

Robotino[®]

The new learning system – Learning with robots

FESTO



Learning with the robot



How do I move a robot along a line?

Understanding technology – Using an entirely different approach

The Robotino® offers more than just technology, it also offers a wide range of exciting new exercises.

What makes the Robotino® so attractive for training applications?

The technology

The student integrates and uses an extensive range of technology, for example electrical drive technology, sensors, control technology, image processing and programming techniques.

The chassis

The Robotino® is a high-quality, mobile robot system with an omnidirectional drive. It can be moved forwards, backwards and sideways in all directions, as well as turned on the spot, by means of three wheels.

The special attraction

The Robotino® is autonomous! Numerous sensors, a camera and a high-performance controller give the system the „intelligence“ it needs. When correctly programmed, it can freely perform the tasks required of it.

The current trend

In addition to industrial robot technology, the market for mobile and service robots is gaining increasingly in importance. With the Robotino®, your training will follow a major technical and economic trend.



Which robot team will score the most goals?

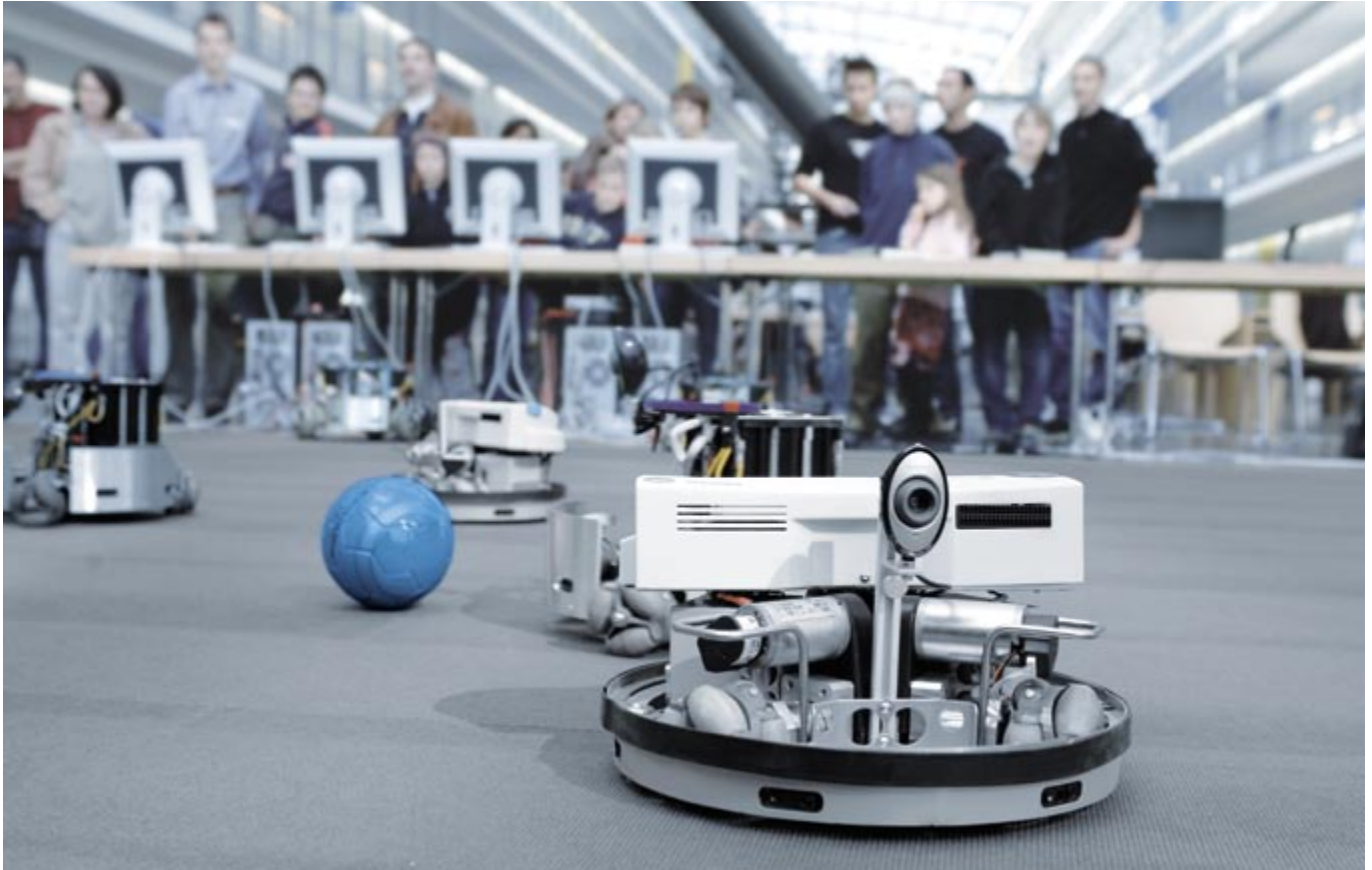


Which robot will navigate a series of obstacles with the greatest speed?



**reddot design award
winner 2006**

The highlights



The name of the game: Motivation

Star Trek, the Orion spacecraft and the Starship Enterprise. The world of spaceships and robots fascinates us – even if it is brought to us using artifice and often huge amounts of papier maché. The Robotino® is real, its movements the result of advanced programming and the tasks it performs originating in industrial or scientific reality or the sporting world.

Plug and play

The Robotino® has one thing over many of its rivals – it is ready-to-use. Its brain – an embedded PC with Linux kernel and Compact Flash card – simply needs to be switched on and then immediately starts to move on the basis of the permanently installed demo application selected.

Kick and rush

The Robotino® is quick and optimally prepared for the addition of sensors and actuators such as grippers or shooting devices. All of these characteristics combine to give the Robotino® a good chance of emerging victorious in sporting competitions.

Wireless communication

Robotino® View, the interactive graphical programming and learning environment, communicates directly with the robot system via wireless LAN. Compilation of the code and downloading to the controller is no longer necessary.

Exciting interaction

With just a few clicks of the mouse you can transmit signals to the motor controller, display, scale and evaluate sensor values or display and further process a live camera image. You can solve even very complex exercises gradually and with relative ease using prepared function modules.

Many training aims ...

- Sensors
- Drive technology
- Motor activation
- Control technology
- Mechatronics
- Programming (symbolic/C++)
- Image processing

... conveyed in an exciting way

The overriding objective is to make learning fun, on the basis that interesting problems go hand in hand with learning success. Examples of problems of this type are „How does the Robotino® find its way from A to B without ending up in a corner?“, or for an even harder problem, „What is the shortest path?“

The mobile robot



Robustly constructed

The three drive modules of the Robotino® are integrated in a sturdy, laser-welded stainless steel chassis. The chassis is protected against collision by means of a rubber protective guard with integrated switching sensor. Numerous additional components such as sensors, handling units or shooting devices can be mounted on a platform using prepared threaded holes.

Robot dimensions:

- Diameter: 370 mm
- Height incl. housing: 210 mm
- Overall weight: approx. 11 kg

Fast mover

With its omnidirectional drive, Robotino® moves quick as a flash forwards, backwards and sideways in all directions and also turns on the spot. Three sturdy industrial DC motors with optical shaft encoders and gears with interchangeable pinions permit speeds of **up to 10 km/h**.

These are the best prerequisites for successful use in sporting competitions.

Everything in view

The chassis contains nine infrared distance sensors. An analogue inductive and an optical sensor is also available by means of which the Robotino® can sense an aluminium strip or a coloured line, for example.

The Robotino® is supplied with a colour webcam with jpeg compression.

The compressed webcam image can be transmitted to an external PC via the WLAN for image evaluation by Robotino® View or used as a live camera image.

An extremely powerful decompression module enables you to additionally use the images from the webcam for standalone control. The Robotino® may not be able to find a needle in a haystack, but it can see what's going on around it with a high degree of accuracy.



Uninterrupted use

Power is supplied via two 12 V lead gel batteries which permit a running time of up to two hours. The scope of delivery includes a further set of batteries for even more uninterrupted learning pleasure!

The scope of delivery likewise includes a charging station which also serves as a maintenance station. The wheels remain freely movable on the charging station, which means that they can also be used during the charging period for experiments in electrical drive or control technology.

Embedded PC for high-level performance

The Robotino® features a high-performance embedded PC consisting of:

- PC 104 processor with real-time Linux kernel
- 64 MB SDRAM
- 128 MB Compact Flash card
- Ethernet, 2 x USB, 2 x RS232, 1 x PS2, 1 x D1E, 1 parallel port and 1 VGA port
- Wireless LAN in accordance with 802.11 g and 802.11 b
- Expansion with additional firewire, CAN bus card or a PCMCIA adapter possible.

The Robotino® server, a real-time Linux application, forms the heart of the controller. It controls the Robotino® drive units and can communicate with external applications in two different ways:

- An open Linux library of C++ basic functions is available for direct programming of the PC 104 under Linux.
- A TCP/IP communication interface is provided for communication with the control computer via wireless LAN. You can write C++ applications for activation of Robotino® via WLAN on the basis of a Windows C++ function library.

Direct access

The membrane keyboard integrated in the controller housing enables you to also access the Robotino® directly without a WLAN:

- Start the boot process for the control computer
- Select the language (DE, EN, ES, FR)
- Status information (e.g. sensor data)
- Display the status of the batteries
- Configure the network connection
- Select permanently programmed standalone demo programs

Motor activation

Activation of the three motors is performed via an additional board with digital and analogue inputs and outputs which is connected with the PC 104 via the serial interface:

- Power outputs for 3 motors incl. PID controller

Expandability

The control board contains the following additional modules for future expansion:

- 10 analogue inputs 0 – 10 V, 50 Hz
- 8 digital inputs and outputs (24 V, short circuit proof and overload proof)
- 2 relays for additional actuators

The free interfaces ensure future expandability at any time.



You can also connect a monitor and keyboard to the embedded PC 104 for programming and diagnostic purposes.



Programming with Robotino® View, scenarios and training aims



Always online

Robotino® View is the interactive graphical programming and learning environment for Robotino®. It communicates directly with the robot system via wireless LAN. Compilation of the code or downloading to the controller is no longer necessary. You can transmit signals directly to the motor controller, display, scale and evaluate sensor values or display and further process a live camera image. Thus Robotino® becomes an online experimentation field, for example for control technology.

Intuitive programming

Robotino® View is a visual programming language. Sequences and operations are created by wiring function modules. The program corresponds to your image of the robot's behaviour and is produced „intuitively“. This means that even parallel processes (multitasking) can be described and easily programmed.

Behaviour-based language

The Robotino® is not human, however its behaviour can be described by way of emotions. „Vigilance“, for example, is the measure of proximity to the objects communicated to the Robotino® by the sensors. The reaction „Avoid!“ or „Pursue!“ can be programmed in response to this. A large number of ideas can thus be easily mapped to Robotino® states.

The work space

The work space is divided into two areas:

- Display of the function module diagram or flow diagram created. The current input and output values of the function modules can optionally be displayed.
- Display of the parameter settings or internal data of the status units, for example live camera image or PID parameters of the motor control system, which you can change online.

The library classes

- **Logic** contains all of the key logic functions
- **Mathematics** contains the basic mathematical operations
- **Vector calculation** with conversion into Cartesian or polar coordinates
- **Generators** contains the basic functions for signal generation
- **Filters** for smoothing values
- **Robotino® hardware** contains all the components of the robot system, for example motor activation, camera, distance sensors, protective guard, power supply
- **Input devices** controlled using a joystick or control panel
- **Sequence control** contains basic functions for creating a sequencing program
- **States** contains custom status diagrams

Robotino® – The learning system for numerous training aims

- Sensors
- Drive technology
- Motor activation
- Control technology
- Mechatronics
- Programming (symbolic/C++)
- Image processing

The scope of delivery includes a comprehensive workbook containing numerous examples of practical project exercises together with recommended solutions:

Commissioning of the mobile robot system

- Preparation of a safe testing environment for operation of the mobile robot system
- Selection of a suitable demo application
- Configuration of a wireless LAN connection via a PC
- Analysis and scaling of the sensor data using a virtual oscilloscope
- Commissioning of the camera system

Motor activation

- Analysis of the control process for motor activation
- Measurement and evaluation of various electrical variables such as speed, motor currents, control parameters, etc.

Drive technology

- Experiments using the omnidirectional drive: accessible vector calculation
- Forwards, backwards, sideways movement
- Execution of rotary movements
- Exchange of pinions in order to change the contour speed

Sensor-driven contour control

- Tracing of a path marked with aluminium adhesive tape using the inductive sensor
- Tracing of a contour using a vision system, i.e. segmenting, extracting and evaluating of images for activation of a motion sequence
- Collision-free contour control across an obstacle course using the nine distance sensors

The complete Robotino® package

The complete learning system consists of:

Mobile robot

with a round stainless steel chassis and three omnidirectional drive units.

- Diameter: 370 mm
- Height incl. housing: 210 mm
- Overall weight: approx. 11 kg

Chassis

with:

- Rubber guard strip with integrated collision protection sensor
- 9 infrared distance sensors
- Analogue inductive sensor
- 2 optical sensors
- Colour webcam with USB interface

Controller

Embedded PC 104 with real-time Linux kernel and numerous communication interfaces:

- Ethernet, VGA and USB for direct connection of a keyboard, monitor and further devices
- Wireless LAN
- Can be expanded using two 20-pin plugs
- Power supply via two 12 V lead gel accumulators. The scope of delivery also includes a second set of accumulators and a charging station.

Robotino® View software

System requirements:

- PC with Win 2000/XP SP2 or higher
- At least Pentium IV
- 512 MB RAM
- Wireless LAN adapter

Workbook

Order no. **544247**

Extensions and accessories on request.



The „Easy start“ package

Included in the scope of delivery:

- Systainer
- Workbook and software
- Battery pack
- Sensors



Festo Didactic GmbH & Co. KG

Rechbergstraße 3
73770 Denkendorf/Germany
Tel. ++49 (0)711/3467-0
Fax ++49 (0)711/34754-88500
www.festo-didactic.com
did@festo.com