

# Chapter 12

## Motion Sensing Robot

Have you ever tried motion-sensing games, like the racing car? This kind of game requires us to control the movement of the car on the screen by changing the direction of the remote controller. It is extremely exciting! Our Maqueen Plus can also realize motion-sensing since the accelerometer on the micro:bit can detect the orientation of the board. With accelerometer and radio communication functions, we can make a similar motion-sensing game using Maqueen Plus.

## Goal



- 1.The basics of radio communication
- 2.Learn how to use accelerometer sensor

## Electronic Component



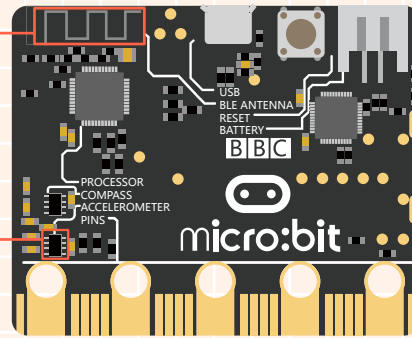
Figure of the Bluetooth and the acceleration sensor Figure of the Bluetooth and the acceleration sensor

### Radio Communication

Allow two or more micro:bits communicate with each other, receive and send radio signals

### Accelerometer

The accelerometer on the micro:bit detects the acceleration in 3 planes: x, y and z.



## Command Learning



### Block Brief

Radio set group

radio set group 1

Sets the group id for radio communications. A micro:bit can only listen to one group ID at any time.

Radio send number

radio send number 0

Broadcasts a number via radio to any connected micro:bit in the group.

Radio received

on radio received receivedNumber

Register code to run when the radio receives a number.

Gesture

on shake ▼

Do something when a gesture is done (11 gestures)

Show LEDs

show leds

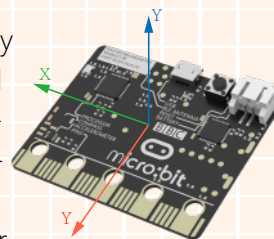
Draws an image on the LED screen.

## What is an accelerometer sensor?

An accelerometer is a device that can detect the change of an object's acceleration. The on-board accelerometer of micro:bit can sense motion of the micro:bit, including its movement, angle, gesture and so on.

### Introduction of the acceleration sensor

The micro:bit comes with a three-axis acceleration sensor that can detect gravity accelerations in three directions: x, y, and z. The measured value on each axis should be positive or negative. When the reading of one axis is 0, it indicates that the acceleration sensor is parallel to that axis. The different attitudes of the micro:bit is determined by calculating the vector sum of the three axes of the acceleration sensor x, y, and z. A vector is a quantity that has magnitude and direction, and vector sums refer to the sum of direction and magnitude.



## Hands-on Practice



### Motion Sensing Robot---Transmitting End

Before we start programming, let's analyze how do we use the accelerometer sensor in this project.

The movement of the robot car is controlled by the gesture of micro:bit. When micro:bit logo up, an "Up arrow" shows on the LED screen, and then the car moves forward; When logo down, show "Down arrow" and the car moves backward; tile left, show "left arrow" and the car turns left; tile right, show "right arrow" and the car turns right.

Tip: to realize radio communication, we need two micro:bits here. One for sending out signal (Transmitting end), one for receiving signal (Receiving end).

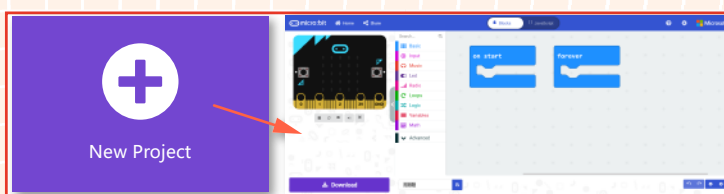
### Step 1 Create a New Project

1. Input <https://makecode.microbit.org/> into your browser to enter MakeCode editor.
2. Click "new project" to enter MakeCode programming interface.
3. Add the Maqueen Plus library: <https://github.com/DFRobot/pxt-DFRobot-Maqueenplus>

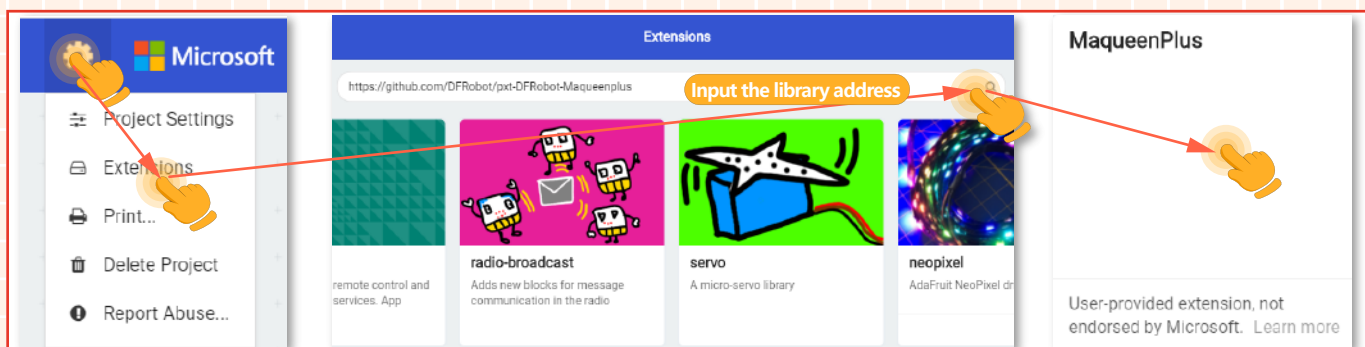
<https://makecode.microbit.org/>



1. Enter MakeCode editor



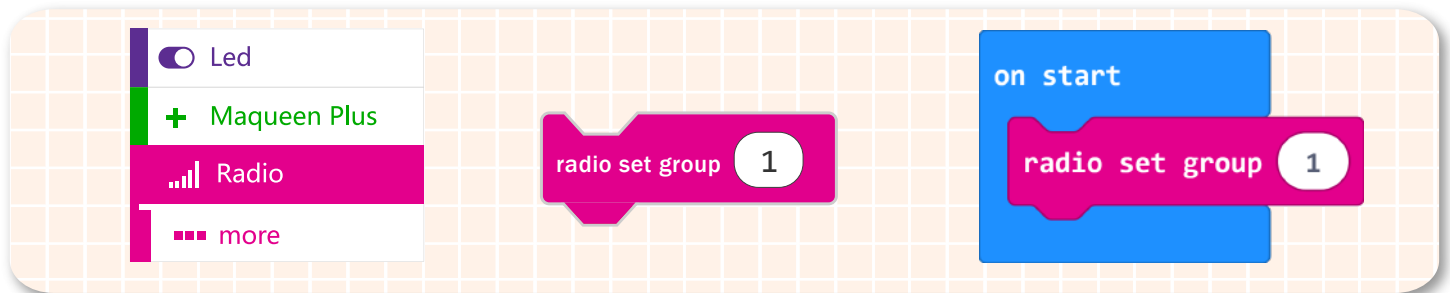
2. Enter programming interface



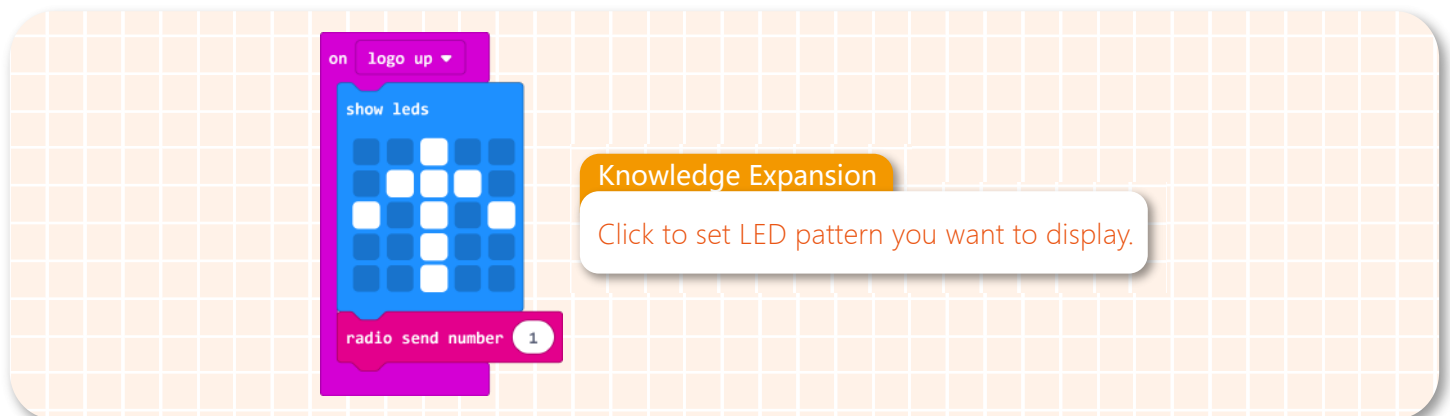
3. Add the extension library

## Step 2 Programming

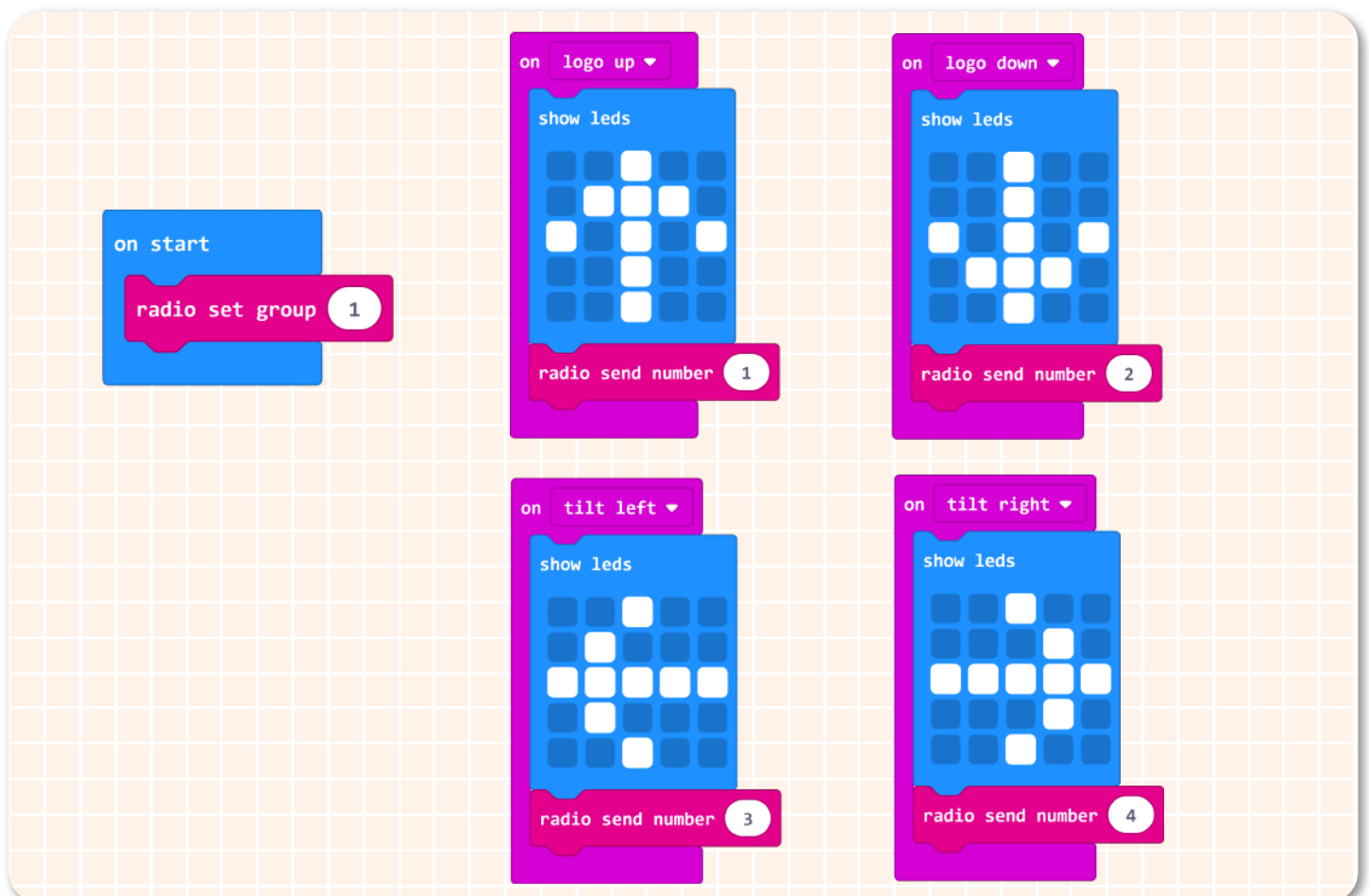
1. Enable the radio communication, set the radio group to 1.



2. When the micro:bit log up, show an "Up arrow" in its LED screen, and send data 1 via radio to the Maqueen Plus.



3. The programs for the rest actions of micro:bit are in much the same way. The whole program for the transmitting end is shown below:

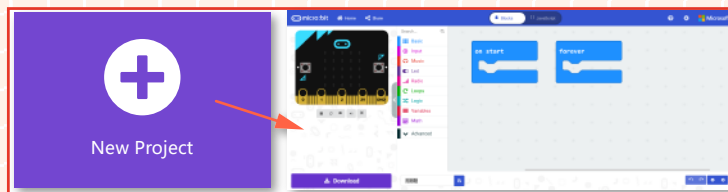


4. Name your project as "Motion sensing robot-Transmitting end" and download it into the micro:bit of transmitting end.

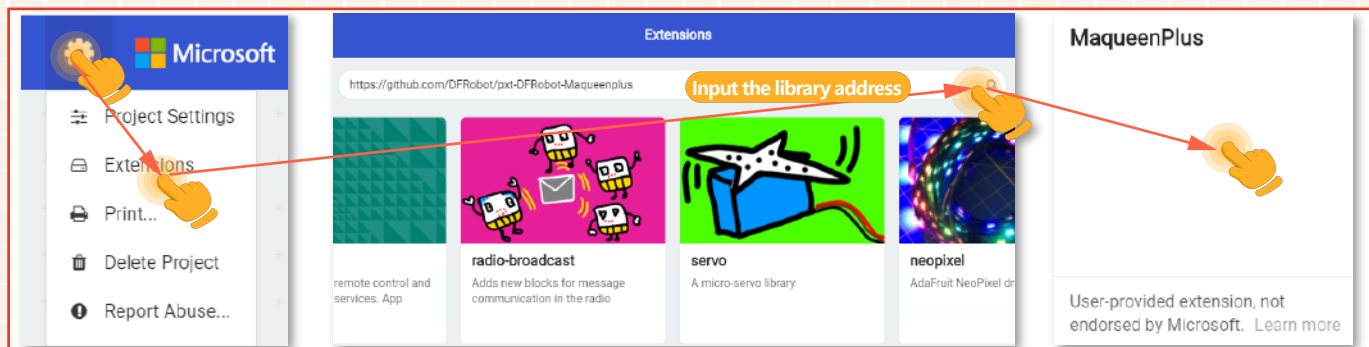
## Motion Sensing---Receiving End: Step 1 Create a new project

<https://makecode.microbit.org/>

1.Enter MakeCode editor



2.Enter programming interface



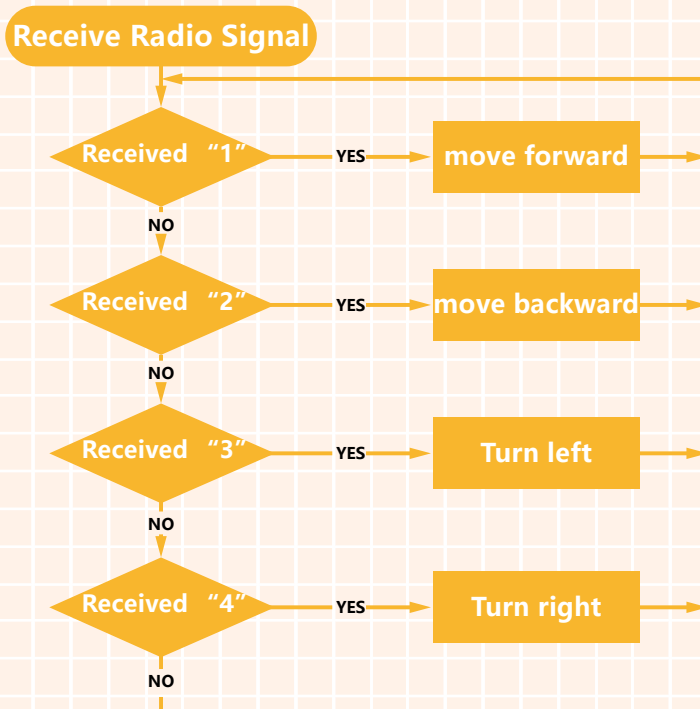
3.Add the extension library

## Step 2 Programming

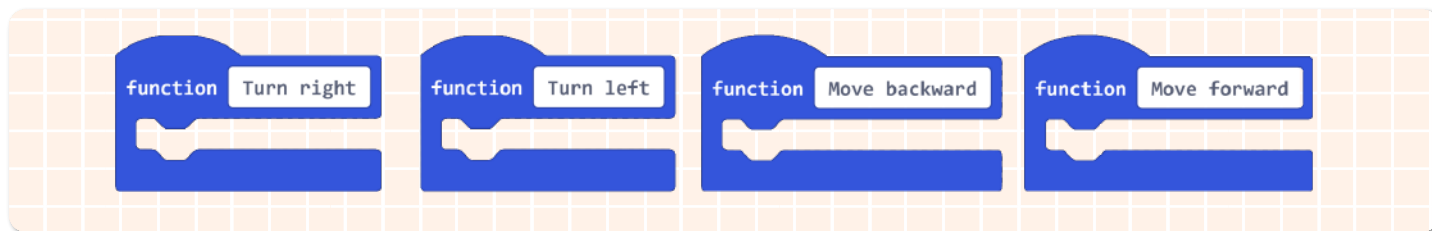
1.Enable radio communication function, set the radio group to 1. (The radio group of transmitting end should be in the same with that of the receiving end.)



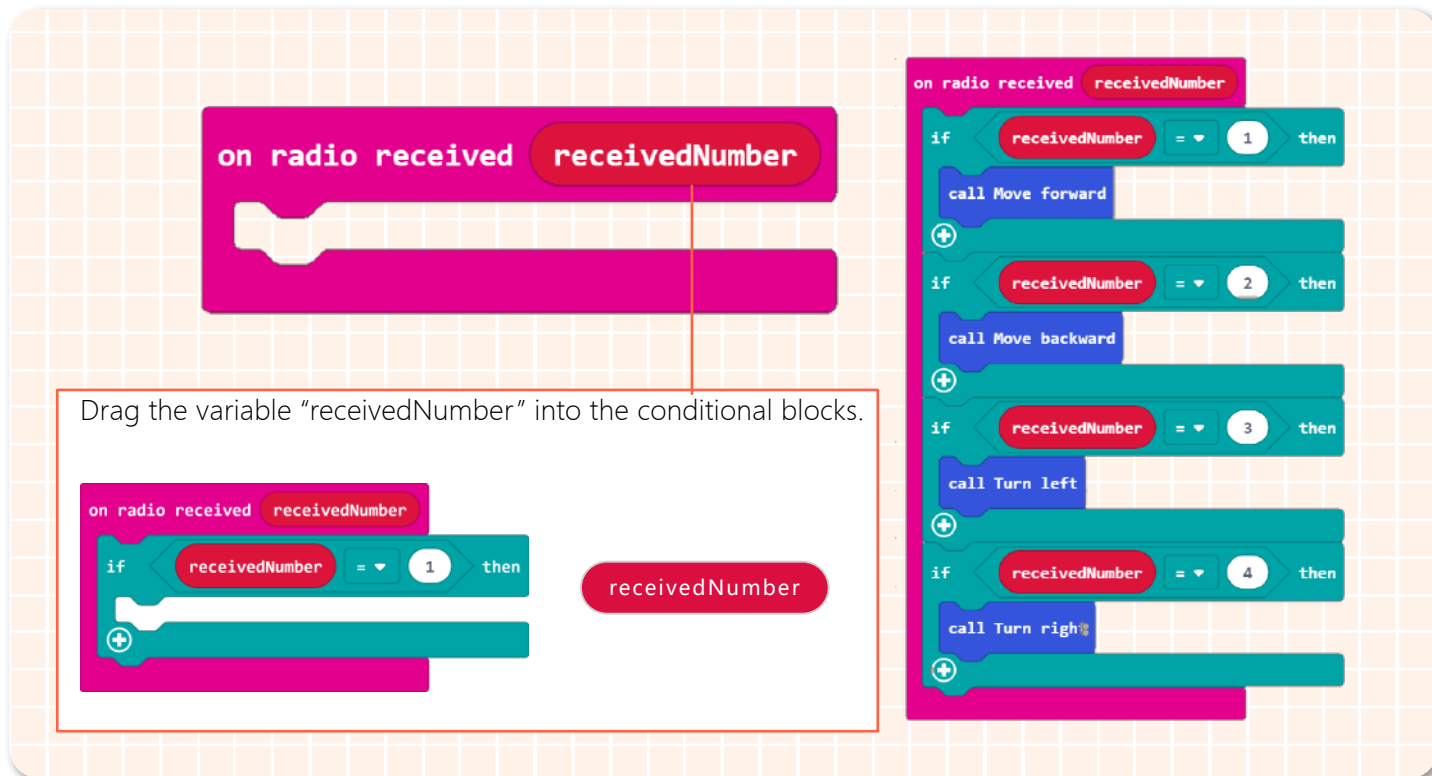
2.Program Maqueen Plus to react according to the received signal.



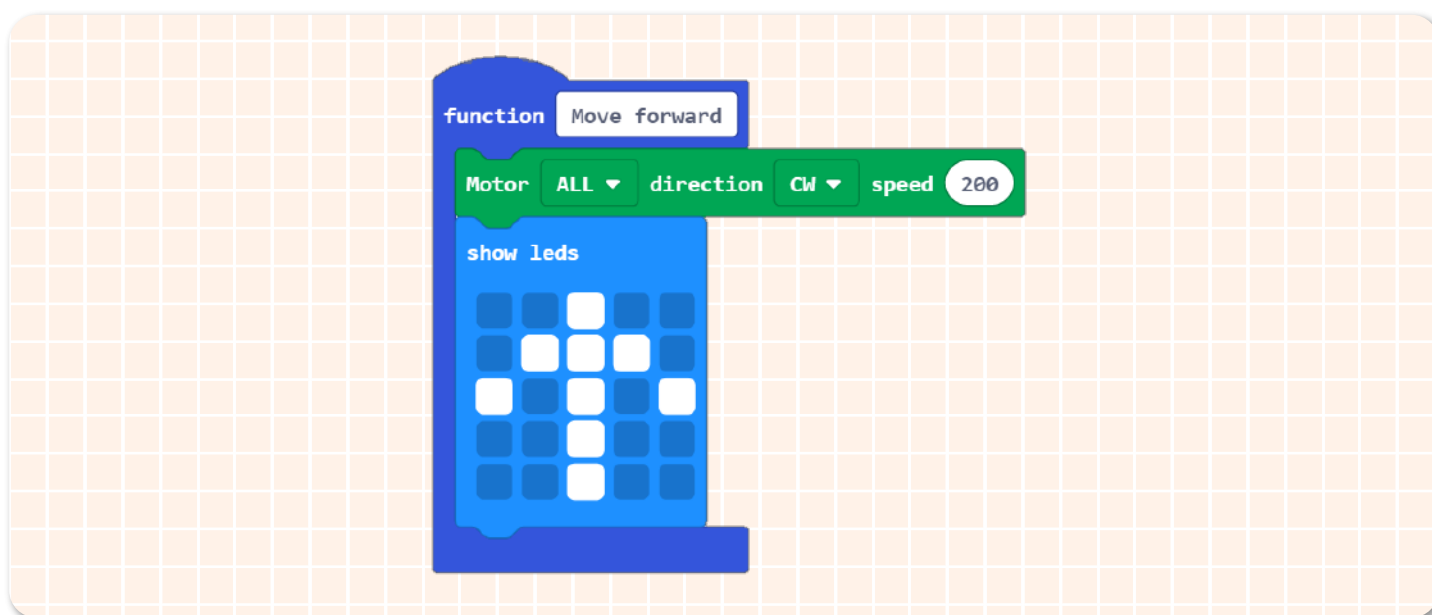
3. Create four functions "move forward", "move backward", "Turn left", "Turn right".



4. We have to use radio receive block to control the Maqueen Plus do different reactions according to the received data.



5. Take the function "move forward" as an example. When the Maqueen Plus car moves forward, we let its LED screen display an "Up arrow".



Please complete the rest functions by yourself.  
6.The program of the receiving end is shown below:

on start

radio set group 1

function Move forward

Motor ALL direction CW speed 200

show leds

function Turn left

Motor left direction CW speed 0

Motor right direction CW speed 200

show leds

on radio received receivedNumber

if receivedNumber = 1 then

call Move forward

+

if receivedNumber = 2 then

call Move backward

+

if receivedNumber = 3 then

call Turn left

+

if receivedNumber = 4 then

call Turn right

+

function Move backward

Motor ALL direction CCW speed 200

show leds

function Turn right

Motor left direction CW speed 200

Motor right direction CW speed 0

show leds

7.Name your project as "Motion sensing robot-Receiving end" and then download the program to the micro:bit in Maqueen Plus.

Effect Display

When completed all the above steps, turn Maqueen Plus’s power switch on, then we can use the micro:bit of the transmitting end to control our car. Give it a go!

Move forward

Note: only when powered on can the micro:bit board work, so the micro:bit of transmitting end should be always connected to a computer during operation.

Think & Explore

When playing a motion-sensing game, the larger angle we turn, the larger angle the object moves on the screen. How do we achieve this on our Maqueen Plus?