ثانويـة التكنولوجيـا التطبيقيـة
Applied Technology High School

Robotics II

Module 4: Bluetooth Communication

PREPARED BY

Academic Services Unit

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Module 4: Bluetooth Communication

Module Objectives

Upon successful completion of this module, students should be able to:

- Set up a Bluetooth connection between two NXTs.
- Send/receive messages wirelessly using send/receive message blocks
- Use one NXT robot as a remote control for another robot

Module Contents:

4.1 Introduction

Bluetooth is a wireless technology commonly used in cell phones, headsets, PDAs, laptops, and other portable devices to exchange information without the use of cables. Although its range is limited, it offers a means to communicate with devices using only a small amount of power. Figure 4.1 shows various devices that use the Bluetooth technology.

Figure 4.1: Devices with Bluetooth Technology

Bluetooth Communication in NXT-G programs can be used to:

1. Download an NXT-G program without the USB cable (wirelessly).
2. Exchange information between two robots such as soccer players.
3. Design a remote control to control a moving vehicle wirelessly

In this module, you will learn how to send/receive data wirelessly using send/receive message blocks.

4.2 Send Message Block

The send message block allows you to send a wireless message to another NXT. Send message block can be found in the Action group on the Complete Palette (see Figure 4.2). Figure 4.3 shows how this block looks when you add it to your program.

Figure 4.2: The Send Message Block on the Complete Palette

Figure 4.3: The Send Message Block

The send message block can be configured using either the configuration panel (Figure 4.4) or using data wires (Figure 4.5).

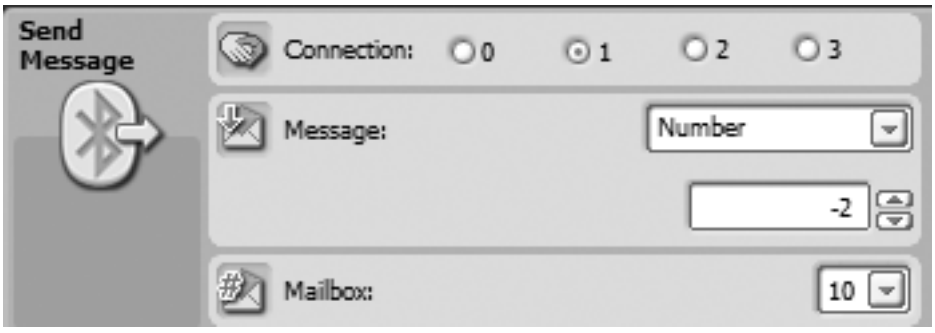


Figure 4.4: The Configuration Panel for the Send Message Block

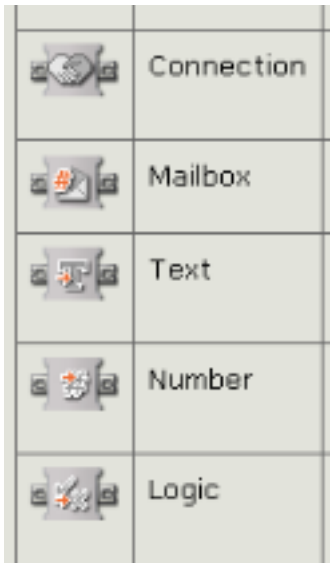


Figure 4.5: The Data Wires for the Send Message Block

To use the send message block, you set the following parameters; connection, message and mailbox

- **Connection:** Connection section is used to identify the connection number of the target NXT (the NXT that will receive the message). It is a value between 0 and 3.
- **Message:** The message section includes the message type and the message content. The message type (logic, number or text) can be selected from the drop-down menu. Then, you can write your message in the text box immediately below the drop-down menu.
- **Mailbox:** Each NXT brick has 10 mailbox numbers where wireless messages can be deposit or stored. Each mailbox number can hold up to five messages. If the mailbox number fills up with five messages, adding one more message will cause the NXT to erase the oldest message. For Example, if a send message block attempts to put a sixth value in Mailbox 5, the first value inserted into Mailbox 5 will be deleted.

4.3 Receive Message Block

The receive message block allows you to receive a wireless message from another NXT. Receive message block can be found in the Sensor group on the Complete Palette (see Figure 4.6). Figure 4.7 shows how this block looks when you add it to your program.

Figure 4.6: The Receive Message Block on the Complete Palette

Figure 4.7: The Receive Message Block

The receive message block can be configured using either the configuration panel (Figure 4.8) or using data wires (Figure 4.9).

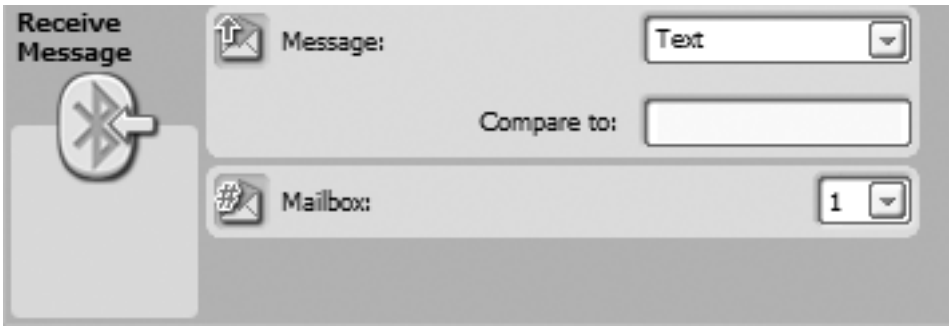


Figure 4.8: The Configuration Panel for the Receive Message Block

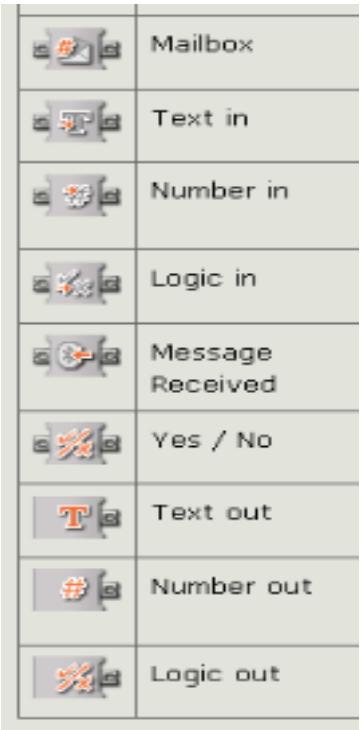


Figure 4.9: The Data Wires for the Receive Message Block

To use the receive message block, you set the following parameters; message, compare to and mailbox

- **Message:** The message section allows you to select the type of message being received (logic, number or text).
- **Compare to:** If you want to compare the incoming message with a test message, either type the test text or number or use the radio buttons to choose the logic test value (True or False). If the test message and the received message are the same, the Yes/No data wire will return a value of "1"; otherwise, it will return a value of "0".
- **Mailbox:** The mailbox identifies the receiver's mailbox where the sent message will be stored.

4.4 Lab Activity 1

Objectives:

1. Set up a Bluetooth connection between two NXTs
2. Understand the use of send message block and its configuration
3. Understand the use of receive message block and its configuration

Material per Group:

1. 2 NXT Bricks
2. 1 USB cable

Procedure:

Step 1: Turn on Bluetooth

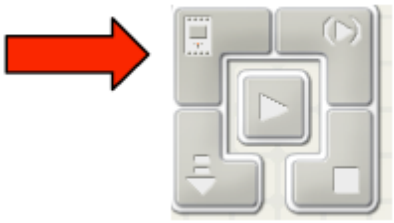
1. On both NXTs, scroll over to BLUETOOTH using the light grey arrows. Select BLUETOOTH by pushing the orange button.

2. Scroll over to ON/OFF using the light grey arrows. To turn on Bluetooth, select ON/OFF by pushing the orange button. When you select ON, a little Bluetooth symbol will appear in the upper left hand corner of the screen (see above picture).

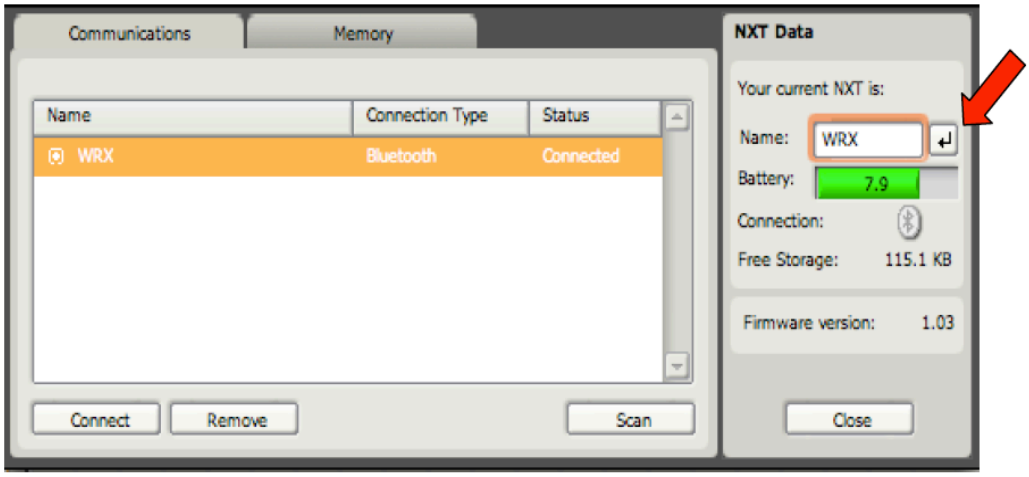
Step 2: Rename your NXT

It's easier to identify each NXT in the Bluetooth setup if each one has a different name.

1. In NXT-G, select your NXT WINDOW icon in your bottom right corner of the controller.



2. Select your NXT under your COMMUNICATION tab by clicking and highlighting it in orange. In the right panel there is a box to rename your NXT. Rename your NXT "WRX". Click the button to the right (see arrow) when done.



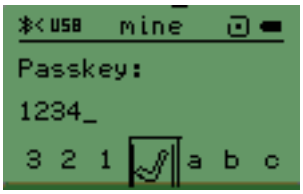
Step 3: Setup Bluetooth NXT-to-NXT Connection

1. Make sure that Bluetooth is turned on for both NXTs (see directions above).
2. On one NXT, scroll over and select the BLUETOOTH menu using the light grey arrow buttons.
3. Then, scroll over to SEARCH

4. Select SEARCH and choose your other NXT (look for the name). This needs to be done with only one of the NXTs. In this example, the second NXT is named "WRX".

5. You will then be prompted if you want to connect (choose yes) and then to choose a slot (the NXT can be connected to 3 devices at a time). Choose any slot.

6. If done correctly, each NXT will beep and be prompted to enter a passkey. The passkey is 1234 and should be automatically entered on the screen.



7. Select the checkmark on both NXTs by clicking the orange button to establish a connection. Connection can be verified by looking up in the top left corner. If the Bluetooth symbol only has a < sign next to it, no connection is made. If it has <> then a connection is made (see below circle).
8. After you have established a connection you will be able to see the

connection under BLUETOOTH→CONNECTIONS. Both NXTs will show the other.

Step 4: Sending and receiving messages

1. Create a new program and name it **sender**
2. Write the following NXT-G code:

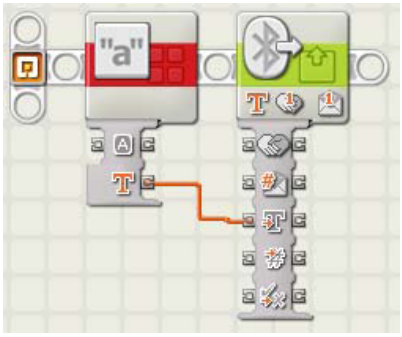
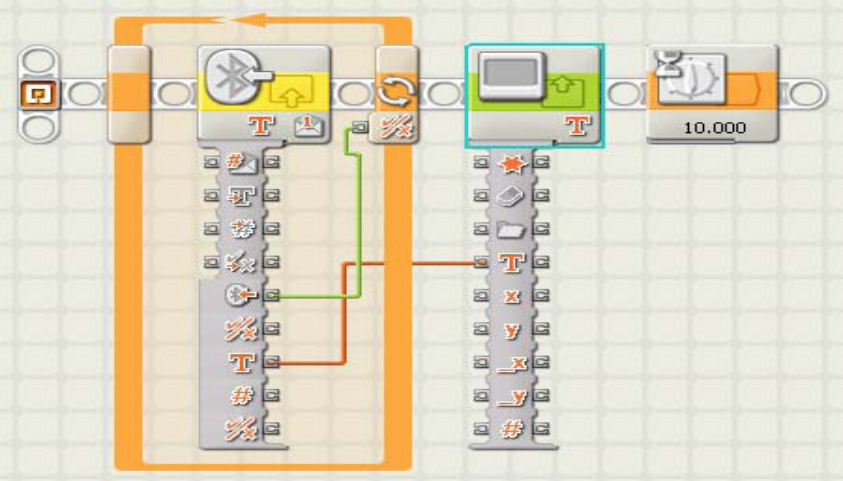


Figure 4.10: Sending a Wireless Text

3. Configure the programming blocks as follow:

Programming Block	Configuration
Text	• A→welcome • B→to • C→Class
Send Message	• Connection→ 1 • Message→ Text • Mailbox→1

4. Download the program on the sender NXT
5. Create a new program and name it **receiver**
6. Write the following NXT-G code:



7. Configure the programming blocks as follow:

Programming Block	Configuration
Loop	• Control→ logic • Until→ true
Receive Message	• Message→ Text • Mailbox→1
Display	• Action→ text • Clear→ checked
Wait	• Control→ Time • Until→10

8. Download the program on the receiver NXT
9. Run the program of the receiver NXT first. Then, run the program of the sender NXT.
10. What is the text displayed on the receiver NXT? _____
11. Update your NXT-G programs to send/receive numbers wirelessly and then display the numbers on the receiver NXT.

12. Write your updated program here:

Questions:

- **Explain the sequence of the sender NXT-G code:**

1. _____
2. _____

- **Explain the sequence of the receiver NXT-G code:**

1. _____
2. _____
3. _____
4. _____

4.5 Lab Activity 2

Objectives:

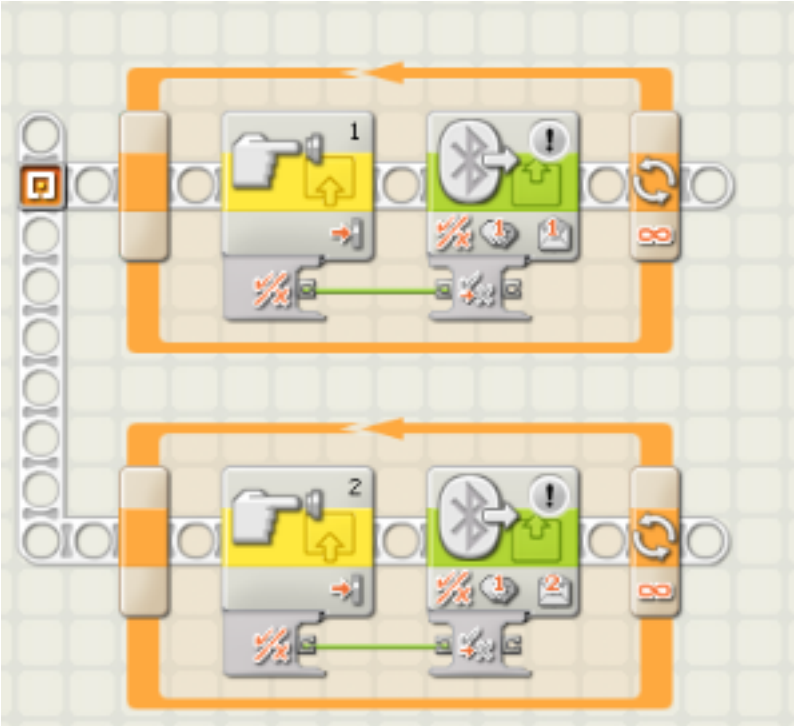
- Design a remote control to control a car wirelessly

Material per Group:

- 1 remote control (building instructions attached)
- 1 car (building instruction attached)
- 1 USB cable

Procedure:

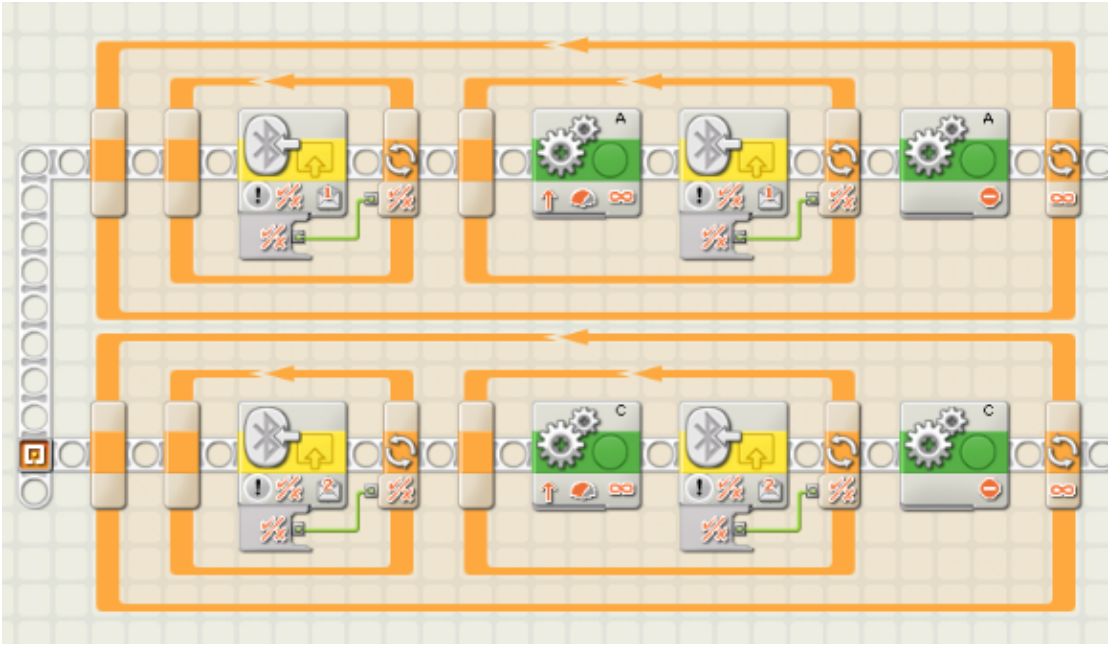
1. Setup Bluetooth Connection between the car and the remote control (Procedure is described in lab activity 1)
2. Write the following NXT-G code:



3. Configure the programming blocks as follow:

Programming Block	Configuration
Touch sensor (upper)	• Port →1 • Action→pressed
Touch sensor (lower)	• Port →2 • Action→pressed
Send message (upper)	• Connection→ 1 • Message→ logic • Mailbox→1
Send message (lower)	• Connection→ 1 • Message→ logic • Mailbox→2
Loop	• Control→ forever

4. Download your program on the remote control unit.
5. Write the following NXT-G code:



(Try to figure out the configuration of the blocks on your own)

(**Note:** the data wire of the received block connected to the loop is True/False plug (result of the comparison))

6. Download your program on the car unit.
7. Connect both motors of the car unit to ports A and C.
8. Run both programs.

9. Press the touch sensor connected to port 1 on the remote control unit. What do you observe?

   _____

10. Press the touch sensor connected to port 2 on the remote control unit. What do you observe?

    _____

11. Press both touch sensors on the remote control unit? What do you observe?

    _____

Question:

- **What is the use of the following loop block in your program?**

_____

_____

_____

_____

_____

_____

4.6 Review Exercise

1. Write an NXT-G code for the sender and receiver units that will do the following (use NXT-G software)
   - The sender unit will read the sound level
   - The sender will display the sound level values on its screen and send them wirelessly to a receiver unit
   - The receiver unit will receive the sound level values.
   - If the sound level values are more than 50%, the receiver unit will move forward; otherwise, it will stop moving.

   Write your program here:

Sender Code:
Receiver Code:

2. Identify the setting of the following send/receive message blocks. Fill the required information in the below table:

				
Connection				
Mailbox				
Message type				

References:

- Kelly,F,G. (2007). *LEGO MINDSTORMS NXT –G Programming Guide.* Apress:USA