

# Simulink Support for LEGO Mindstorms NXT

The LEGO® MINDSTORMS® NXT robotics invention system lets you create and control robots using programmable motors and sensors. Using Simulink, Real-Time Workshop, and Real-Time Workshop Embedded Coder with a free, readily-available software package, you can create robots that operate autonomously. This is an ideal platform for teaching advanced concepts in controls and embedded systems.

The LEGO MINDSTORMS NXT robotics system is a widely available robotics platform with an ARM processor, servo motors and a wide variety of digital and analog sensors. Designed for easy assembly by beginners without any engineering background, it is nonetheless powerful enough to create sophisticated robots and teach advanced concepts like closed-loop control systems and embedded systems.

The Embedded Coder Robot (ECCoder) software solution for Simulink allows you to create an application that will run autonomously on the LEGO NXT robot. You simulate and visualize your application on the host computer. When you are ready, the Simulink model can be compiled and downloaded to the LEGO NXT with a single mouse click. This allows you to:

- Avoid Bluetooth or USB cable range limitations because the program runs directly on the LEGO NXT
- Program motors and sensors precisely for coordinated, real-time execution
- Model, visualize, and test your robot's behavior using Simulink 3D Animation software
- Learn about control algorithms and production code generation using Model-Based Design

The ECCoder software comes with Simulink blocks for standard LEGO NXT capabilities:

- Input from acceleration, color, infrared, gyro, light, sound, touch, compass, and ultrasonic sensors
- Output to servo motors (and input from the encoders on the motors)
- Sound generation (tones or from WAV files)
- Input from buttons on the NXT
- PC-NXT or NXT-NXT communication using Bluetooth
- Remote control of a robot using a PC analog gamepad

## Getting Started

### Required hardware:

- LEGO MINDSTORMS NXT 1.0 or NXT 2.0

### Required MathWorks products:

- MATLAB (R2006a or later)
- Simulink
- Real-Time Workshop
- Real-Time Workshop Embedded Coder

### Recommended MathWorks products:

- Simulink 3D Animation

- Stateflow
- Stateflow Coder

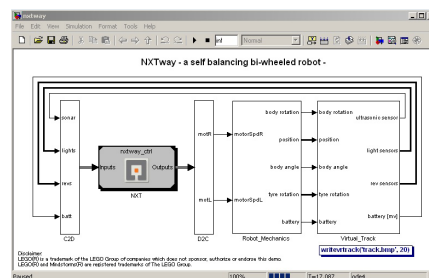
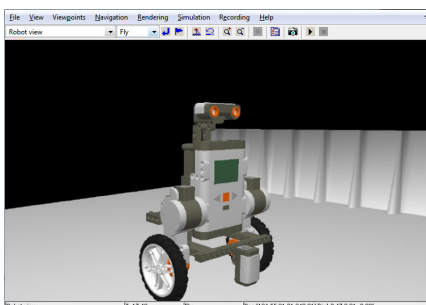
### Required MathWorks Download:

One of the following (Windows platform only):

- ECCoder software, with instructions on how to get third-party tools
- ECCoder Installer, a set of MATLAB programs that retrieves and installs ECCoder and all the necessary third-party tools

## Online Resources

- Details and links to downloads on the MathWorks LEGO MINDSTORMS NXT page: [mathworks.com/academia/lego-mindstorms-nxt-software/](http://mathworks.com/academia/lego-mindstorms-nxt-software/)
- Resources for teaching with MATLAB & Simulink: [mathworks.com/academia/classroom-resources/](http://mathworks.com/academia/classroom-resources/)
- Videos of robots developed using ECCoder: [search youtube.com](http://search.youtube.com) for "simulink lego nxt robot"
- Resources for project-based learning with MATLAB & Simulink [mathworks.com/academia/hardware-resources/](http://mathworks.com/academia/hardware-resources/)



Far Left: Virtual reality animation of the NXTway-GS, a two-wheeled robot that automatically balances itself using a gyro sensor. Left: Controller and virtual reality plant model for NXTway-GS. The controller can be downloaded to an actual NXTway-GS with a single mouse click.

## QUESTIONS AND COMMENTS:

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