Robot Soccer Challenge

Pre-Activity Quiz

1. **What kind of wireless electrical connection can EV3 robots use to communicate with other electrical devices (including other EV3s)?**

2. **Can you think of a way to use a Bluetooth connection to enable one EV3 robot to remotely control another? Describe it.**

Pre-Activity Quiz **Answers**

1. **What kind of wireless electrical connection can EV3 robots use to communicate with other electrical devices (including other EV3s)?**

   Bluetooth technology is a wireless connection that enables communication between electrical devices.

2. **Can you think of a way to use a Bluetooth connection to enable one EV3 robot to remotely control another? Describe it.**

   Let's call one EV3 the "controller" and the other EV3 the "receiver."

# Pre-Activity Quiz **Answers** (continued)

When each button (orange, left, right) is pressed on the controller EV3, have the controller send a distinct message ("1", "2", "3") via Bluetooth to the receiver.

When no controller button is pressed on the controller EV3, have the controller send another distinct message ("0") to the receiver.

Program the receiver so that:

- when it receives "1" it moves forward
- when it receives "2" it moves left
- when it receives "3" it moves right
- when it receives "0" it does nothing

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Your Design Challenge
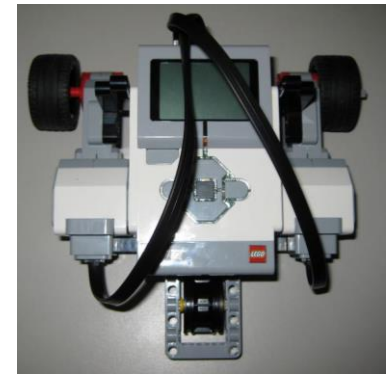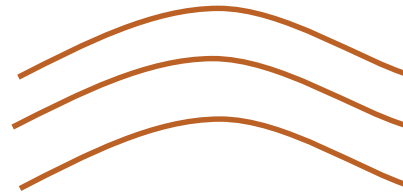
To program two EV3s (a "controller" and a "receiver") so that one can be used to remotely control the other via a wireless Bluetooth connection so that...

➢ **When you press the middle button on the controller EV3, the receiver EV3 moves forward.**

➢ **When you press the left arrow button on the controller EV3, the receiver EV3 turns left.**

➢ **When you press the right arrow button on the controller EV3, the receiver EV3 turns right.**

Design Challenge Objectives (continued)

➢ **When we are done, we will be able to control the LEGO MINDSTORMS EV3 taskbot (the "receiver") similarly to how the robot in this video is controlled: http://youtu.be/zohDeKxXUPo?t=1m.**

➢ **If several groups are able to run their programs at the same time, they can use their EV3 taksbots to "play soccer" with a small ball.**

To do this, each group remotely controls its taskbot, which acts as one of the soccer players.

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Part 1: Understanding the Programs

Before you use one EV3 to remotely control another, you must understand how the programs for the controller and receiver EV3s work and how they interact with one another.
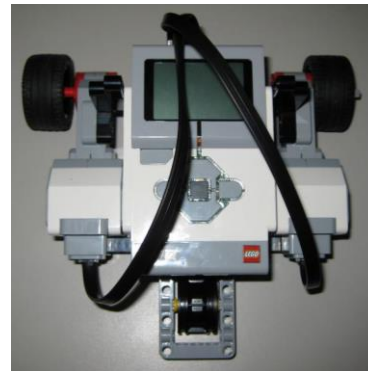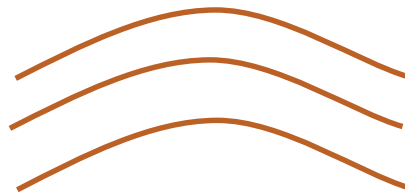
Review:
What is an electrical connection?

➢ **An electrical connection is the link or bond that passes electricity between two or more things.**

➢ **Wireless electrical connections allow two devices to be linked remotely without being joined by a wire.**
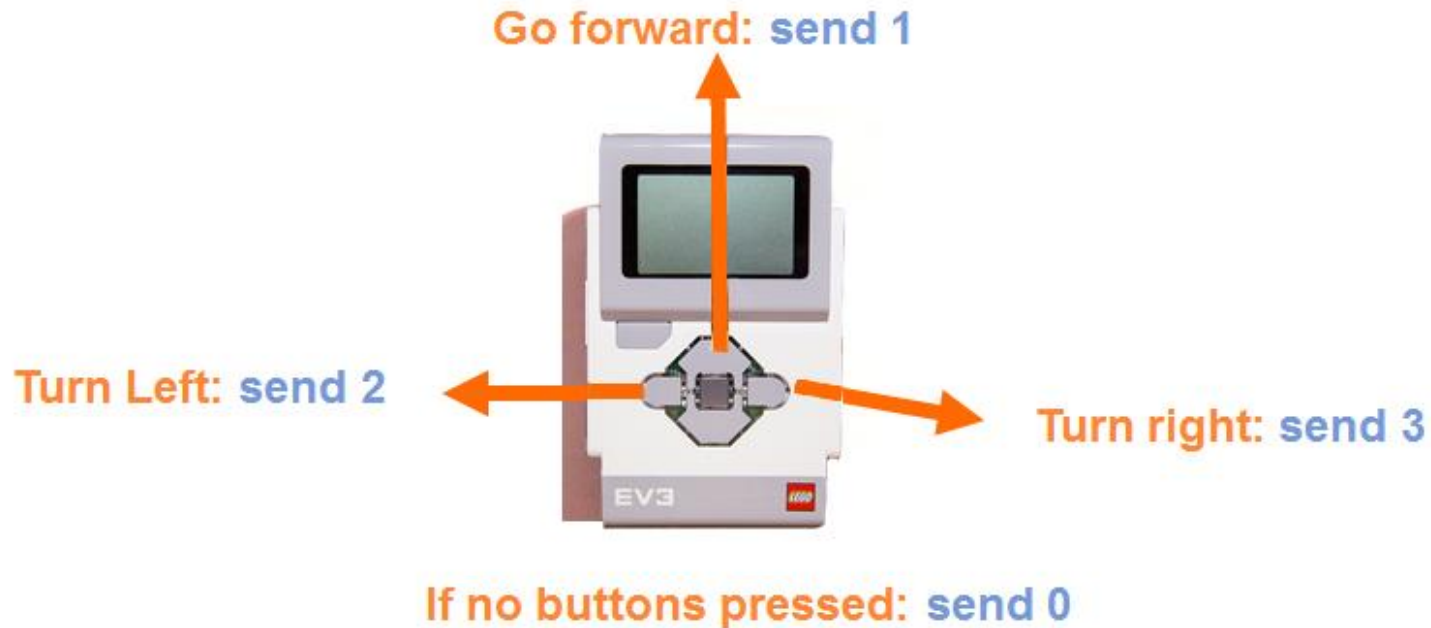
Review:
Bluetooth with the EV3

➢ **EV3 robots can use a wireless connection called Bluetooth® to communicate.**

➢ **Like many other devices (such as smartphones), the EV3 can send text messages through Bluetooth.**

➢ **Example: If you were worried about an intruder coming into your room, you could program the EV3 to use the ultrasonic sensor to "watch" the door to your bedroom. If the ultrasonic sensor detects the door moving, it could send you a message saying "intruder alert."**

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Bluetooth Program Overview

➢ **In this activity, we need one EV3 to be the remote control device (the "controller") and the other to be the vehicle that responds to the controller (the "receiver").**

➢ **So one EV3, the controller, sends messages via Bluetooth when you press different buttons on the EV3 brick.**

➢ **The other EV3, the receiver, receives those messages via Bluetooth and is programmed to move forward, left, right or backwards when it receives the messages.**

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Controller Program

Go forward: send 1

Turn Left: send 2

Turn right: send 3

EV3

If no buttons pressed: send 0

When any one of the three LEGO brick buttons (see above) is pressed, we want the controller to send a corresponding message ("1", "2," or "3") to the receiver.

When no buttons are pressed, the controller sends the message "0."

Receiver Program

➢ **When the receiver EV3 receives the "0" message via Bluetooth, it knows that the controller EV3 does not have any buttons being pushed and stops moving.**

➢ **When the receiver receives "1," it knows that the controller's orange button is being pushed and the receiver moves forward.**

➢ **When the receiver receives "2," it knows that the controller's left button is being pushed and the receiver turns left.**

➢ **When the receiver receives "3," it knows that the controller's right button is being pushed and the receiver turns right.**

Summary:
EV3 Interactions Using Bluetooth

Controller Program		Receiver Program	
controller button pushed ⬇	Via Bluetooth, the controller sends this message ⬇	Via Bluetooth, the receiver receives this message ⬇	receiver action ⬇
no button	"0"	"0"	does not move
orange	"1"	"1"	moves forward
left	"2"	"2"	turns left
right	"3"	"3"	turns right

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Part 2: Running the Programs!

- **Now that you understand how the programs work, let's download them onto the EV3s!**

- **Once groups have the controller/receiver programs working and have some practice with remotely controlling their taskbots, we'll organize a game of robot soccer!**

Change the Receiver EV3 Name

Since the class will have more than one EV3 robot using Bluetooth at the same time, it is best to change the receiving EV3s' names to something unique so that they are easily recognizable from each other.

To do this, follow the instructions below and on the following slides:

- **Turn on the receiving EV3 and use the USB cord to plug it into the computer.**

- **Launch "LEGO MINSTORMS EV3" software on the computer.**

- **Open a new or existing program.**

Change the Receiver EV3 Name
(continued)

○ **Look for a gray panel of buttons to appear in the bottom right corner of the screen.**

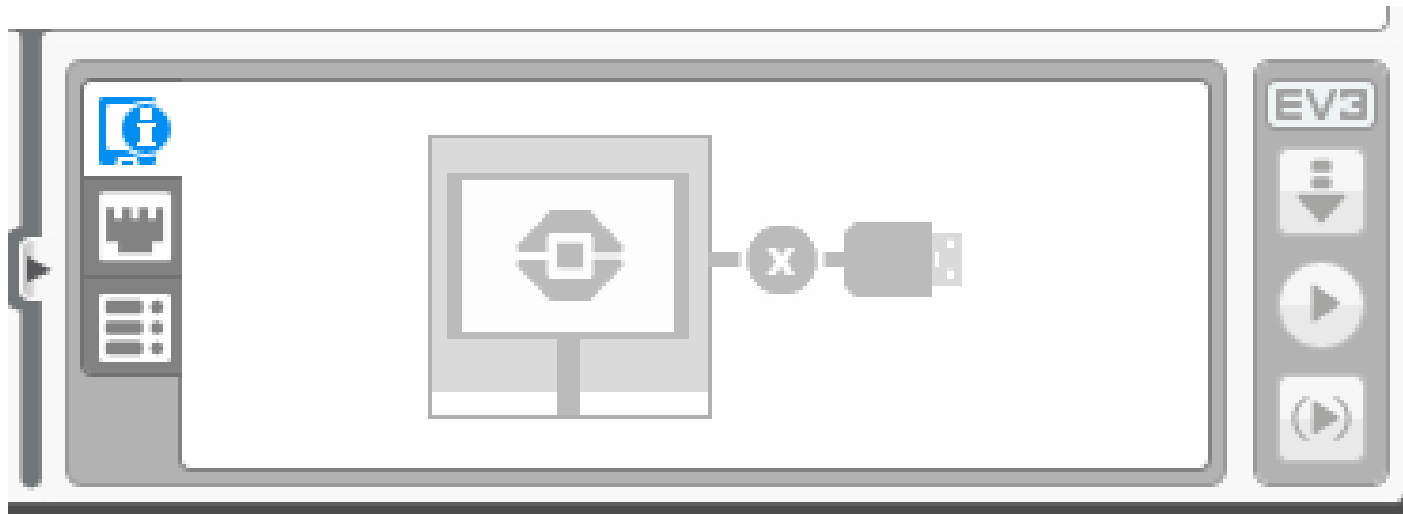○ **Click on the button with a picture of the EV3 brick on it.**
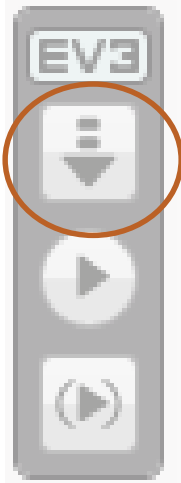
Change the the Receiver EV3 Name
(continued)

- **A window appears** (see below)

Downloading Instructions

Now you are ready to download the controller and receiver programs onto both EV3 bricks.

Note: These two programs are provided so you do not have to create them—no programming is necessary for this challenge.

1. **Download the receiver program, Receiver.ev3, onto the EV3 that will be receiving messages, which should be an EV3 on a taskbot that can move.**

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Downloading Instructions
(continued)

2. **Download the controller program by performing these steps:**

   - **Open the controller program, Controller.ev3, on the computer and highlight the second block.**

   - **In the field next to "Connect To," type in the unique name you gave your receiver robot.**

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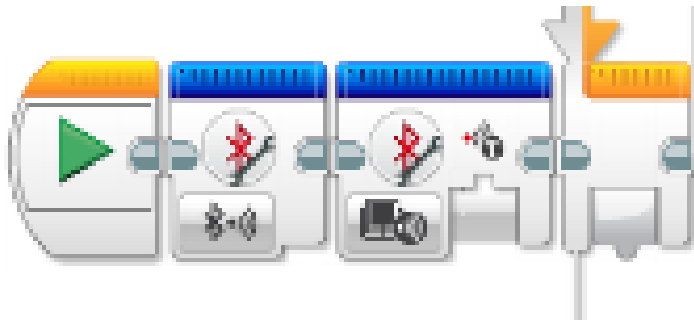
Downloading Instructions

(continued)

- **Download the controller program, Controller.ev3, onto the EV3 that you want to use as a remote control device.**

- **(This order is important →) Begin running the receiver program on the receiving EV3. Then run the controller program on the EV3 that remotely controls it.**

Have fun!

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Post-Activity Quiz

1. **Explain how we used messages sent over a Bluetooth connection to enable one EV3 to be used to remotely control another.**

2. **What ideas do you have for how you might change the programming to accomplish different tasks using two EV3 bricks?**

3. **In your own words, what are the steps of the engineering design process? Which is your favorite step?**

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Post-Activity Quiz **Answer**

1. **Explain how we used messages sent over a Bluetooth connection to enable one EV3 to be used to remotely control another.**

   Let's call one EV3 the "controller" and the other EV3 the "receiver."

   When each button (orange, left, right) is pressed on the controller, it sends a distinct message ("1", "2", "3") via Bluetooth to the receiver. When no button is pressed on the controller, it sends another distinct message ("0") to the receiver.

   We programmed the receiver EV3 so that...
   when it receives "1" it moves forward
   when it receives "2" it moves left
   when it receives "3" it moves right
   when it receives "0" it does nothing

2. **What ideas do you have for how you might change the programming to accomplish different tasks using two EV3 bricks?** Answers will vary.

3. **In your own words, what are the steps of the engineering design process? And which is your favorite step?**

   The main steps: 1) understand the problem or challenge, 2) brainstorm and research to generate solution ideas and preliminary designs, 3) choose the best solution to pursue as the definitive design, 4) create a prototype, 5) test it and make improvements, 6) present the results and final solution.

Vocabulary

Bluetooth technology: A type of wireless electrical connection used for communication between two devices.

electrical connection: The link or bond that passes electricity between two or more things.

soccer field ➜