



FIX All on AI
Future Innovation tech eXpo Conference 2025

Opportunity or Overhyped Trend for Automotive Suppliers?

Ender Nadir
Senior Director



Your engineering and consulting partner – strong, competent and reliable

GLOBAL REACH –
ONE FACE TO THE CUSTOMER

7,000

Employees
globally

~740 M€

Total output
(2024)

>250

Test cells for batteries
& fuel cells, e-drives,
T/M and engines

200

Patent applications
per year

70%

Academics

>45

Years of experience

>45

Subsidiaries on
five continents

>50

Different nations



We are the innovation powerhouse for mobility, energy and software that fosters sustainability and a greater quality of life for all

BUSINESS AREAS



- › Chassis
- › Cab
 - Body in White
 - Ext. & Interior
 - Lighting
- › Architecture
- › Performance
- › NVH
- › Integration



- › System Eng
- › FUSA
- › Cyber Security
- › ADAS / AD
- › Connected Mob.
- › Infotainment
- › SW & E/E platform.



- › ICE
 - Gasoline
 - Diesel
 - Gas
 - H2
- › Gearbox & Axles
- › Battery
- › EDU & e-Axle
- › Inverter
- › Fuel Cell



- › Fuel Cell / H2 (direct burn)
- › Battery (dev. & testing)
- › SAF
- › HV systems
- › SW Solutions
- › Cyber Security
- › MBSE



- › Energy plants
 - Wind
 - Solar
 - H2
- › Energy storage



- › Market studies
- › Benchmarks
- › Roadmaps
- › Concept studies
- › Modularization
- › Sourcing strategy
- › Cost reductions
- › Value chain opt.

We offer techno-strategic consulting and advisory services to the automotive, energy, and other high-tech driven industries



**Smart
Mobility**



**Powertrain
systems**



**Next Gen
R&D**



Energy



Sustainability



**Advanced
Robotics**

Our key solutions

- ▶ Intelligence & Foresight
- ▶ Benchmarking
- ▶ Business Strategies
- ▶ Technology Strategies
- ▶ Cost & Value Management
- ▶ Industrialization

From visionary ideas to industrial excellence, our services cover every stage of your product's journey

OUR KEY SOLUTIONS



Intelligence & Foresight

- › Regulation
- › Market Forecasting
- › Roadmapping
- › Competitor Analysis



Benchmarking

- › Design Benchmarking
- › Cost Benchmarking
- › Benchmarking Academy
- › Innovation Lab



Business Strategies

- › Mergers & Acquisitions
- › Innovation Management
- › Business Models
- › Techno-Economic Analysis
- › Market Entry Strategies



Technology Strategies

- › Portfolio Strategies
- › Modular Platforms
- › Concept Studies
- › Feasibility Studies
- › Powertrain Forecasting



Cost & Value Management

- › Target Costing
- › Cost Engineering
- › Cost Reduction
- › Design to Value



Industrialization

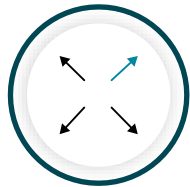
- › Strategic Procurement
- › Supply Chain Management
- › Advanced Manufacturing
- › Quality management

Unlike traditional robots, humanoids offer flexibility and adaptability in unstructured environments

TRADITIONAL ROBOTS VS. HUMANOIDS

 Traditional robots		 Humanoids
Mostly stationary	Mobility	Multiple degrees of freedom
Task-specific	Task flexibility	General-purpose
Pre-programmed	Control	AI-driven with adaptive learning
Minimal or indirect	Interactivity	Designed for direct human interaction
Operate in isolated environments	Safety measures	Designed for safe human-robot collaboration

Key humanoid advantages



Task flexibility



Low implementation barriers



Human interaction



Decision making

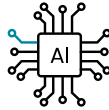


The humanoid robot market is rapidly developing due to falling component costs & advancements in AI

TRENDS AND DRIVERS – HUMANOID ROBOTS



Falling component costs



Advancements in AI & sensors



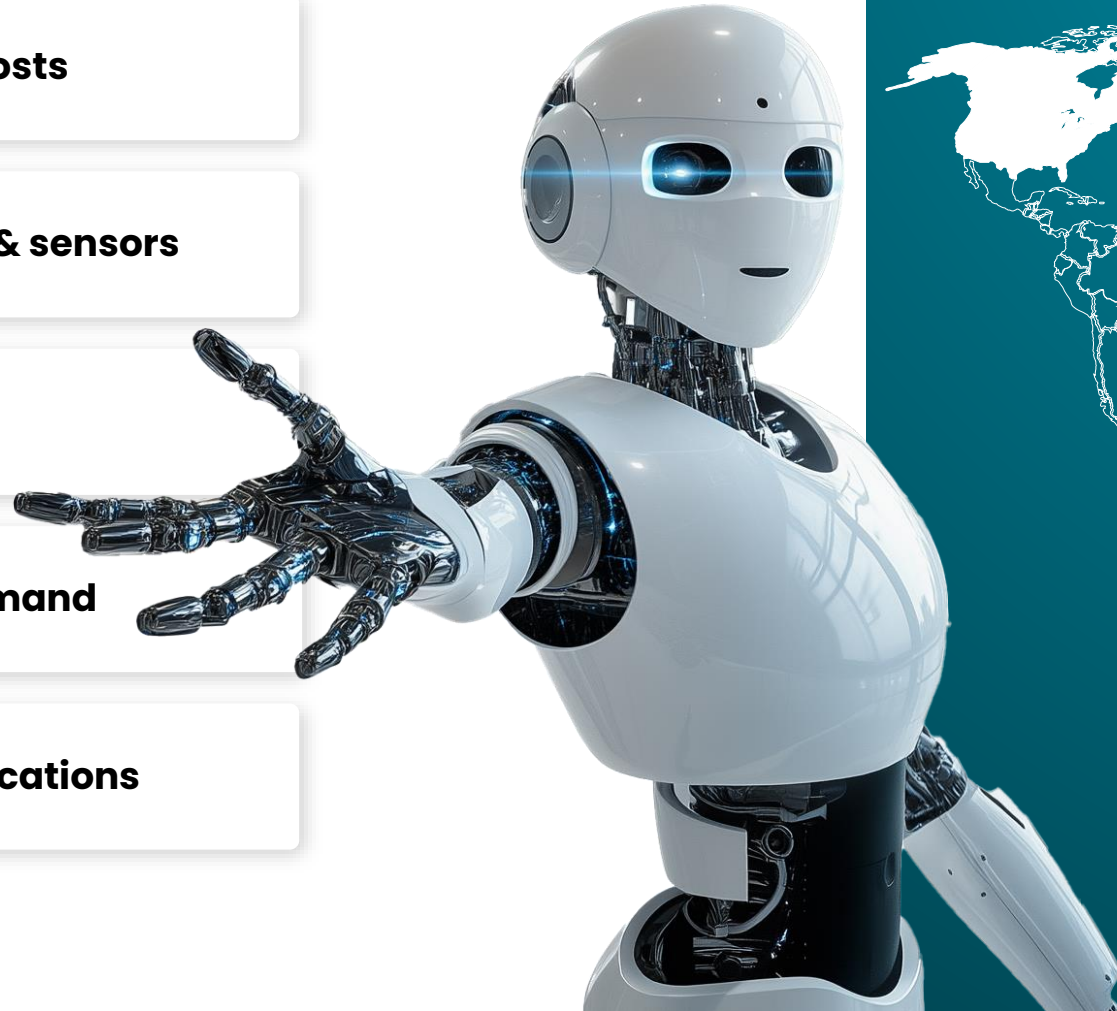
Labor shortages



High automation demand



Cross-industry applications



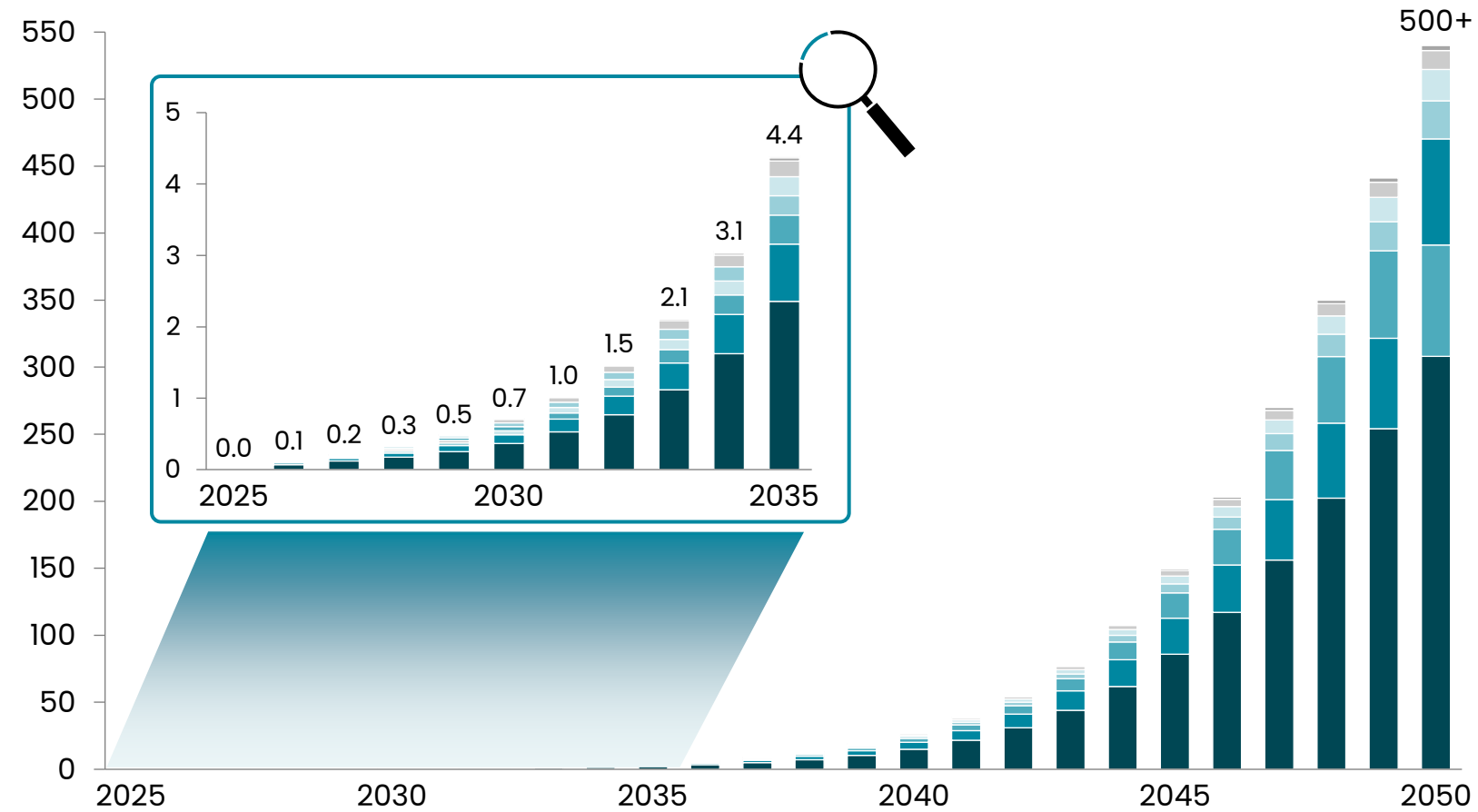
Leading humanoid robotics OEMs are clustered in North America, Europe & China    

Over 500 million humanoid robots will be operating in 2050 with rapid growth after 2040; early adoption driven by mfg., retail & service and households

FEV HUMANOID ROBOT FORECAST

Q3/2025 Forecast

Millions of humanoid robots in operation



Legend

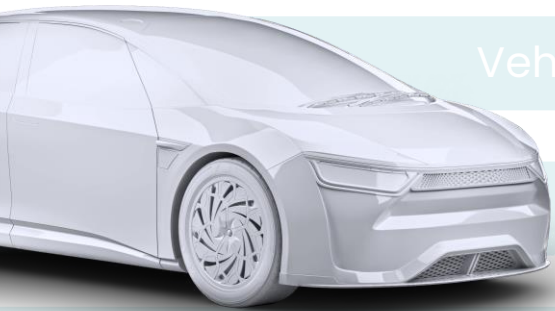
- Military
- Mining & Quarrying
- Warehousing
- Health & Social Care
- Construction
- Agriculture
- Manufacturing
- Retail & Consumer Services
- Household

Comments

- Modest adoption pre-2035
- Growth driven by available employment basis
- Human-to-humanoid replacement ratio affects use case share
- Focus on wheeled & biped humanoids

Humanoids & software-defined electric vehicles are both highly engineered systems that present opportunities for automotive HW & SW suppliers

SOFTWARE DEFINED ELECTRIC VEHICLE VS. HUMANOID ROBOT



Vehicle software platform¹⁾

Perception sensors

Actuation systems (e.g., EDU)

Energy & power management

Vehicle platform & body structures

Compute, electrical & wiring

Infotainment & user interface

How can
automotive
suppliers
bridge this
gap?



End-effectors

Software stack

Sensing systems

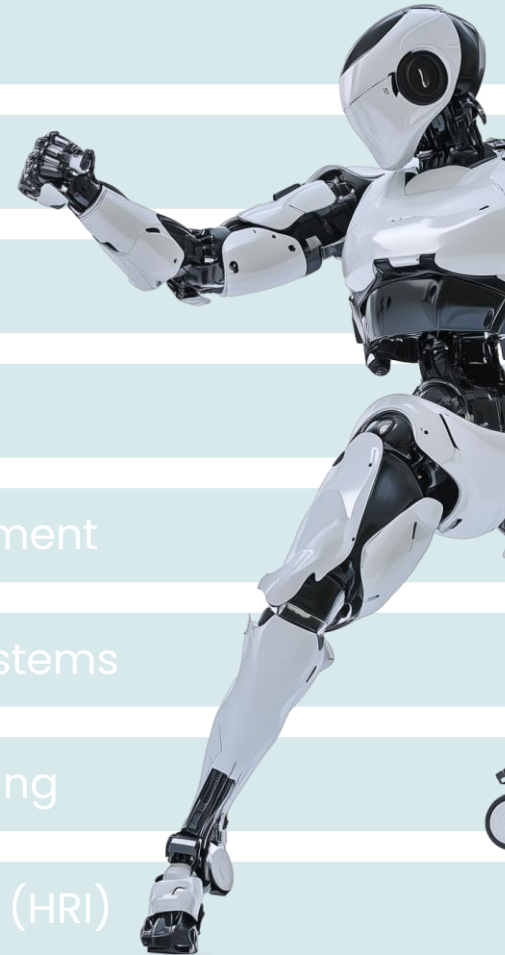
Actuators

Energy & power management

Structural & kinematic systems

Compute, electrical & wiring

Human-robot interaction (HRI)

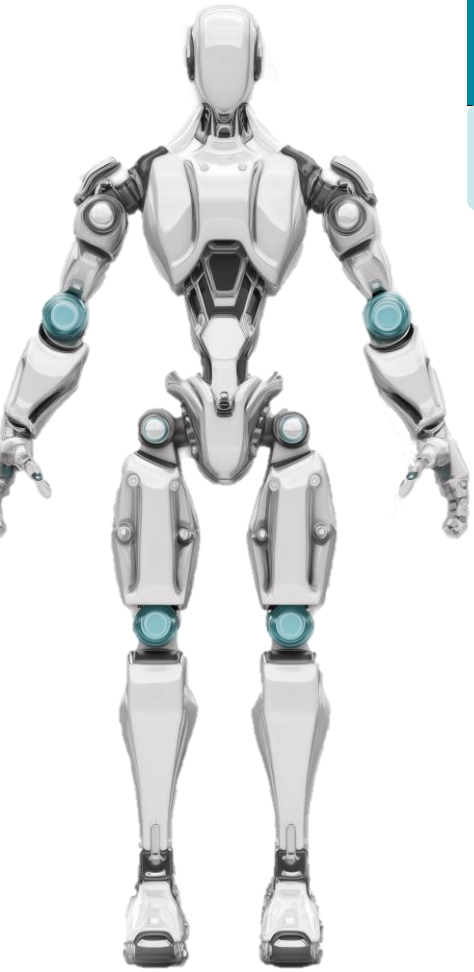


¹⁾ ADAS/AD software, cloud connectivity, cybersecurity software
Source: FEV

Humanoid robots can be decomposed into seven functional regions with over 140 components across all sub-systems

HUMANOID ROBOT DECOMPOSITION

► Illustrative



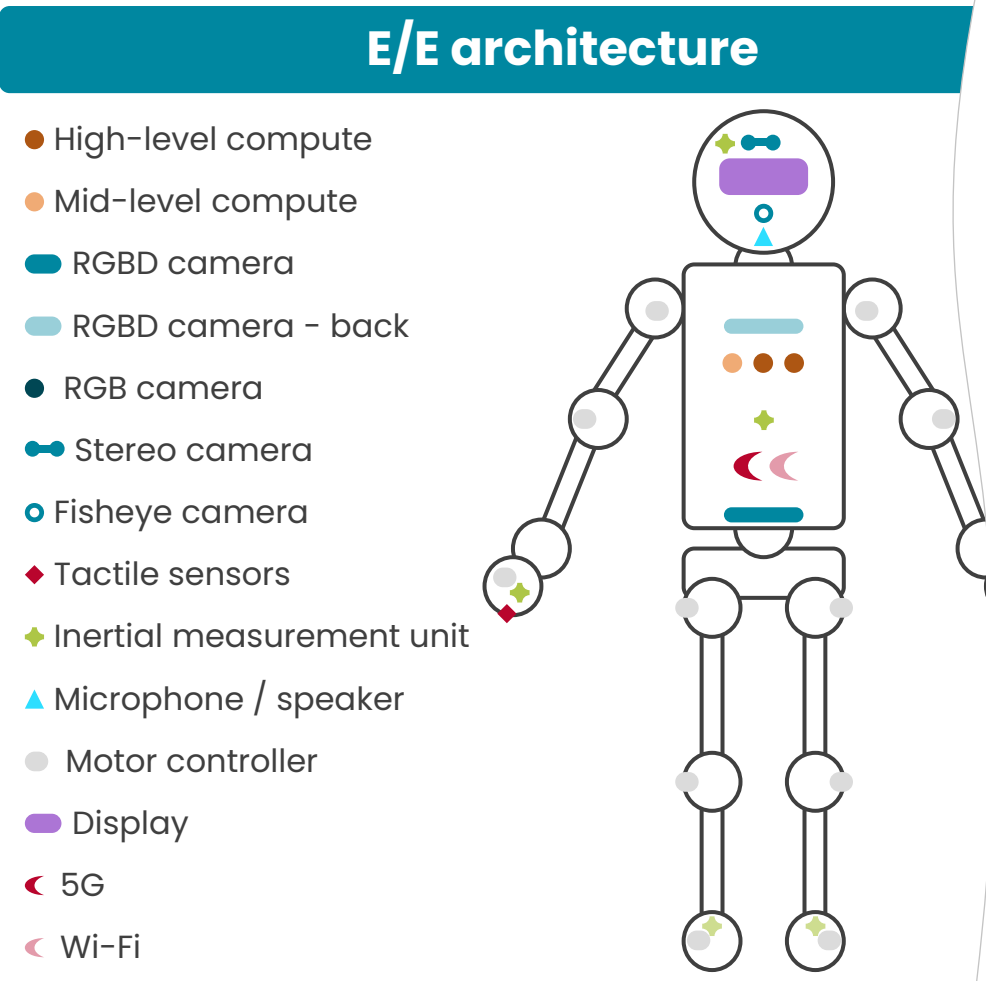
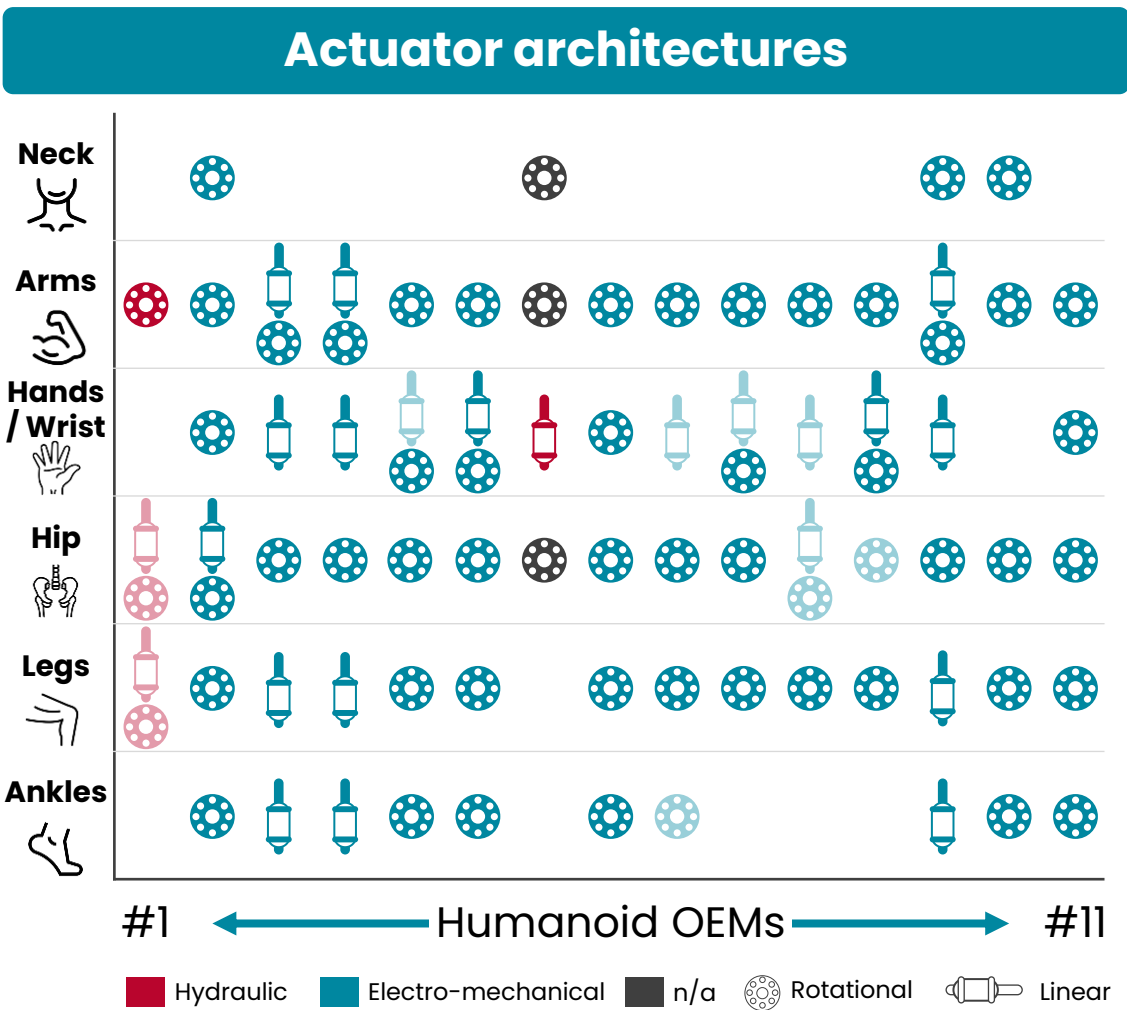
Functional region	Sub-system	Component
Head	Vision sensors	RGB camera
		Depth camera: stereo
		Depth camera: time-of-flight
		LiDAR
		Radar
Arms	Orientation sensors	Ultrasonic sensor
Torso		Inertial measurement unit
Hands	Thermal management	Fan
		Heat sink
		Cooling plates
Lower body	Sound sensor	Microphones
	Sound system	Speakers
Joints	Structure	Head skeleton
Wiring Harness	Information indication	Display
	Communication equipment	LEDs

Note: Exemplary components are being shown for each sub-system
Source: FEV

Electro-mechanical rotary actuators dominate the humanoid robot BOM, while OEMs continue to iterate their sensor strategies within the EEA

HUMANOID HARDWARE TECHNOLOGY MAPS

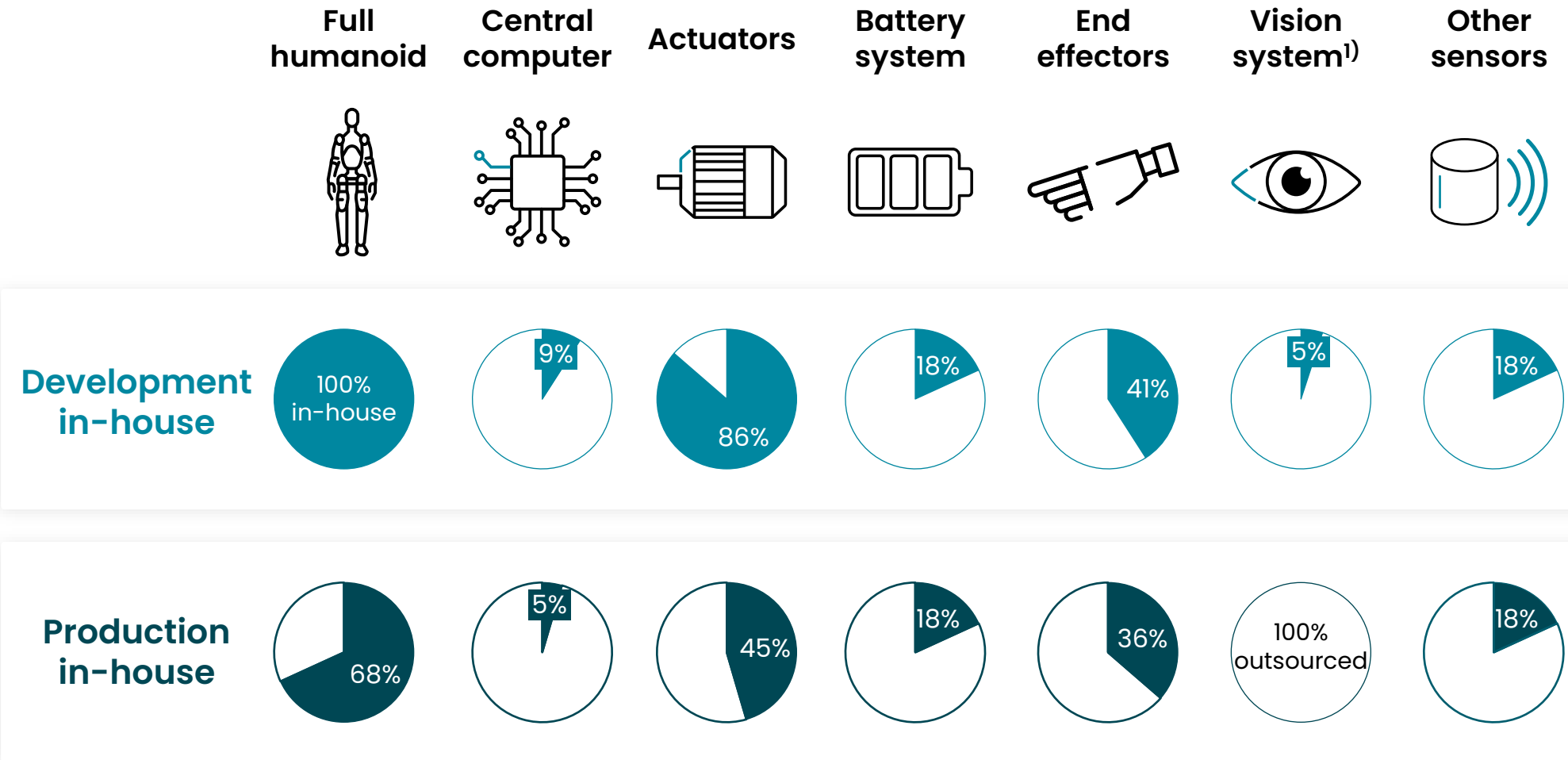
Illustrative



Humanoid robot manufacturers utilize varying strategies of insourcing and outsourcing, creating opportunities for new suppliers to enter the market

HUMANOID OEM DEVELOPMENT & PRODUCTION STRATEGIES

Based on insights from 11 leading humanoid robot OEMs



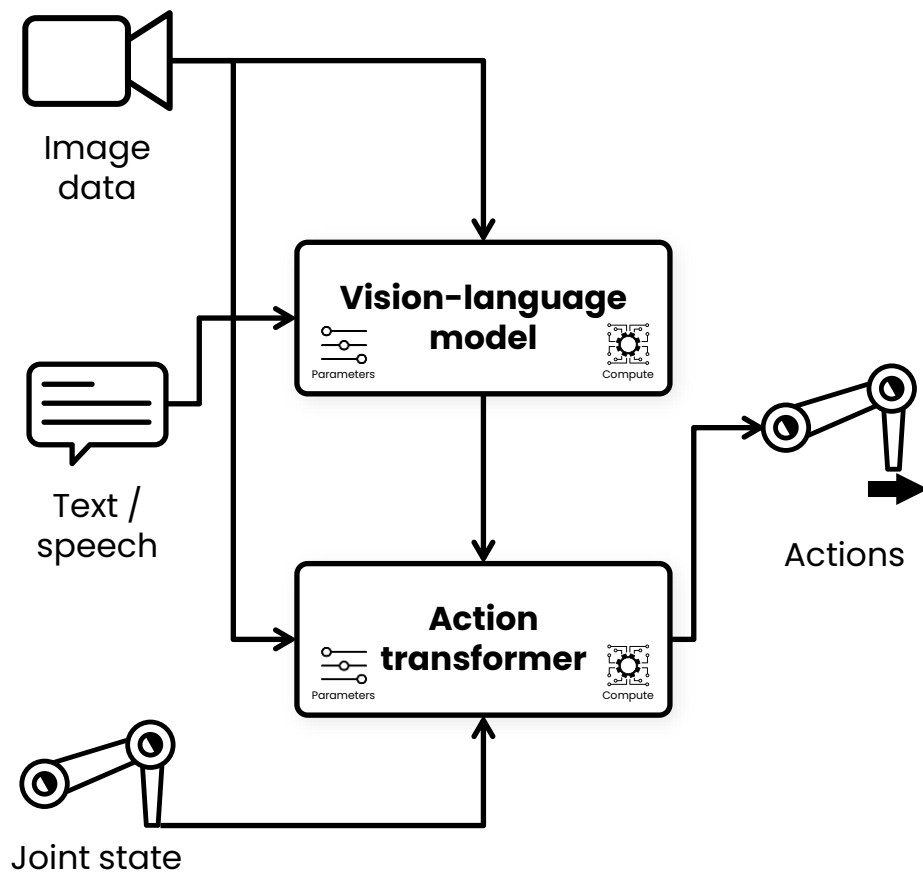
1) Individual cameras, LiDAR, time of flight
Source: FEV

Designed to be general-purpose, humanoid robots utilize vision language action models within a SW stack to transform human instruction into action

HUMANOID SOFTWARE STACK

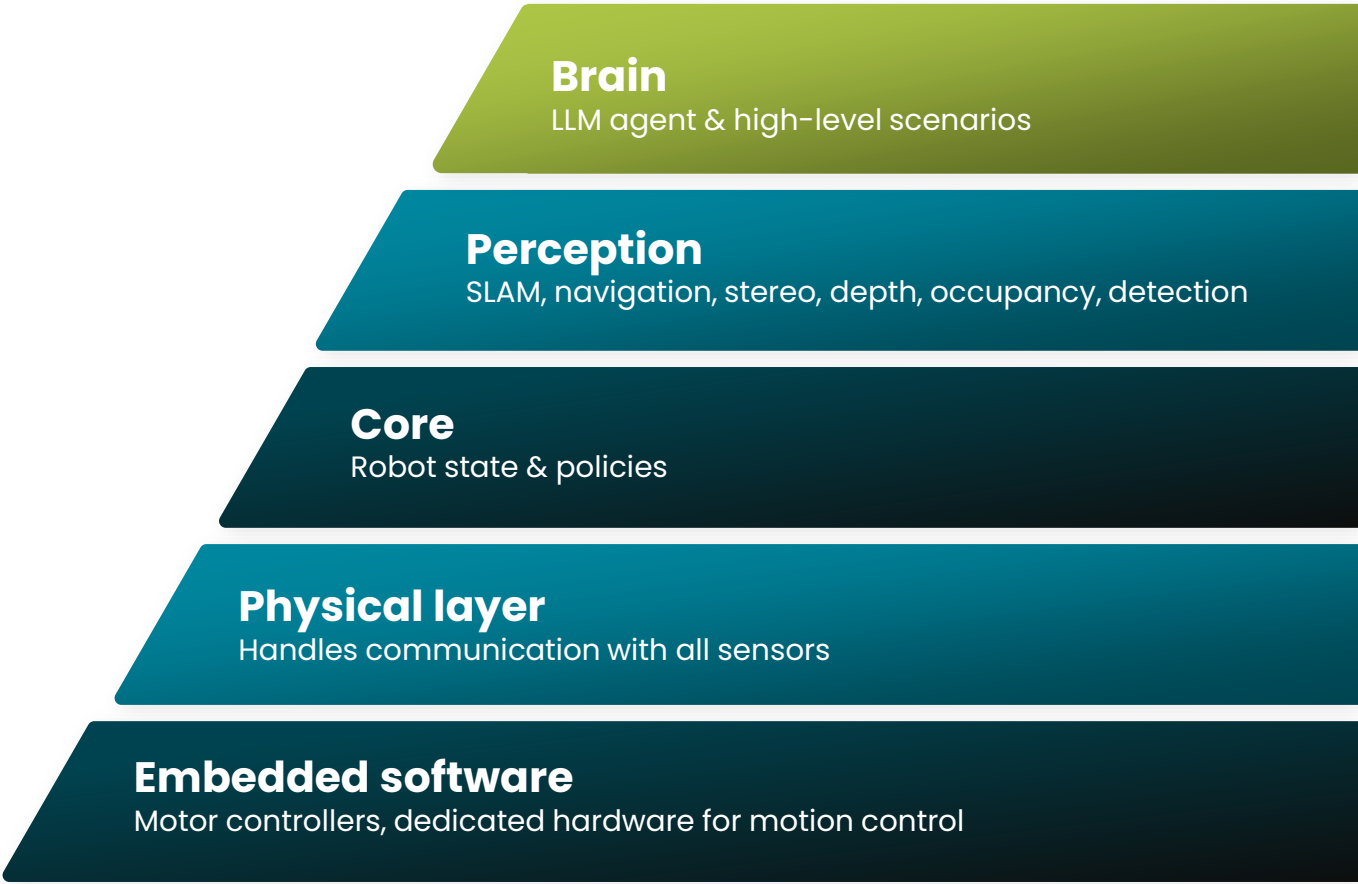
➤ Example only

Vision language action model



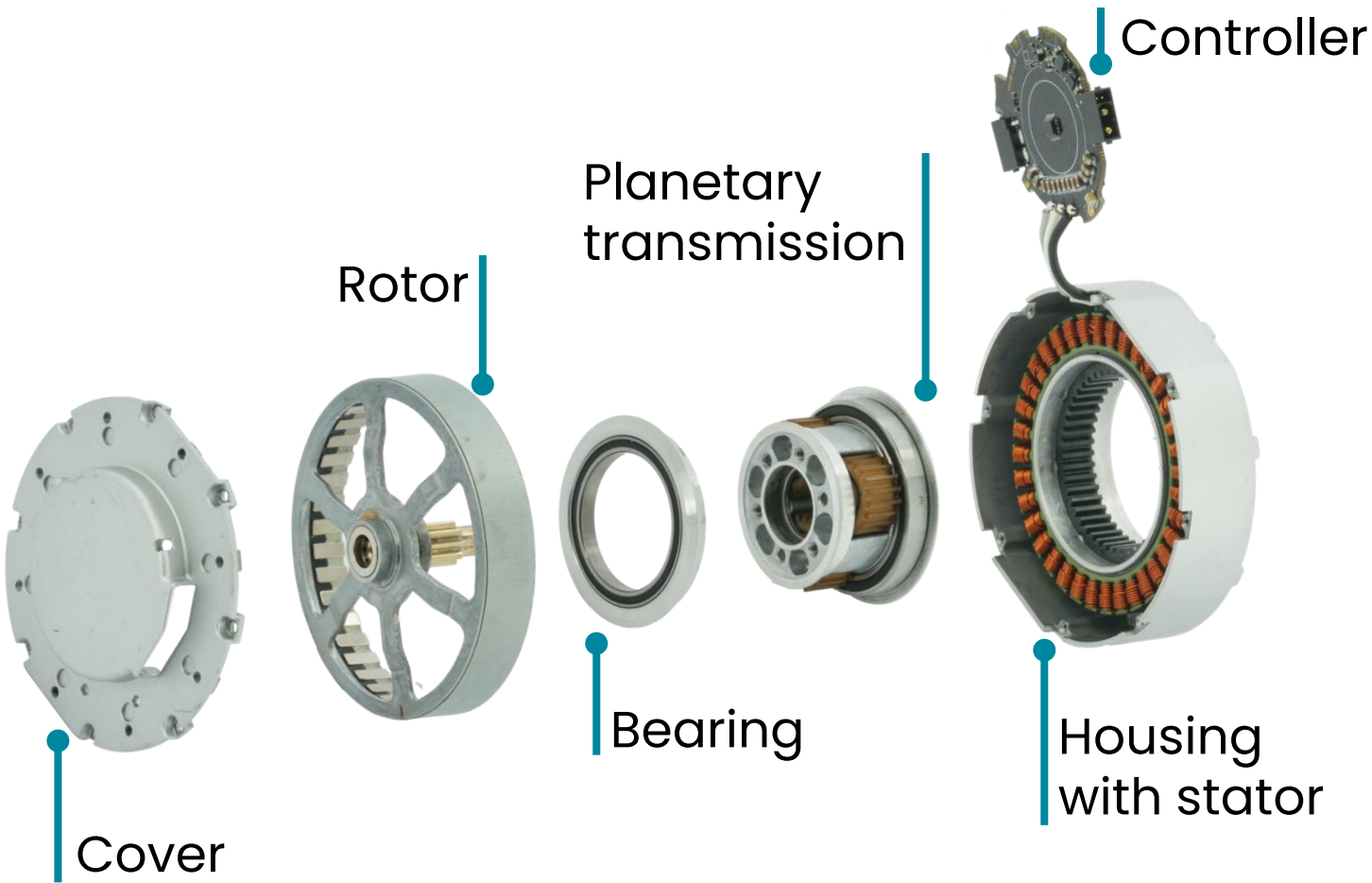
LLM: Large language model
Source: FEV

Generic software stack



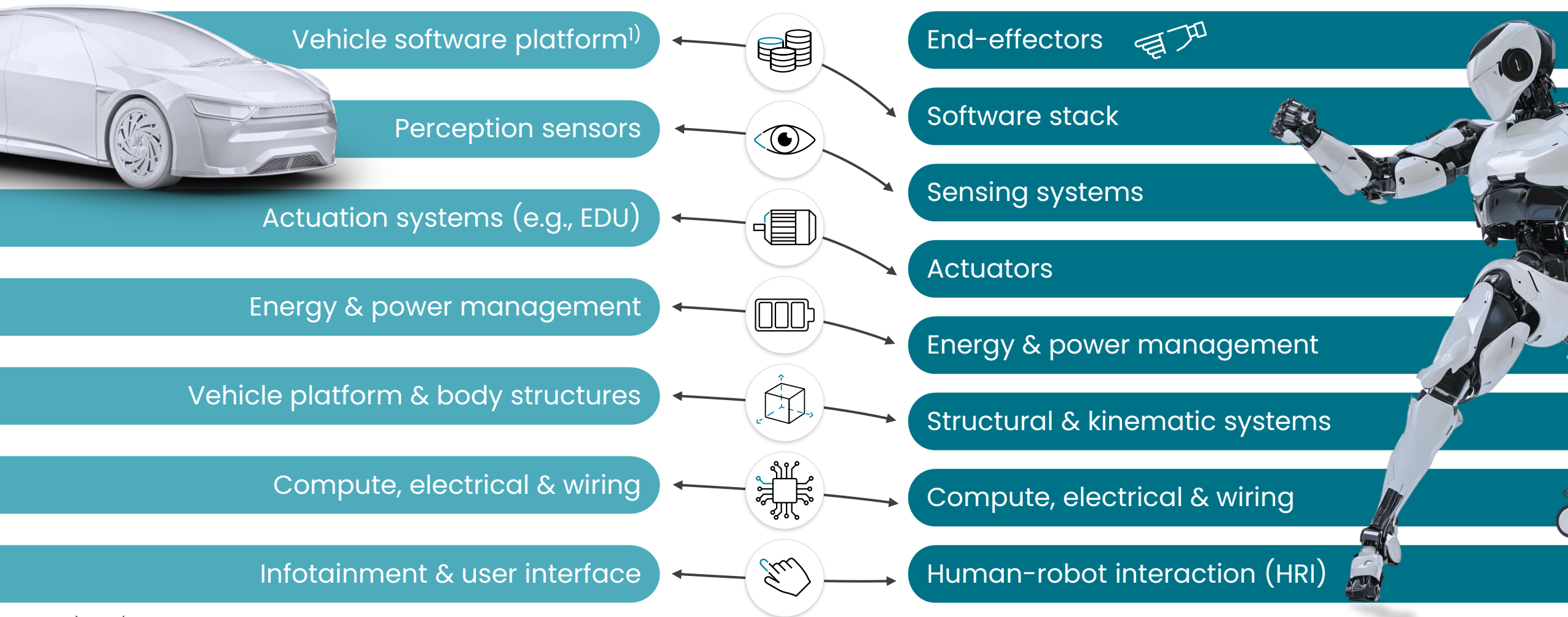
As a leader in humanoid robotics, we have recently completed a teardown of Unitree's GO-M8010-6 rotary actuator at our benchmark facilities

HUMANOID ROBOT ACTUATOR TEARDOWN – UNITREE GO-M8010-6



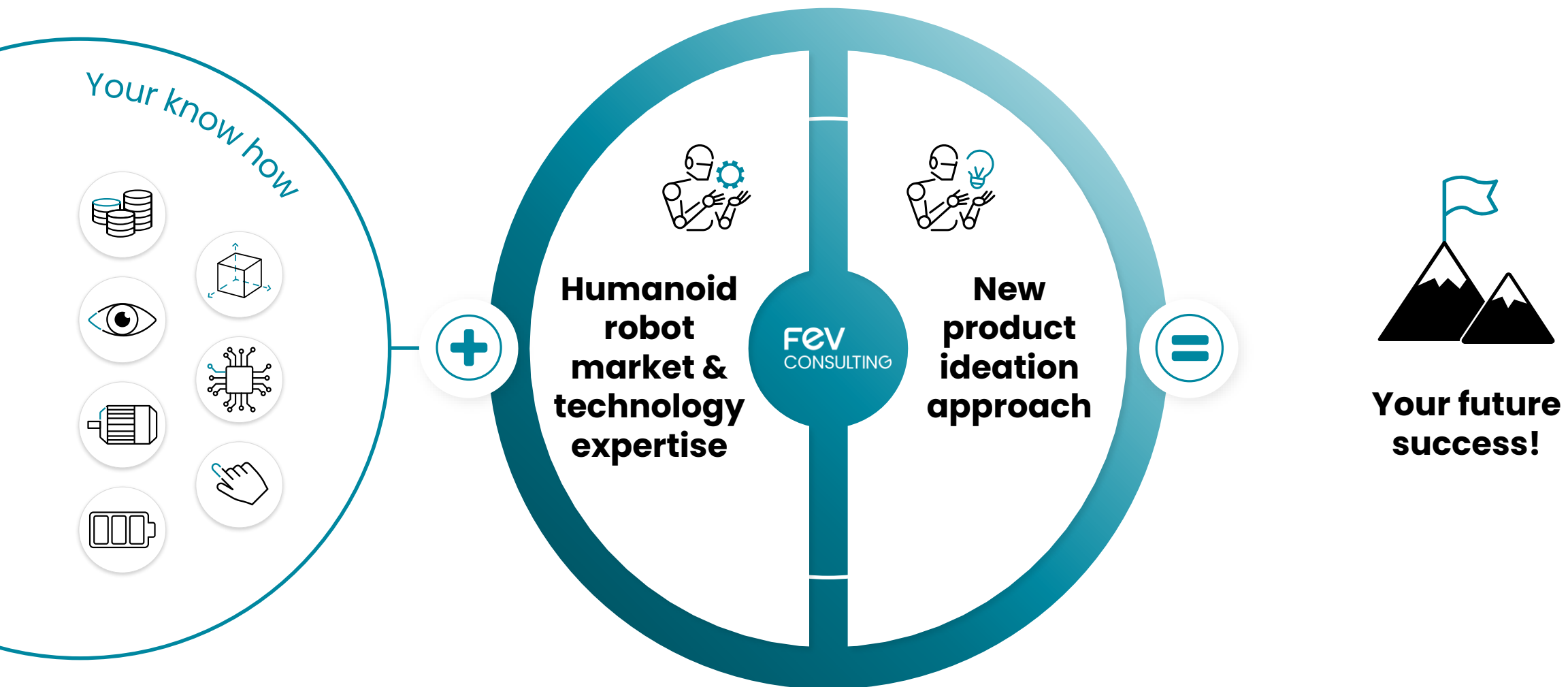
Humanoids and software-defined electric vehicles are made up of many, similar systems & components, albeit with different scales & form factors

BRIDGING THE GAP



¹⁾ ADAS/AD software, cloud connectivity, cybersecurity software
Source: FEV

By combining your know-how with our humanoid market & technology expertise & NPO approach, we can enable a successful market entry together



**We're transforming ideas
into impact – exploring
real-world use cases for
humanoid robotics and
performing hands-on
testing on robotic
hardware and intelligent
software**



Any Questions? Get in touch with us!



Ender Nadir

Senior Director

+49 162 2923162
nadir@fev.com
linkedin.com/endernadir

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LinkedIn**



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Website**



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on LinkedIn:**

