

Teaching mBot to Drive by Itself

An autonomous vehicle is a car (or airplane or drone) that is able to move without a human driver. You can make mBot travel a route on its own with the Draw and Run feature in the Makeblock app. But as you've seen, its path isn't very precise. You'll have better accuracy if you write a program to control mBot's movement.

mBlock Blockly Overview

Open the mBlock Blockly app on your mobile device. (If you have the Makeblock app open, close it before opening the mBlock Blockly app.) You can access several tutorials by tapping the mBot button; if your teacher doesn't assign tutorials to you, you can look at them later if you have questions about programming mBot.

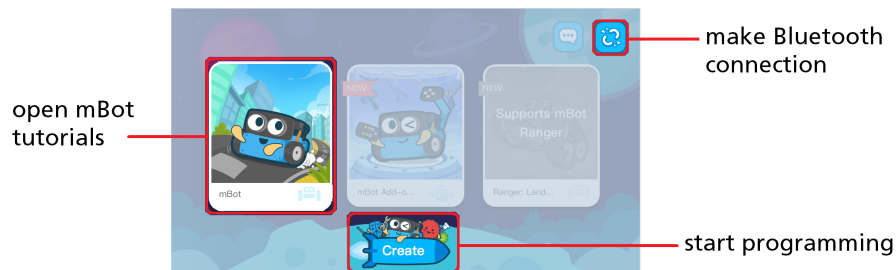


FIGURE 1 Main screen of the mBlock Blockly app

Your First mBot Program

Let's write a program to direct mBot to drive forward quickly for 2 seconds, turn right, and then drive backward slowly for 3 seconds.

1. To start programming in mBlock Blockly, tap Create (see Figure 1). In the programming platform (see Figure 2), you will find the programming palettes. The palettes contain blocks that snap together to build a program.

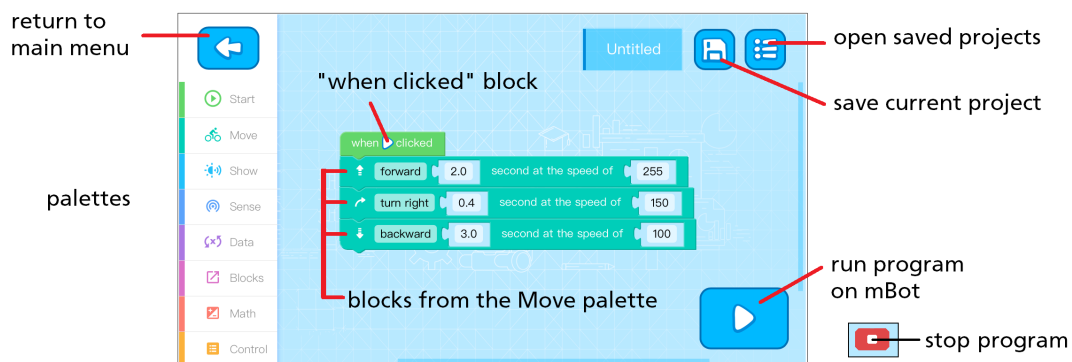


FIGURE 2 mBlock Blockly programming platform

TIP If you ever need to delete a block, simply drag it back toward the left sidebar. A trashcan will appear. Drag the block to the trashcan.

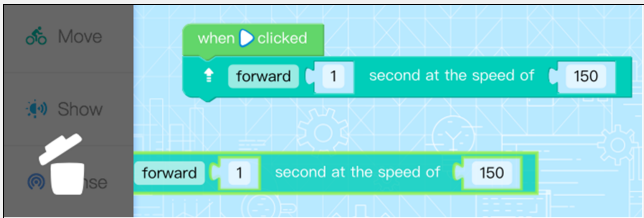

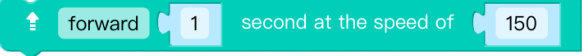


FIGURE 3

2. Every program you write for mBot must start with a "when clicked" block, which can be found in the Start palette. Tap the Start palette and add the "when clicked" block to the programming area.

TABLE 1		
Palette	Block	
Start	"when clicked"	
Move	"move forward"	

3. Next, find the "move forward" block in the Move palette. Add the "move forward" block to the programming area, and move it underneath the "when clicked" block. As you move the blocks close together, the blocks will snap together.

We call this a "move forward" block because forward is the default setting, but notice that there are three fields that can be modified:

- **Direction:** When you tap the direction field, you can choose forward, backward, turn right, or turn left. This means you can use the same block to make mBot move forward, backward, or turn. For this first block, set the direction to forward.
- **Duration:** The next field sets duration. Notice that when you tap the duration field, you can set a value for the number of seconds. Since mBot should initially move for 2 seconds, set the left column to **2** and then tap the green check mark.
- **Speed:** When you tap the speed value, you'll notice that the default is set to fast (150). You can use the slider to set the speed to slow (100), fast (150), or fastest (255). Our first task is to make mBot move quickly, so slide the switch all the way to the right and then tap the green check mark.

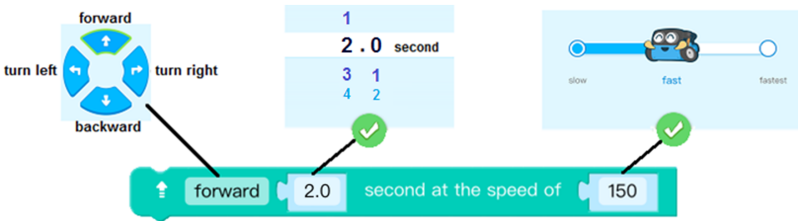



FIGURE 4 Editing a "move forward" block

4. Save your work so far by tapping Save, . Enter **First Drive** as the name.
5. The next step of our program is to direct mBot to make a right turn. To do this, add a second "move forward" block to the programming area. Set the direction to "turn right." Note that in the First Drive program in Figure 5, we reduced the duration to 0.4 seconds. When we had duration set to 1 second, mBot turned around so far it was driving forward, but back toward the starting point rather than continuing in the original direction. You will need to test to find the best duration for your robot and the environment. The value will be affected by the type of floor covering and the amount of charge in the mBot battery.
6. The final step is to make mBot move backward slowly for 3 seconds. Add a third "move forward" block to the programming area and connect it to the bottom of the code. Adjust the direction, time, and speed. Your final program should look similar to Figure 5.

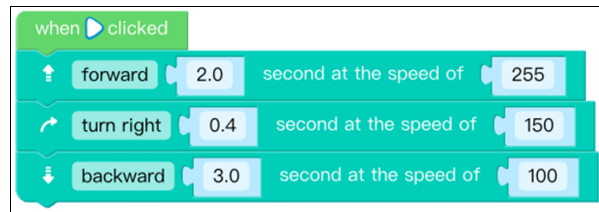






FIGURE 5 First Drive program

Try It Out

Let's test the First Drive program. Place mBot on the floor in an open space. Tap Run, . Your code will automatically be sent to mBot. You should see your mBot drive forward quickly, turn right, and drive backward slowly. **NOTE** After tapping , notice that the icon changes to Stop, . Tap  to stop the program.

Did your mBot follow the correct sequence? If not, adjust your program and test it again.

When you are done, make sure you have saved your project. You will use this program as a starting point in other activities in this module.

TIP When you first opened the mBlock Blockly app, you were probably asked to connect to mBot. If you did not connect it when you opened the app, you will see a message asking you to connect. Hold your device close to mBot and tap Connect Now.

Challenge Extension

Find the Optimal Delivery Route

For many delivery services, the so called *final mile* (the last mile of delivery to the delivery address) is considered the most expensive step. Time is often lost while drivers search for addresses and shuffle through packages. An autonomous delivery system could save time and money. Your task is to plan the most efficient route for your mBot to deliver packages to four different locations:

- Lay out a delivery area on the floor approximately 2×1.5 m.
- Use small boxes or other objects to represent the delivery locations mapped in Figure 6. **NOTE** The exact placement of the locations is not important, but you may want to mark each location with a piece of tape in case mBot accidentally pushes an object away from its position.
- mBot must start and end at the warehouse. Your mBot does not have to physically stop at each location (in other words, simply driving by is enough), but mBot must pass by the front door of the locations (marked with a black dot). mBot can visit the delivery locations in any order you choose.
- You can use any speed setting and drive in any direction (even backwards), but mBot should not run into any buildings.
- Be sure to save your program while you are coding and when you are done!

How long did it take you to make all four deliveries? Do you think you can improve on your delivery route?

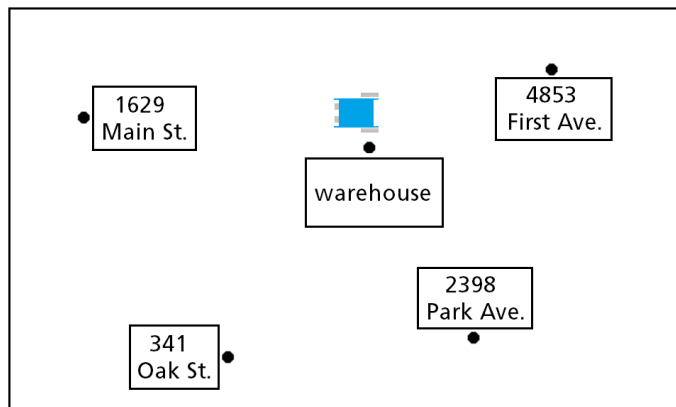


FIGURE 6