

Robotino.

Mobile Robotics Platform  
for Research and Education



Robotino<sup>®</sup>

## Motivation: Strong demand for mobile robotics applications

Sales 2011	15 000 units	Mobile Robotics	2 500 000 units
Sales 2012	16 000 units	Mobile Robotics	3 000 000 units
Sales Forecast 2013-2016	94 000 units	Mobile Robotics	22 000 000 units

source: IFR 2013

### Professional Applications

Field Robots

Logistic

Cleaning

Medical

Inspection

Defence

Construction

Underwater

### Personal Applications

Handicap Assistance

Entertainment

Domestic Tasks

Vacuum Cleaning

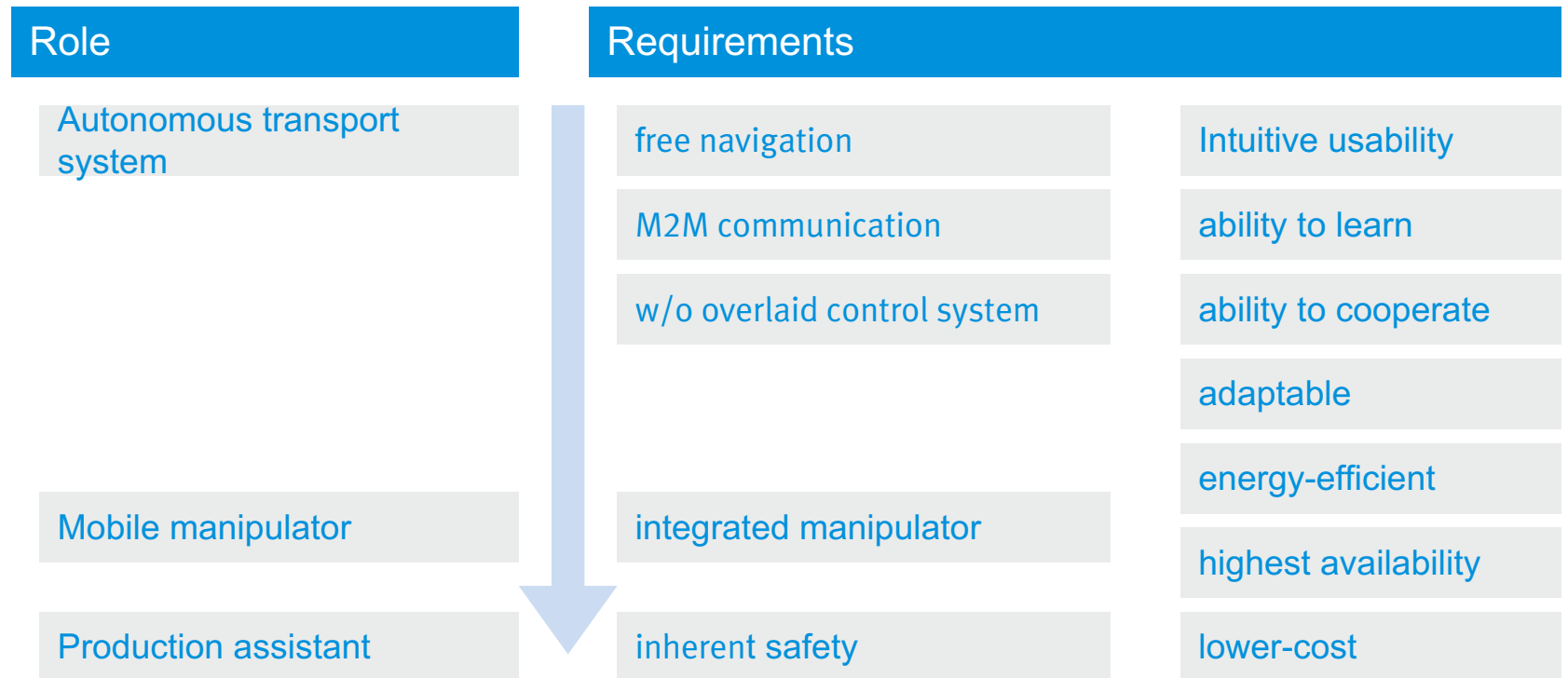
Floor Wiping

Window Cleaning

Lawn Mowing

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## Motivation: Mobile robots in smart factories coming up



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## Motivation: Supporting research and education in mobile robotics

### Research Areas

- Navigation Technologies
- Machine Learning
- Multi-Sensor Data Fusion
- Autonomous Systems
- Artificial Intelligence
- Co-Operative Robot Systems
- Mobile Manipulation
- Service Robotics Applications

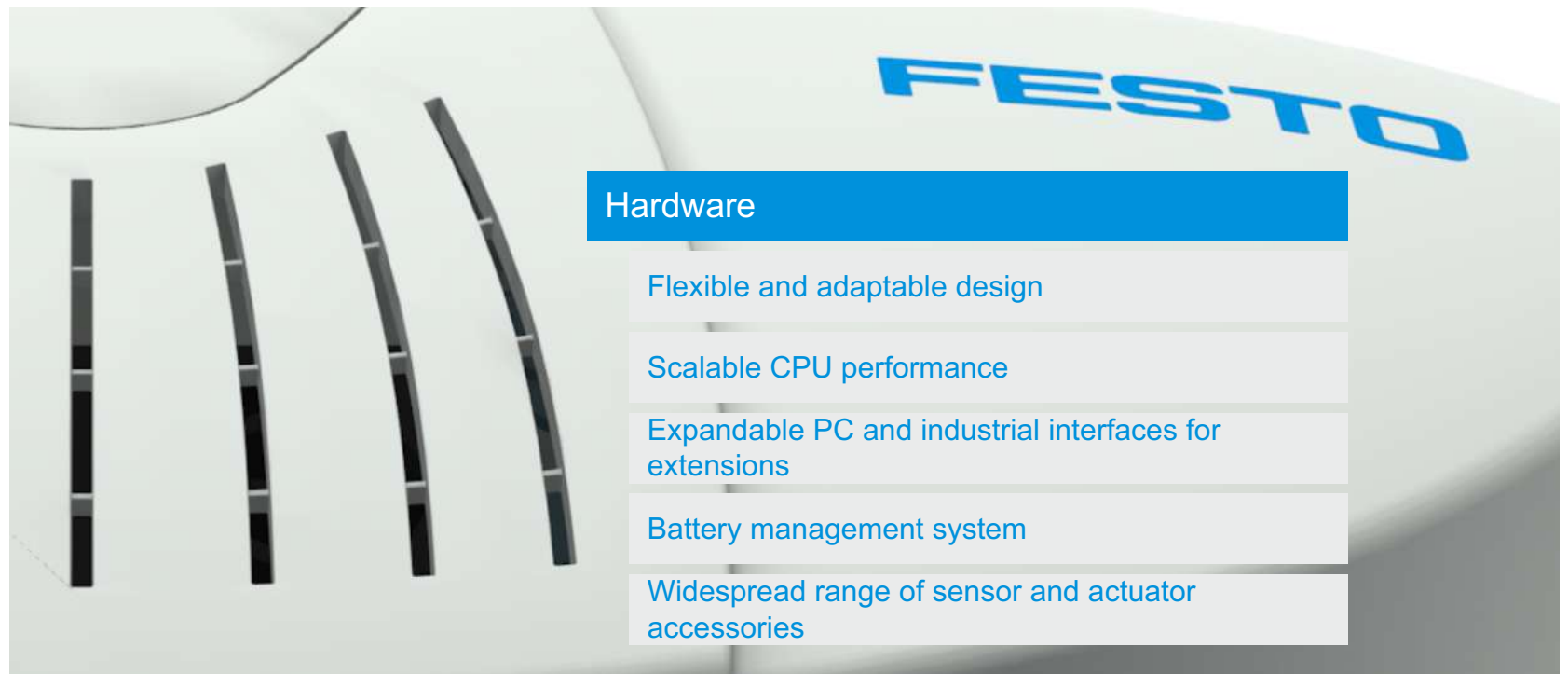


### Fields of Knowledge

- Drive Technology
- Motor Control
- Sensor Technology
- Image Processing
- Microcontroller Programming
- Service Robotics
- Automated Guided Vehicles
- Production Logistics

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## Highlights



### Hardware

Flexible and adaptable design

Scalable CPU performance

Expandable PC and industrial interfaces for extensions

Battery management system

Widespread range of sensor and actuator accessories

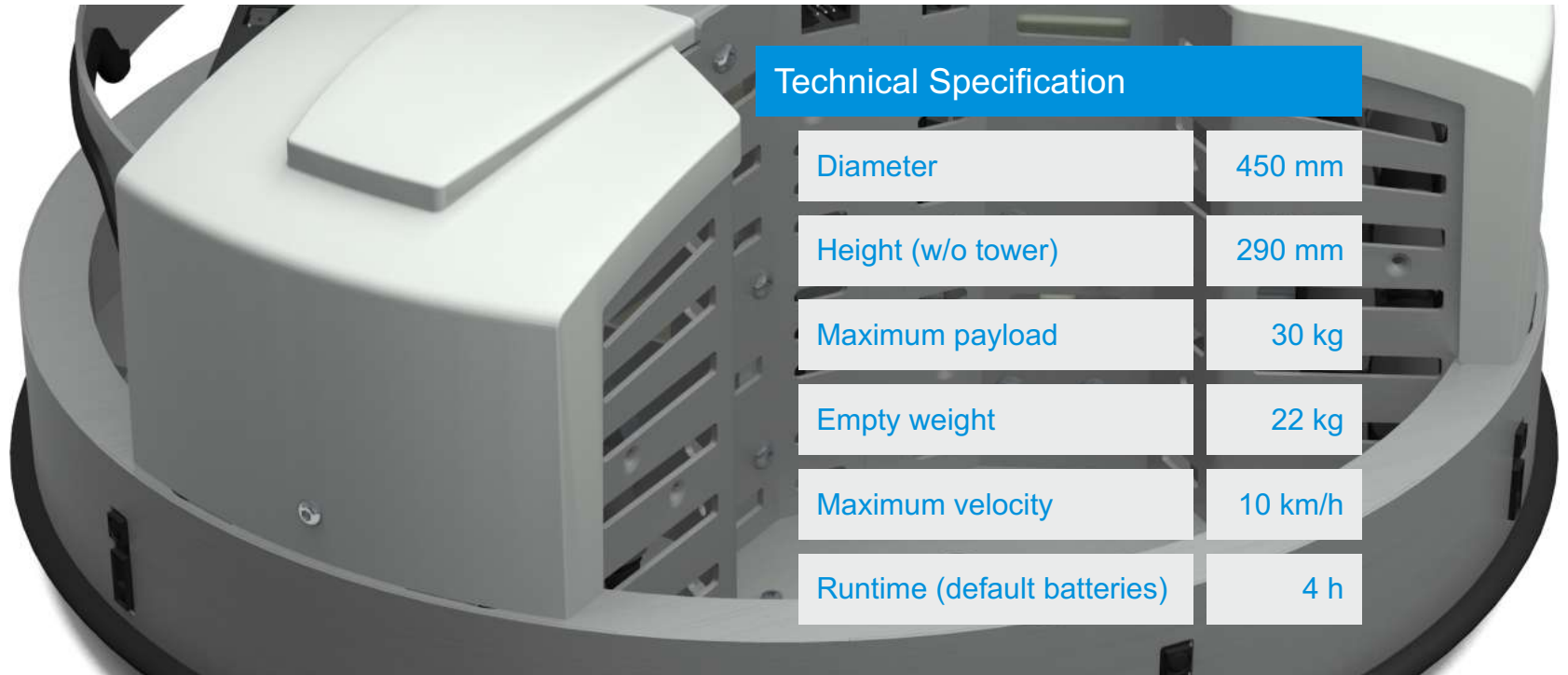
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**Maximum payload**  
larger than own weight



Robotino.

## Highlights



Robotino.

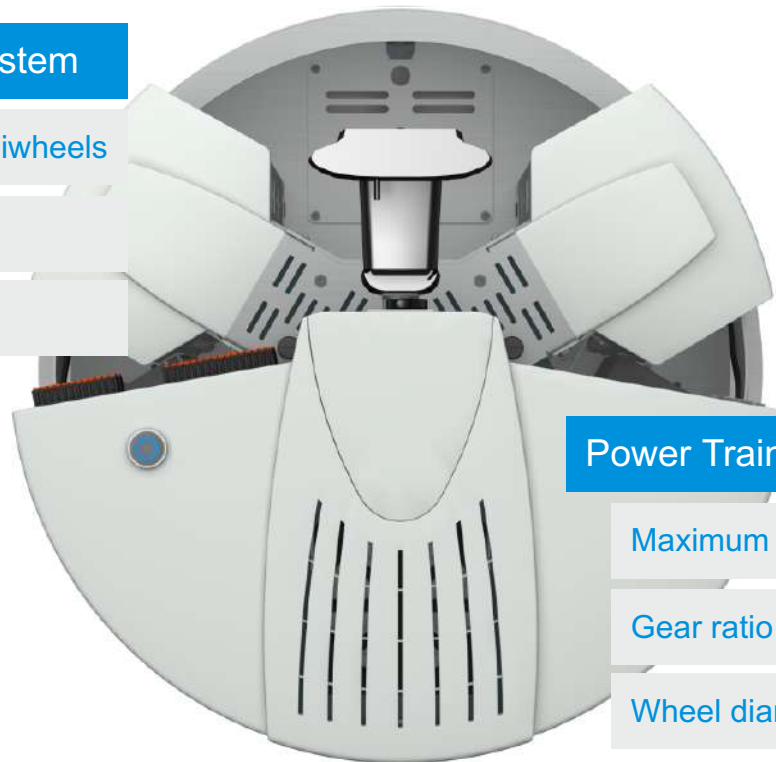
## Adaptive and smooth movement

### Omnidirectional Drive System

Independently driven omniwheels

Moving in all directions

Rotating in fixed position



### Power Train

Maximum motor speed	3 600 rpm
Gear ratio	32:1
Wheel diameter	125 mm



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## Facts on Sensors

### Camera

Type Logitech® HD Pro C920

Photo 15 MP

Video full HD 1080p

Audio dual-stereo microphone

### Distance Sensors

Number and type 9 x infrared

Measuring range 2 – 40 cm



### Optical Sensors

Working range 0 ... 120 mm

### Inductive Sensor

Measuring range 0 ... 6 mm

### Gyroscope Sensor

Output data rate 8 000 Hz

### Bumper

Type mechanical switch

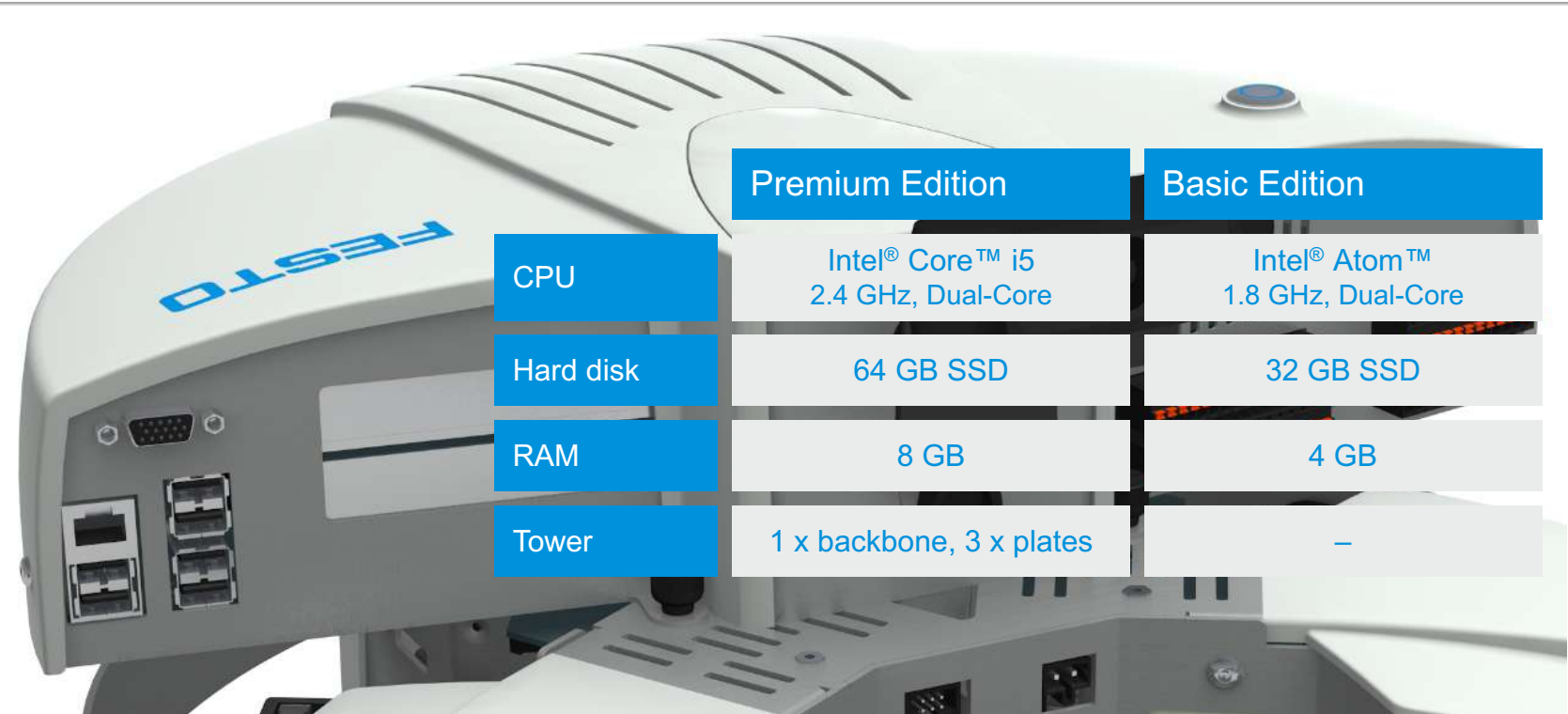
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**Extremely powerful:**  
The new computational  
performance



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## Featuring Premium & Basic Edition



	Premium Edition	Basic Edition
CPU	Intel® Core™ i5 2.4 GHz, Dual-Core	Intel® Atom™ 1.8 GHz, Dual-Core
Hard disk	64 GB SSD	32 GB SSD
RAM	8 GB	4 GB
Tower	1 x backbone, 3 x plates	—

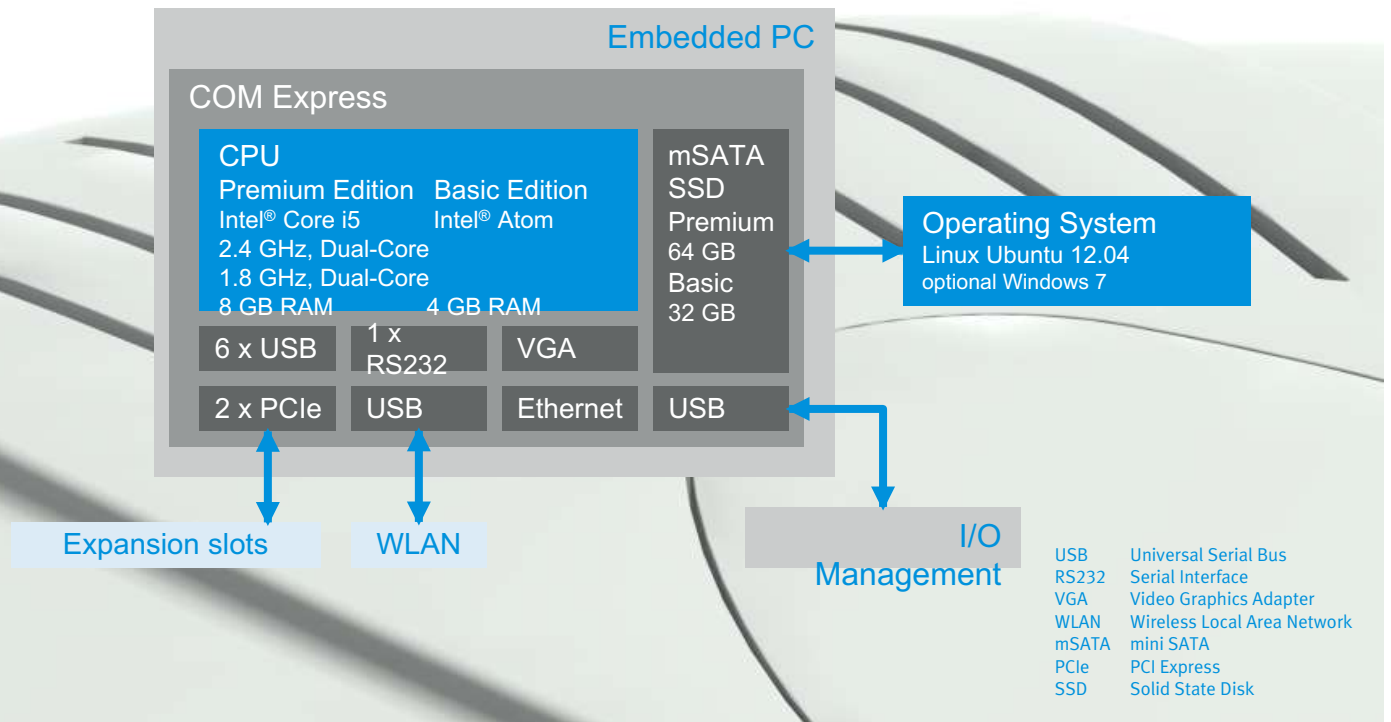
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**More  
interfaces**  
than ever  
before

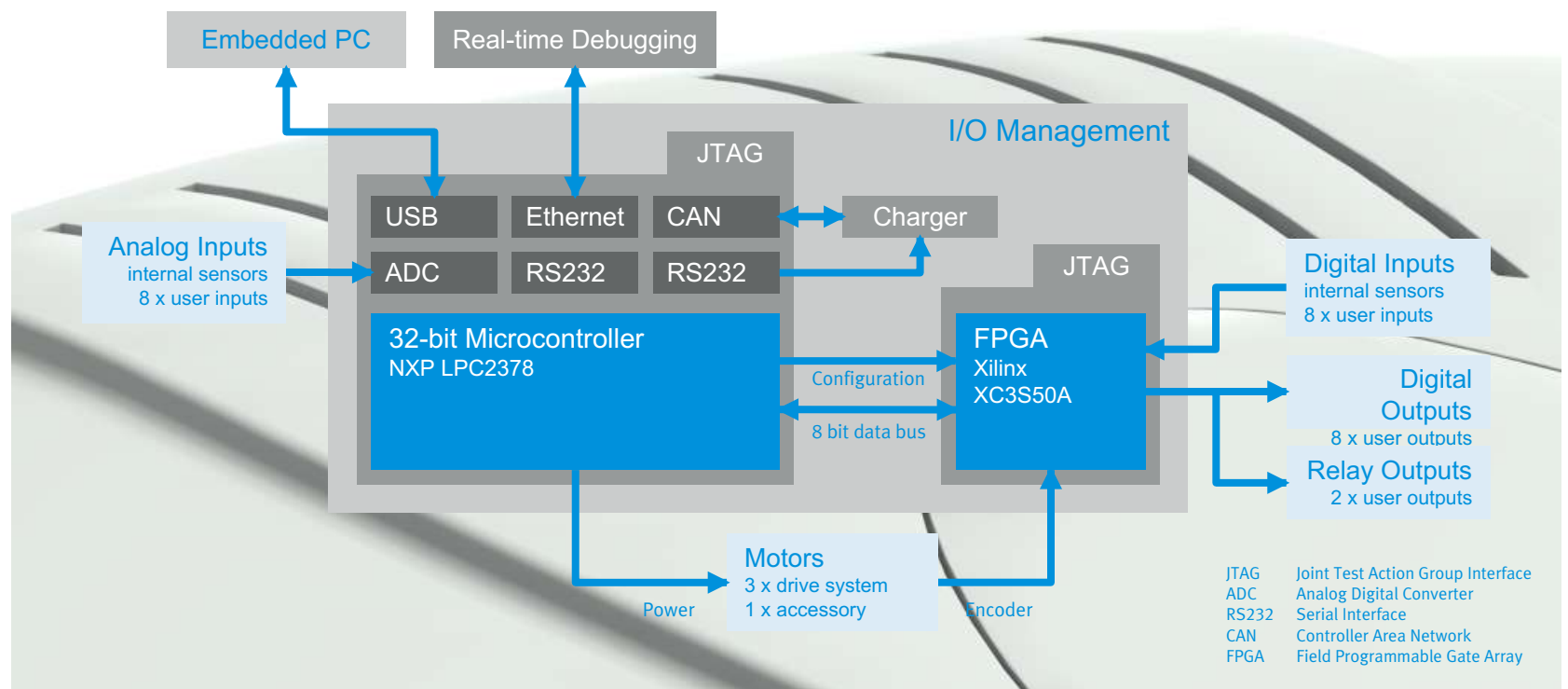
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# Embedded PC inside!



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# Powerful I/O Management



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**Factory Automation**  
Integration into MPS®



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Flexible, adaptable mechanical design





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**New potential**  
at eye level with MPS®



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Complete Open  
Source

Build your application



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## Highlights



### Software

Complete open source and Plug & Play concept

Support for all major programming languages and systems

Robotino® Service Portal for system setup and maintenance

Robotino® Wiki and Robotino® Forum for development of applications

Operating system running on Linux or Windows (in preparation)

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## Connect your Robotino!

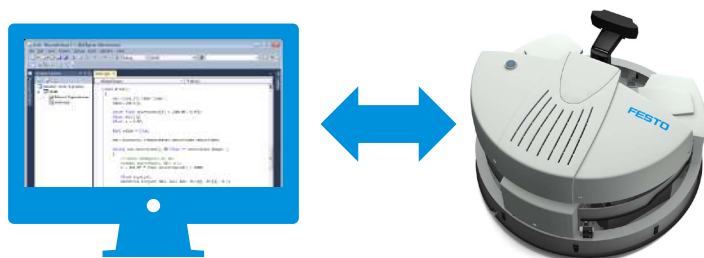
### Maintain via Web Interface



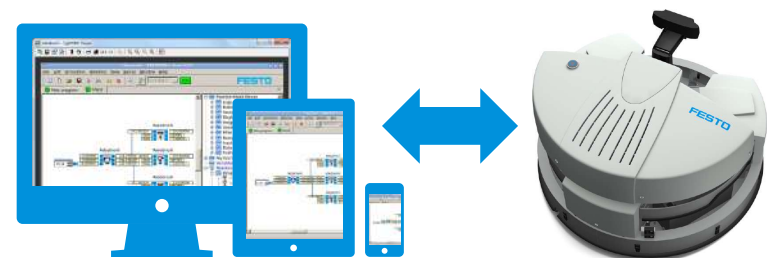
### Access to operating & file system via SSH & SCP



### External programming & control via API

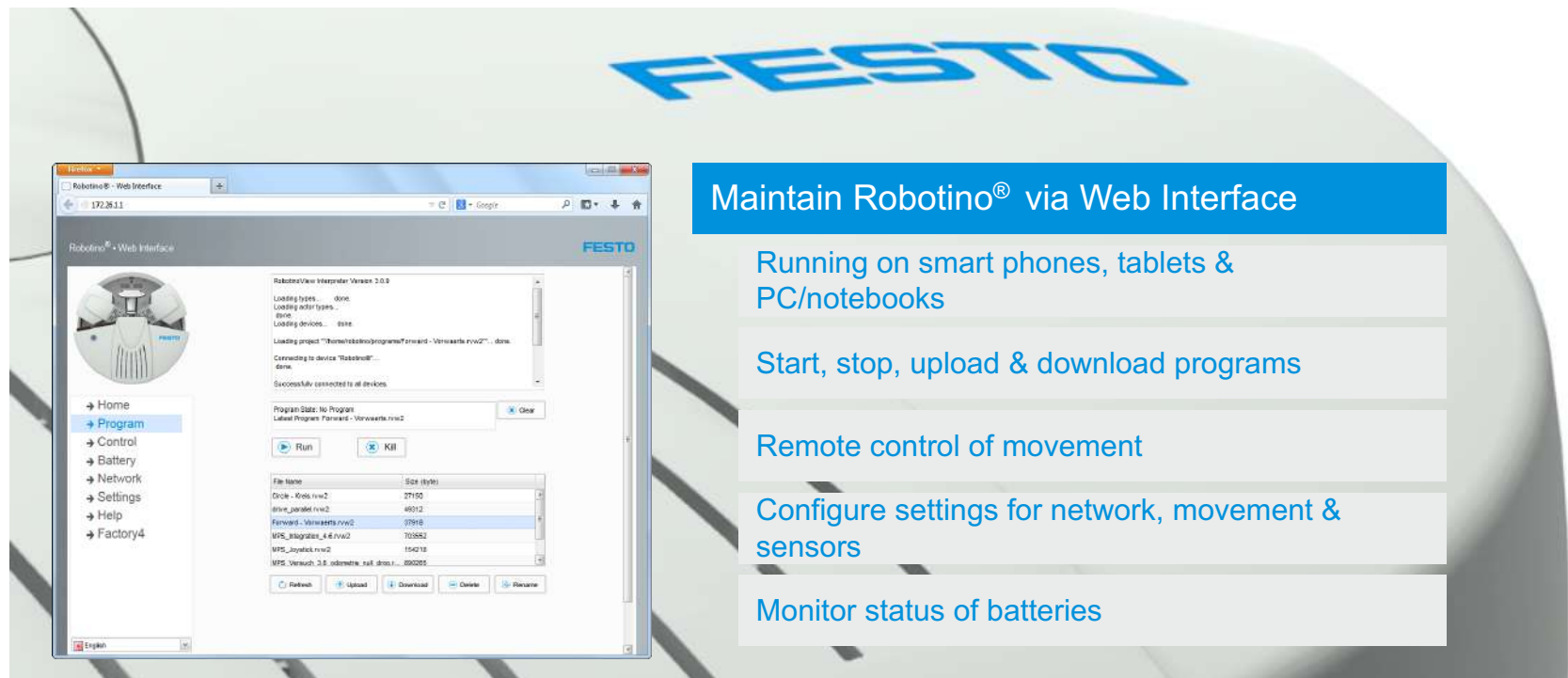


### Online programming & remote access via VNC



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## Web Interface



### Maintain Robotino® via Web Interface

Running on smart phones, tablets & PC/notebooks

Start, stop, upload & download programs

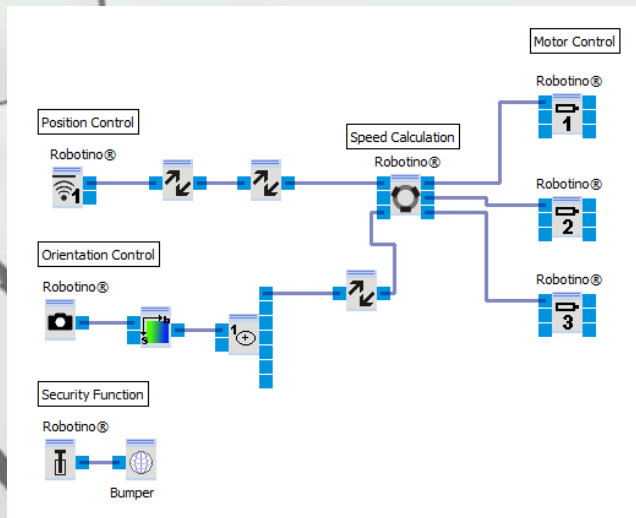
Remote control of movement

Configure settings for network, movement & sensors

Monitor status of batteries

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# Programming



## Running Robotino®

Robotino® View

C++, JAVA, .Net

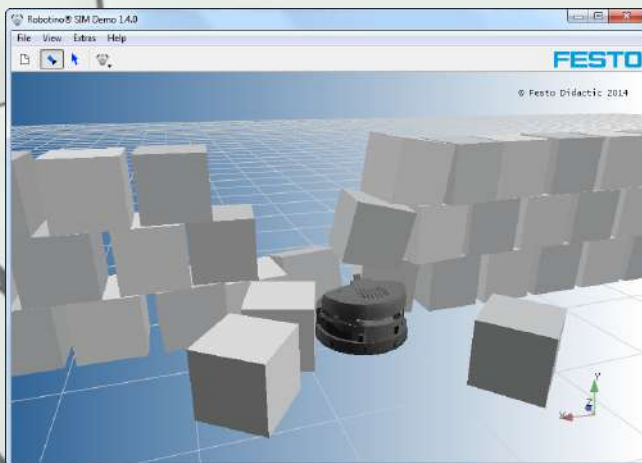
LabVIEW, MATLAB/Simulink

ROS (Robot Operating System)

Microsoft Robotics Developer Studio

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## Simulation



### Robotino® SIM – The virtual Robotino®

Simulates several Robotinos® at one time

Physics simulation based on NVIDIA® PhysX®

Integrated behavior and sensor simulation

Controlled by Robotino® View or via API

Entry-level version free-of-charge!

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VNC enables programming Robotino® with your smart device



### Robotino® Remote Access

Robotino® provides VNC server with 4 desktops

Remote access to Robotino® View and other apps

Use your smart device to program & control



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## Support

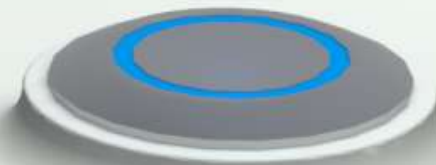
### Robotino® Service Portal

[Instructions on system setup & operating](#)

[Details on components and extensions](#)

[Programming getting started](#)

[Links to Robotino® Wiki and Robotino®  
Forum](#)



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# Support

→ Robotino® Service Portal

→ [www.robotino.com](http://www.robotino.com)

→ Robotino® Wiki

→ Robotino® Forum

Home Learning Systems Training and Consulting **Services** Company News


References  
Help  
Fairs and events

Printed media  
MPS  
Robotino®  
Hardware

Control  
Drive systems  
Sensors  
Interface  
Supply

Web interface  
Programming  
Simulation  
Tools  
Support  
Robotino® XXT  
FACT Centres  
Teciam

## Hardware



Control	Drive systems	Sensors	Interfaces	Supply
→ Power switch	→ Omnidrive	→ Bumper	→ WLAN	→ Batteries
→ Control unit	→ Motors	→ Distance sensors	→ I/O-interfaces	→ Power supply unit
→ Embedded PC	→ Incremental encoder	→ Gyroscope	→ Motor/encoder	→ Charging electronics
→ Microcontroller	→ Gear units	→ Camera	→ USB	→ Pedestal
→ Reset button	→ Wheels	→ Opto-electronic sensors	→ PCI Express	
		→ Inductive sensors	→ Ethernet	
			→ VGA	

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Teachware



## Robotino® Workbook

Instructions on how to use Robotino® during training

Description of project exercises with worksheets

Theory section & sample solutions

Exercises allocated according to topic

CD-ROM with programs for the project exercises

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# Teachware



## Robotino® Workbook

- Project 1  
Inspection of supplied components and commissioning of the Robotino
- Project 2  
Linear travelling of a mobile robot system in any direction
- Project 3  
Linear travelling and positioning of a mobile robot system
- Project 4  
Path tracking of an automated guided vehicle system using two diffuse sensors
- Project 5  
Accurately positioned approach of a loading station
- Project 6  
Approaching an obstacle and maintaining a defined distance

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Teachware

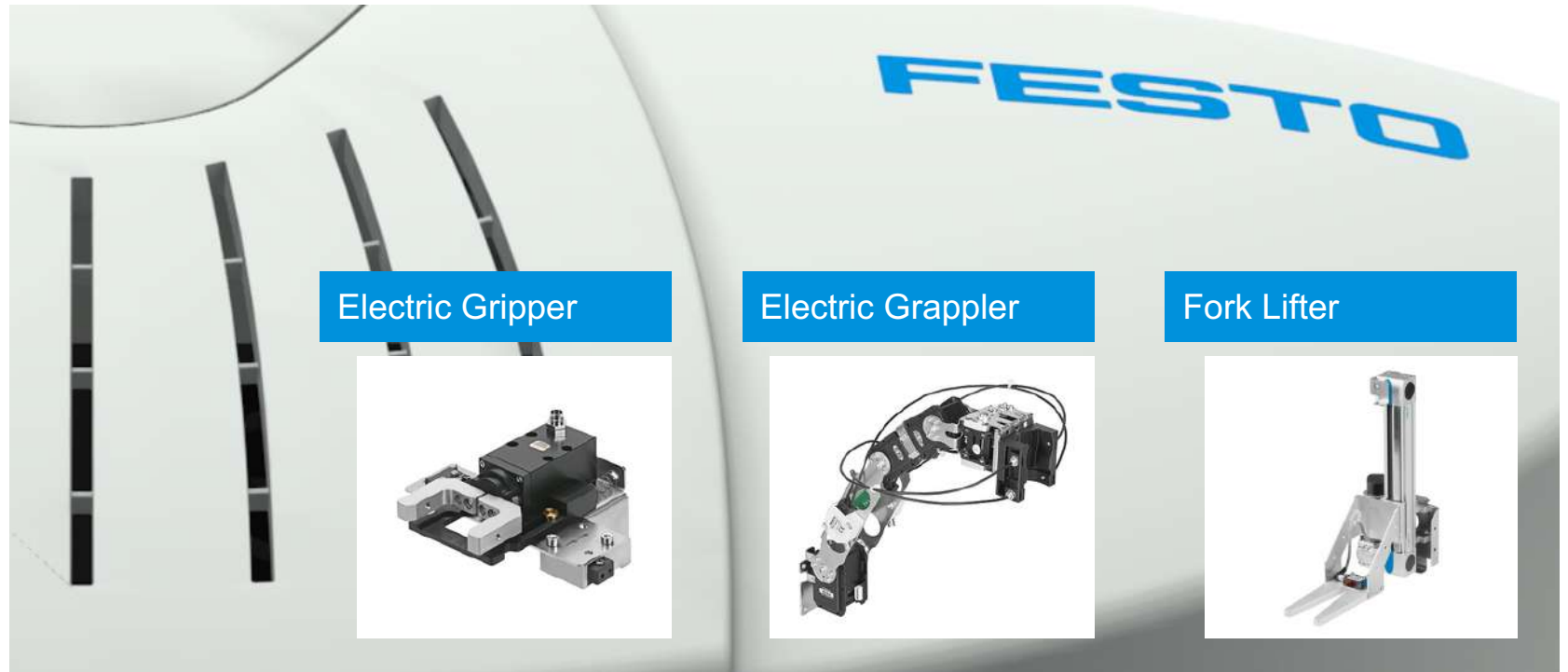


### Robotino® Workbook

- Project 7  
Circling a station and approaching various transfer positions
- Project 8  
Path tracking of an automated guided vehicle system using an analogue inductive sensor
- Project 9  
Determining the optimal motion behaviour
- Project 10  
Path tracking of an automated guided vehicle system with the help of a webcam
- Project 11  
Searching and approaching a coloured object with the help of a webcam

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# Accessories



Electric Gripper



Electric Grappler

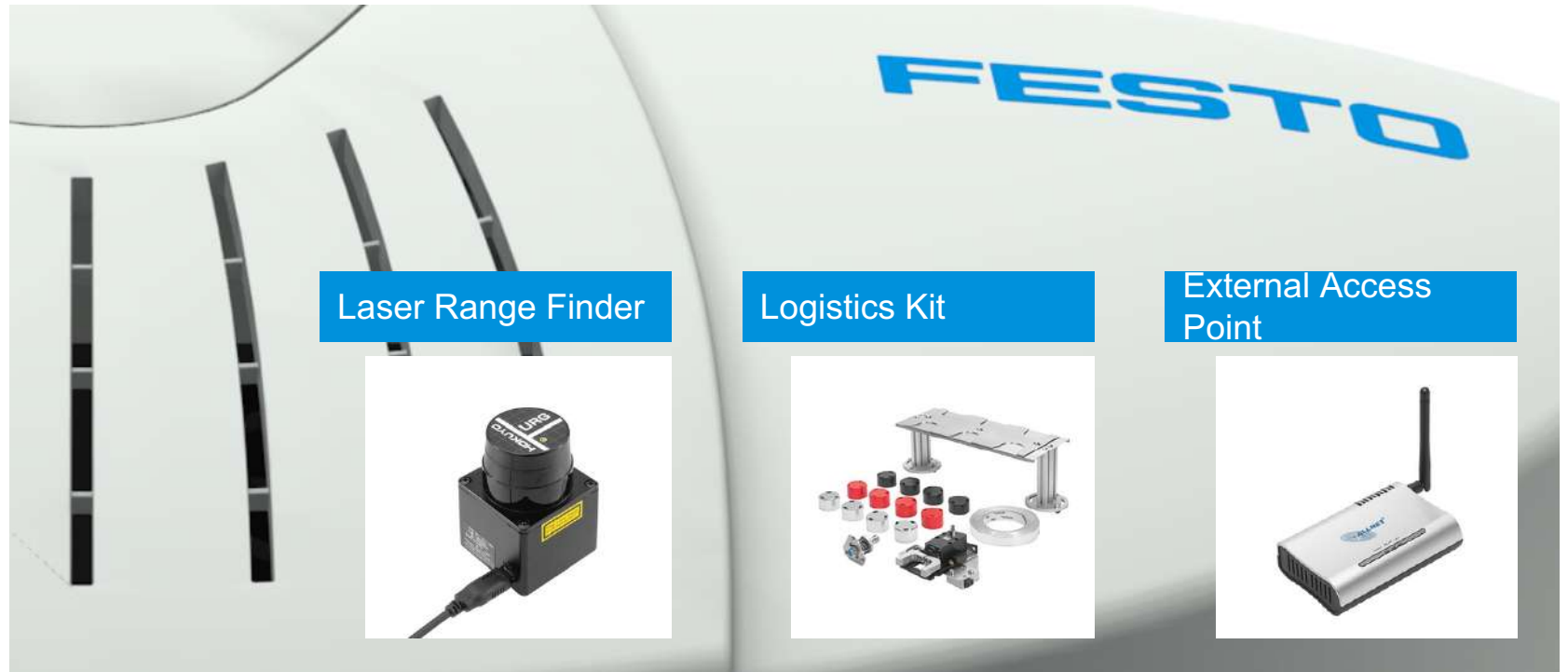


Fork Lifter



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## Accessories



Laser Range Finder



Logistics Kit



External Access Point



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## Robotino. at the RoboCup



### RoboCup Logistics League

An interdisciplinary challenge in the fields of mechatronics, computer science and logistics has to be answered with a flexible yet precise autonomous solution based on mobile robots.

Source: LLSF technical committee

Festo sponsors the RoboCup since 2006

RoboCup 2009 in Graz, Austria

Festo Hockey Challenge with 6 teams

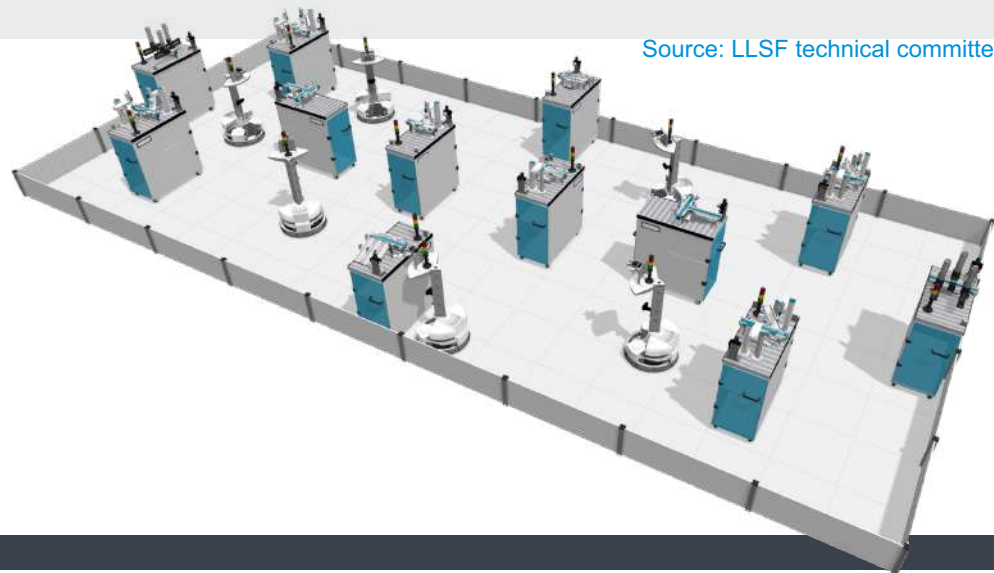
RoboCup 2010 in Singapore

Festo Logistics Competition with 9 teams

RoboCup 2011 in Istanbul, Turkey

Festo Logistics Competition with 15 teams

Official RoboCup Logistics League  
sponsored by Festo since 2012





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## Robotino. at the RoboCup



RoboCup  
Logistics League

**RoboCup World 2015 in Hefei, China**  
**RoboCup World 2016 in Leipzig, Germany**



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## Robotino. at the RoboCup



### RoboCup Robotino® RoboCup Set – Special Offer 2015

Up to three sets of the Robotino® RoboCup Set are available for each team participating at the RoboCup Logistics League sponsored by Festo within 12 months.



- 1 x Robotino® Premium Edition (order no.: 8029256)  
including:
- Intel® Core i5 with 2.4 GHz, 64 GB SSD, 8 GB RAM
- 2 x optical sensors
- 1 x inductive sensor
- 1 x assembly tower with 1 x backbone, 3 x plates

1 x Set of Workpieces (order no.: 554301)

**Special total price for customers: 5 500 EUR plus tax**

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## Support



Dirk Pensky

Product Management

→ pens@de.festo.com