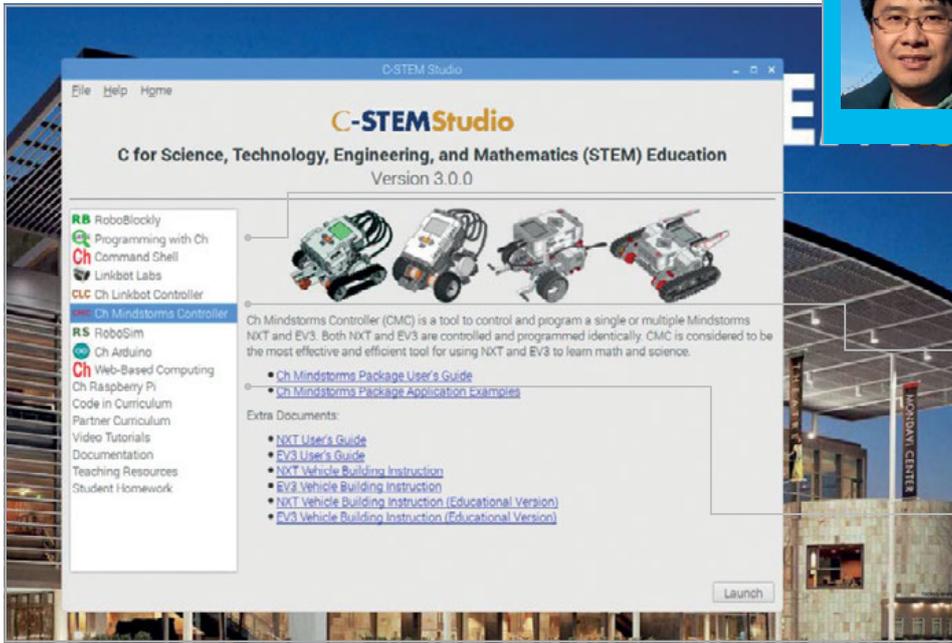




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Programming with Ch will launch ChIDE, which supports all the programming for your robot

Ch Mindstorms Controller will launch an interactive GUI for connecting to and controlling your robots

Ch Raspberry Pi will launch a simple GUI to interact with the GPIO pins

CONTROLLING LEGO MINDSTORMS ROBOTS WITH A RASPBERRY PI

You'll Need

- ▶ C-STEMbian OS magpi.cc/2p3JUNP
- ▶ A monitor or display
- ▶ MINDSTORMS NXT/EV3 robots (up to seven)

Discover an alternative and user-friendly platform to control multiple MINDSTORMS robots

In this tutorial, you will find the tools you need to easily connect to your robots, and a variety of options for programming and controlling them. Interfacing LEGO MINDSTORMS robots with Raspberry Pi is made easy thanks to the Ch Mindstorms Controller (CMC). The C-STEM Center at UC Davis has developed C-STEM Studio with CMC to provide a simple-to-use platform for 4- to 19-year-old students to learn

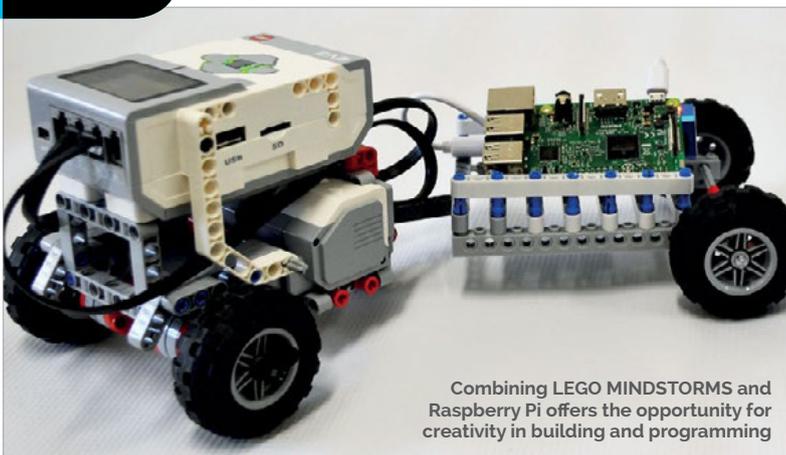
Computing, Science, Technology, Engineering, and Maths with LEGO MINDSTORMS NXT and EV3 robots.

C-STEM Studio is a user-friendly platform that allows you to control LEGO MINDSTORMS NXT and EV3 robots directly from a Raspberry Pi. A single program can also control multiple NXT/EV3 robots at the same time. This tutorial will guide you through the steps of installing the software, connecting to your robots, and controlling them.

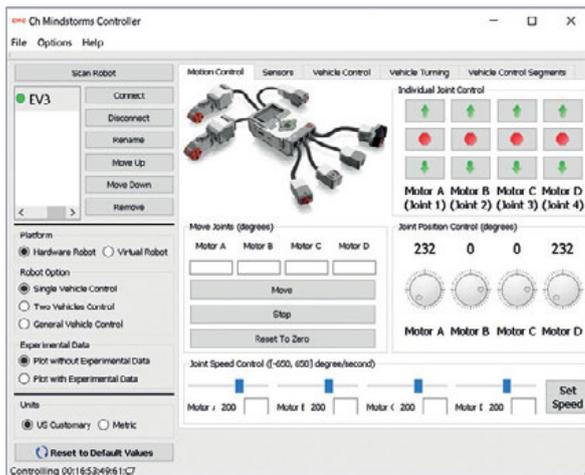
Software

In order to connect to your MINDSTORMS robot from the Ch Mindstorms Controller, you will need access to the C-STEM Studio platform. We recommend downloading and installing C-STEMbian, a free open-source Linux operating system for Raspberry Pi. C-STEMbian is a superset of Raspbian, and includes several tools that provide a user-friendly environment for computing, robotics, and cyber-physical systems.

If your Raspberry Pi is already running Raspbian, you can install the C-STEM software modules individually. All the necessary software, including



Combining LEGO MINDSTORMS and Raspberry Pi offers the opportunity for creativity in building and programming



Above The Motion Control panel features many options for individual motor control, and displays information about the current positions of each motor

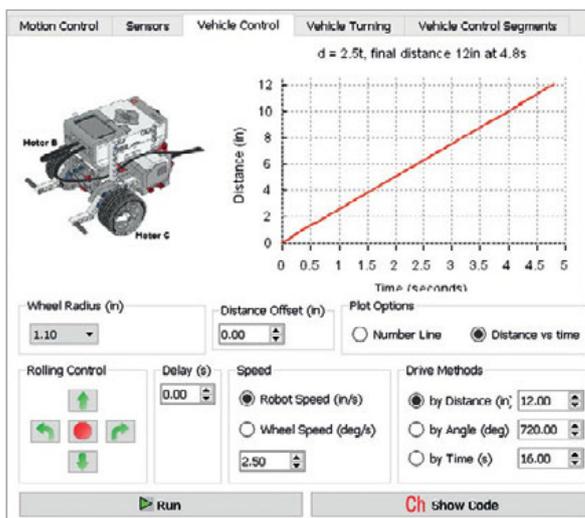
C-STEMbian, is available from the C-STEM website (magpi.cc/2p3JUNP), along with instructions to guide you through the installation process, and to help you connect to your Raspberry Pi.

Connecting to your MINDSTORMS robot(s)

Connecting to your MINDSTORMS robot is simple with the C-STEM software.

Open C-STEM Studio and launch the Ch Mindstorms Controller. Ch Mindstorms Controller can connect with both EV3 and NXT robots. Simply press the Scan Robot button, then add the robots that are found to the list on your robot manager. Follow the instructions on screen to pair the robots with your Raspberry Pi, and add the robots you want to work with. Do make sure that the robots are turned on and have Bluetooth enabled.

Once the robots have been scanned and added to the list, select the ones you would like to connect to and press Connect. Robots to which you are connected will have a green dot next to their names.



Above The Vehicle Control panel provides options for driving by distance, angle, and time, and can plot the resulting data

group_four Mindstorms.ch

Language

>C/C++

DOWNLOAD:
magpi.cc/2yaWpbX

```
/* Control multiple robots simultaneously
using the CMindstormsGroup class*/
```

```
#include <mindstorms.h>
```

```
CMindstorms robot1, robot2, robot3, robot4;
CMindstormsGroup group;
```

```
double radius = 1.1; // radius of the wheels (inches)
double trackWidth = 4.54; // track width of the robots (inches)
```

```
/* add the four robots as members of the group */
group.addRobot(robot1);
group.addRobot(robot2);
group.addRobot(robot3);
group.addRobot(robot4);
```

```
group.driveDistance(5, radius); // drive robots forward 5 inches
group.turnLeft(90, radius, trackWidth); // turn robots left 90
degrees
group.driveDistance(10, radius); //drive robots forward 10 inches
```

Controlling your MINDSTORMS robots

Once you are connected to your robot, the CMC offers many options for control.

Real-time control

Using the Motion Control panel, you can rotate individual motors continuously, move motors by given angles, and drag and drop motors into a desired angle. You can also set the speed of each motor at any time.

Monitor sensor data

Use the Sensors panel to monitor the sensors attached to the robot. You can set sensors to different modes, and the values from the sensors will update automatically.

Educational features

In the other panels we introduced some educational features, designed to help students learn mathematical concepts. For example, in the Vehicle Control panel, a student controls a robot configured as a vehicle. Students can set the vehicle's wheel size and speed, and drive the vehicle by distance, by angle, or by time. The robot then drives as programmed, and a graph of distance versus time is plotted. With these features, students can learn about number lines, linear relationships, and the concept of pi.

Program robots in C/C++ interpreter Ch

To program the robots, you need to keep them connected in the controller, then open ChIDE and start programming. You can program up to seven robots, which is hard to do using other platforms.

PROGRAMMING IDEAS AND HELP

Open the Learn Mindstorms folder in the Code in Curriculum section of C-STEM Studio to find Ch programs for MINDSTORMS.

ADVANCED APPLICATIONS

Explore the Demos folder (in Code in Curriculum) for additional examples and applications using sensors, Linkbots, and different robot configurations.