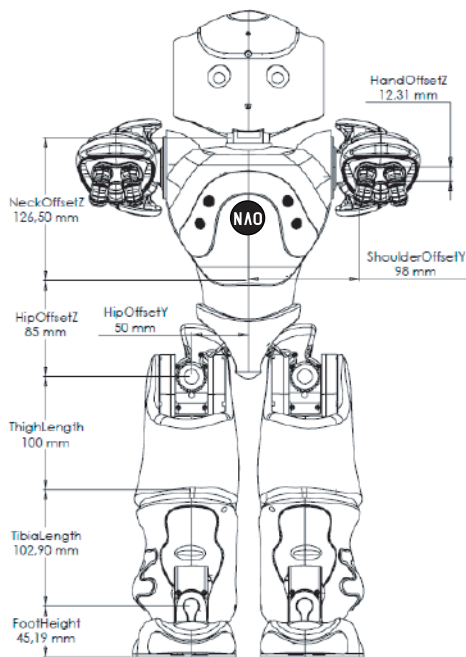
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Technical Features

GENERAL

Size (HxDxW)	574x311x275 mm / 22.6x12.2x10.8 in
Weight	5.48 kg / 12.08 lb

BRAIN SYSTEM

MOTHER BOARD

CPU	CPU processor	ATOM E3845
	Cache memory	2 MB
	Clock speed	1.91 GHz
RAM	4GB DDR3	
Flash memory	32GB eMMC	

HUMAN INTERACTION

LANGUAGES

Text to speech & Automatic speech Recognition	Czech, Danish, Dutch, English, Finnish, French, German, Italian, Japanese, Greek, Polish, European Portuguese, Brazilian Portuguese, Spanish, Swedish, Russian, Turkish, Arabic, Brazilian, Standard Mandarin, Taiwanese Mandarin, Norwegian.

AUDIO

Loud Speakers	Left & Right	
	Diameter	40 mm
	Impedance	4Ω
	Audio power	87 dB +/- 3dB
	Freq range	up to ~20 kHz
	Input	2 W
Microphones	×4 omnidirectional on the head	
	Sensitivity	-12dBV/PA @1kHz
	Frequency range	100HZ to 10KHZ

LEDS

Placement	Quantity	Description
Tactile Head	12	16 White levels
Eyes	2×8	RGB FullColor
Ears	2×10	16 Blue levels
Chest button	1	RGB FullColor
Feet	2×1	RGB FullColor

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Technical Features

CONNECTION

Ethernet	1×RJ45 - 10/100/1000 BASE T
WIFI	IEEE 802.11a/b/g/n
WPAN IEEE 802.15.1 (Bluetooth)	4.0 (LE)

SOFTWARE

Open Nao	Embedded GNU/Linux Distribution based on Gentoo
Architecture	86
Programming	Embedded: C++ / Python Remote: Java

Main Hardware Improvements

	NAO	NAO V6
Motherboard	ATOM Z530 1.6 GHz CPU Bi core 1 GB RAM 2 GB Flash memory + 8 GB Micro SDHC	ATOM E3845 1.91 GHz CPU Quad core 4 GB DDR3 RAM 32 GB SSD
Camera	Field of view : 72.6°DFOV (60.9°HFOV,47.6°VFOV) Focus range: 30cm ~ infinity Focus type : Fixed focus	Field of view : 68.2°DFOV (57.2°HFOV,44.3°VFOV) Focus range : 30cm ~ infinity Focus type : Autofocus
Audio	Cardioid microphones (-12dB) Loudspeakers: Foxconn Amato	Omnidirectional microphones (-12dB) + Audio codec Loudspeakers: Seltech 40S19 custom
Motor		New motors with a lifetime improvement
Color	Red, blue, light grey	Dark grey

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Value Proposition & Benefits

EDUCATION

Educational robot: Improve knowledge dissemination, augment student engagement & broaden window for future talents

- OPTIMIZED TEACHING-AID TOOL
  New & innovative pedagogical topics -sharpen concentration & focus

  Tailored and flexible teaching programs - motivate STEM subjects & encourage creativity (eg: Open Roberta)

  Enable remoted education - virtual presence & distance learning

- EFFICIENT SOLUTION TO INCLUSIVE EDUCATION

  Promote inclusivity – engage special education e.g. autism* & students with disabilities

  Barrier-free communication (Reduce shyness, reluctance, confidence and frustration*)

  Various ready-to-use applications are available by our partners – accessible & upgradable

- ADVANCED DEVELOPMENT PLATFORM

  Innovative platform allows development from simple concepts to complex algorithms

  Visual & intuitive programming interface Problem solving & analytical skills development

CONSUMER FACING ENVIRONMENT

- SINGLE VIEW OF CUSTOMER

  A powerful touch point to omnichannel; A single but comprehensive view of each individual customer

- MARKETING & ENGAGEMENT

  Interact with customers using relevant messages & offers
  Treated them specially, personally and individually

- COMMERCE & SERVICES

  Guide and assist the customers to sell the product or improve awareness by providing services, based on their needs & requirements

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Value Proposition
& Benefits

HEALTHCARE

● **HEALTHCARE ADVOCACY**

Ambassador to arise public awareness on prevention care

Unique and optimized patient experience for better engagement

Interactive & intellectual interface for patient adherence enhancement

● **INVESTMENT VALORIZATION: RAAS (Robot As A Service)**

The differentiator – a distinctive & attractive digital offer

Scalable platform to expand business with other value-chain players

Service-orientated models to realise monetisation of value

● **INTERGRATED CARE CONTRIBUTOR**

Integrated & connected solution to expand more value-based care

Remote-monitoring capabilities to expand reach of care-giving

A learning & training tool to develop patient's functional ability & intrinsic capacity

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NAO v6 vs. NAO Evolution

	NAO	NAO V6	NAO V6 PERFORMANCE *
Boot time	131.7 s	51 s	~3x faster
System upgrade time	22' min	4'24" min	~5x faster
Ethernet performance	Download 162 Mbit/s Upload 138 Mbit/s	Download 657.54 Mbit/s Upload 652.01 Mbit/s	~4x faster ~4x faster
Wi-Fi performance	Download 13 Mbit/s Upload 15.5 Mbit/s	Download 124.45 Mbit/s Upload 83.90 Mbit/s	~10x faster ~5x faster
Disk memory	Read speed 4.6 MB/s Write speed 1.9 MB/s Effective user dedicated space 15 GB	Read speed 73 MB/s Write speed 67 MB/s Effective user dedicated space 23 GB	~16x faster ~35x faster ~2x better
CPU	Effective user dedicated CPU 33%	Effective user dedicated CPU 58%	~2x more effective
RAM	Effective user dedicated RAM 600 MB	Effective user dedicated RAM 2.8 GB	~5x more effective
Fan Noise @ 1m (100% / 60%)	40,7 dB(a) / 38,8 dB(a)	50 dB(a) / 36 dB(a)	Better cooling performance
Worst case CPU temp (fan 100%)	84°C	74°C	Better cooling performance
WER in quiet environment : ⊠ ambient 50dB / voice 70dB	90%	10%	~9x understanding
WER in public environment : ⊠ ambient 73dB / voice 76dB	80%	30%	~2.5x understanding
Speaker volume	80dB(c)	89dB(c)	~2x louder
Microphone saturation (from speakers in %)	N/A	74 %	Allow Acoustic Echo Cancellation
Camera resolution	Top : 1280 x 960 @ 5fps Bottom : 1280 x 960 @ 5fps	Top : 2560x1920 @15fps Bottom : 1280x960 @ 15fps	~2x on Top camera / similar on bottom
Dual Mode Camera	Not stable	Yes	New feature
Camera Auto-focus	Not available	Yes	New feature

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