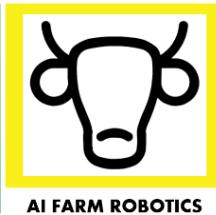# Robo:Car Educational Kits

Read me first!

Online MicroBit wiki: https://en.wikipedia.org/wiki/Micro_Bit

Download extension: https://github.com/MENG-Vathanak/ROBOCAR_CONTROL.git

Official makecode: https://makecode.microbit.org/

1. Introduction

Modern society is being driven at an astonishing pace by technological advancements, and STEM education (integrated education in Science, Technology, Engineering, and Mathematics) is receiving increasing attention as a key way to cultivate the next generation of innovative talent.

RoboCar is an educational 4WD omni-wheel robot designed for teaching robotics, coding, and sensor integration. It is built around the Micro:bit microcontroller, features a custom-designed aluminum frame, and is supported by a custom PCB and a Micro:bit MakeCode extension library. The platform enables educators to teach topics ranging from basic motion control to advanced robotics logic using real-world applications.

Micro:bit is significantly applied to STEM education, as a small microcontroller, which features small in size, easy to carry, and powerful function. At present, innovative technology products, like robots, wearable devices and interactive electronic games can be produced by programming and code. In this kit, we will guide you how to control and generate a Micro:bit RoboCar through programming in_makecode.
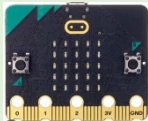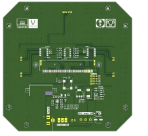
2. Key Feature
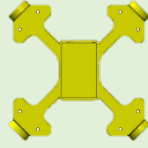
- *Micro:bit-based controller*
- *4WD omni-directional movement*
- *4 Servo motors support*
- *Built-in RGB LEDs (x4)*
- *Ultrasonic sensors*
- *Music output functionality*
- *Custom MakeCode extension library*

3. Specification

- *Working voltage: 3.3V Micro:Bit*

- *Input voltage: 7.4V-8.4V*

- *Motor speed: 5V 900rpm*

- *Motor drive mode: TB6612FNG*

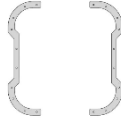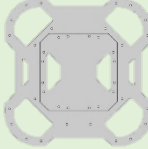- *Ultrasonic detection distance: 2cm-400cm*

- *Ultrasonic induction angle: < 15 degree*

- *Battery: 18650-lithium battery [7.4V, capacity 3400mAh]*

- *Frame: Aluminum*

- *Dc motor: 4WD (4-wheel direction)*

- *Weight:*

4. Product list

No	Name	Qty	Picture
1	Micro:Bit Main Board	2	
2	PCB Main Board	1	
3	Dc Motor	4	

4	Battery 7.4V	*1*	
5	*USB Cable Micro USB*	*1*	
6	Omni Wheel	*4*	
7	*2-slot battery holder* *1.5V AAA battery*	*11*	
8	Screw driver	*1*	
9	*Ultrasonic*	*1*	
10	Frame P1	*1*	
11	Frame P2	*1*	
12	Frame P3	*1*	
13	Frame P4	*1*	

14	Battery 1.5V AAA	2	
15	Jumper Wire	2	
16	Nut 3mm*	30	
17	Nut 3mm*	30	
18	Servo Motor	3	
19	Yahboom Remote	1	
20	Item1	1	
21	Item2	1	
22	Item3	1	

- Noted:

5. Micro:bit
5.1. About Micro:bit
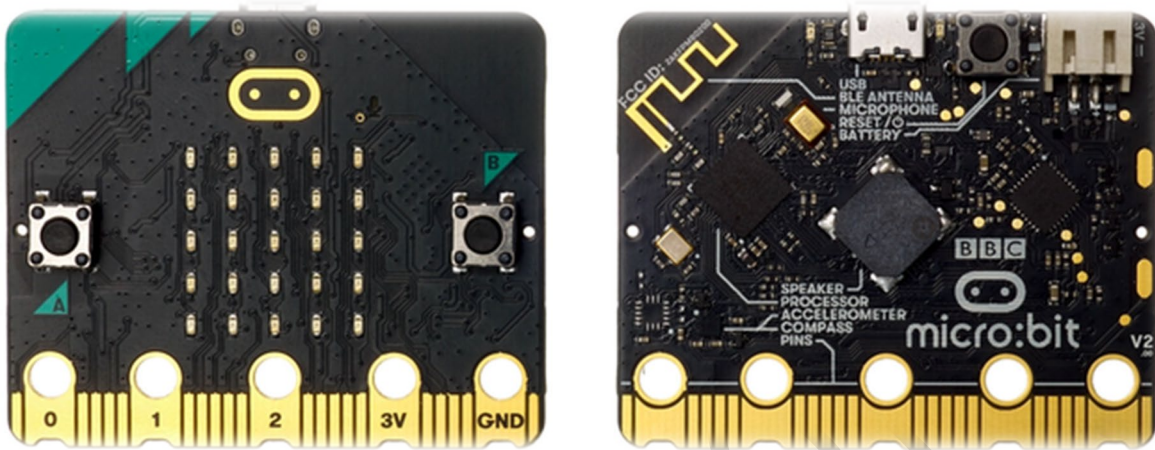
- *The BBC Micro:bit is an award-winning programmable device that allows students to get hands-on with coding and digital making. For more information, please go to*: https://microbit.org/get-started/what-is-the-microbit/

5.2. Micro:bit`s function

Main function of Micro:Bit

Features:

- *NRF511822 processor (16Mhz 32bits, ARM cortex-M0, Bluetooth 4.0 low consumption/2.4GHz RF wireless, 16KkB RAM and 256kB flash)*

- *KL26Z microcontroller (48Mhz ARM Cortex-M0+ core, 128kB flash)*
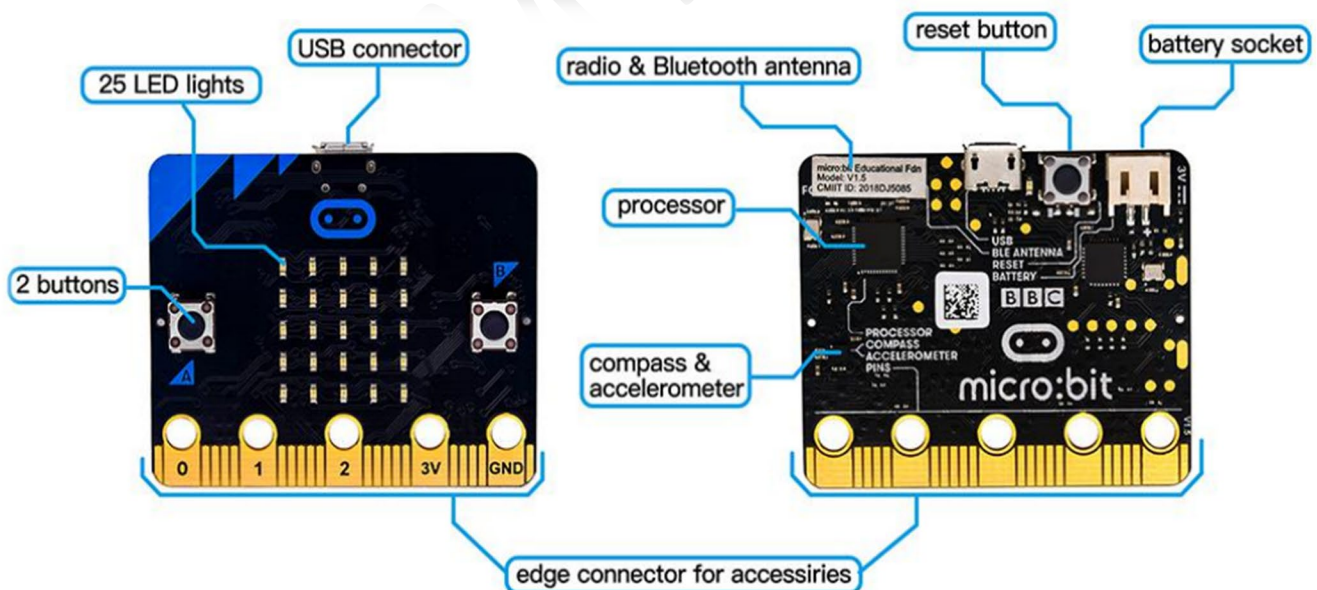
- *25 pcs programmable LEDs*

- *2 programmable buttons*

- *Physical pins*

- *Light and Temperature sensor*

- *Accelerometer (MMA86532 and I2C get the data from accelerator sensor)*

- *Geomagnetic sensor/compass (MAG3110, I2C obtain three-axis geomagnetic data)*

- *Wireless communication, by radio and Bluetooth.*

- *For more information Micro:Bit details, enter:* https://tech.microbit.org/hardware/

Micro:Bit`s Pins:

*Before getting started with the following projects, firstly need to figure out each pin of Micro:bit main board. The BBC Micro:bit has **25 external** connections on the edge connector of the board, which we refer to as "pins". The edge connector is the gray area on the right side of the figure below. There are five large pins, that are also connected to holes in the board labeled: **0, 1, 2, 3V, and GND**. And along the same edge, there are **20 small pins** that you can use when plugging the BBC Micro:bit into an edge connector.*

Please refer to the figure shown below:
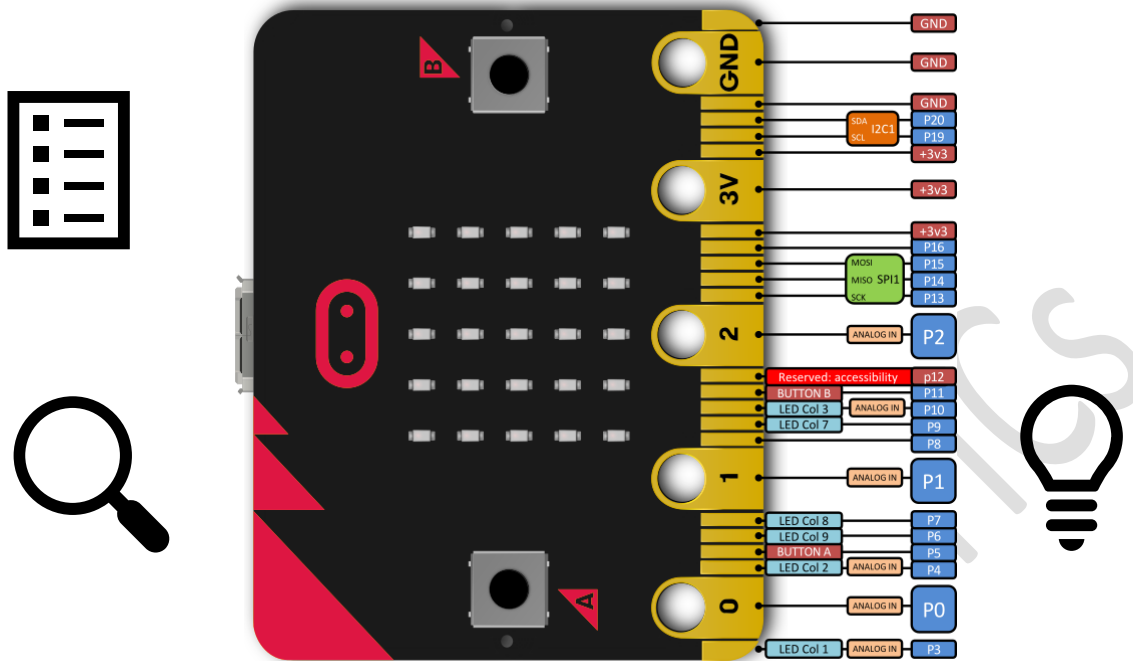
For more details please enter: https://makecode.microbit.org/device/pins

6. RoboCar Installation

RoboCar Assembly

Prepare all the materials as below:

- *Micro:Bit (MCU) x2*

- *Frame Robot (PART1, PART2, PART3, and PARt4)*

- *Main board PCB x1*

- *Dc motor 6v 900rpm x4*

- *Battery lithium 7.4V (x1) and Battery AAA 1.5V (x2)*

- *Omni wheel x4*

- *Battery Box x1*

- *Screw for Socket cap (3mm) x1*

- *USB Micro x1*

- *Ultrasonic x1*

- *Nut (3mm*10mm) x30Pcs*

- *Nut Socket Cap (3mm * 5mm) x30Pcs*

- *Jumper wire (optional)*

- *Servo Motor x2*

- *Yahboom IR remote control x1*

7. RoboCar Connection to Micro:Bit
7.1. Connections

Connection of Micro:Bit to RoboCar:

Micro:bit`s pin	Components of pin connected to	
P8, P9 & EN 8	*Motor 1*	*PCA1 ADD = 0x40*
P15, P16 & EN 1	*Motor 2*	
P10, P12 & EN 9	*Motor 3*	
P13, P14 & EN 0	*Motor 4*	
Driver Pins 0	*Servo 1*	*PCA2 ADD = 0x41*
Driver Pins 1	*Servo 2*	
Driver Pins 2	*Servo 3*	
Driver Pins 3	*Servo 4*	

P1	*Trig (T) of ultrasonic*
P2	*Echo (E) of ultrasonic*
P8	*Passive Buzzer*
P0	*RGB*

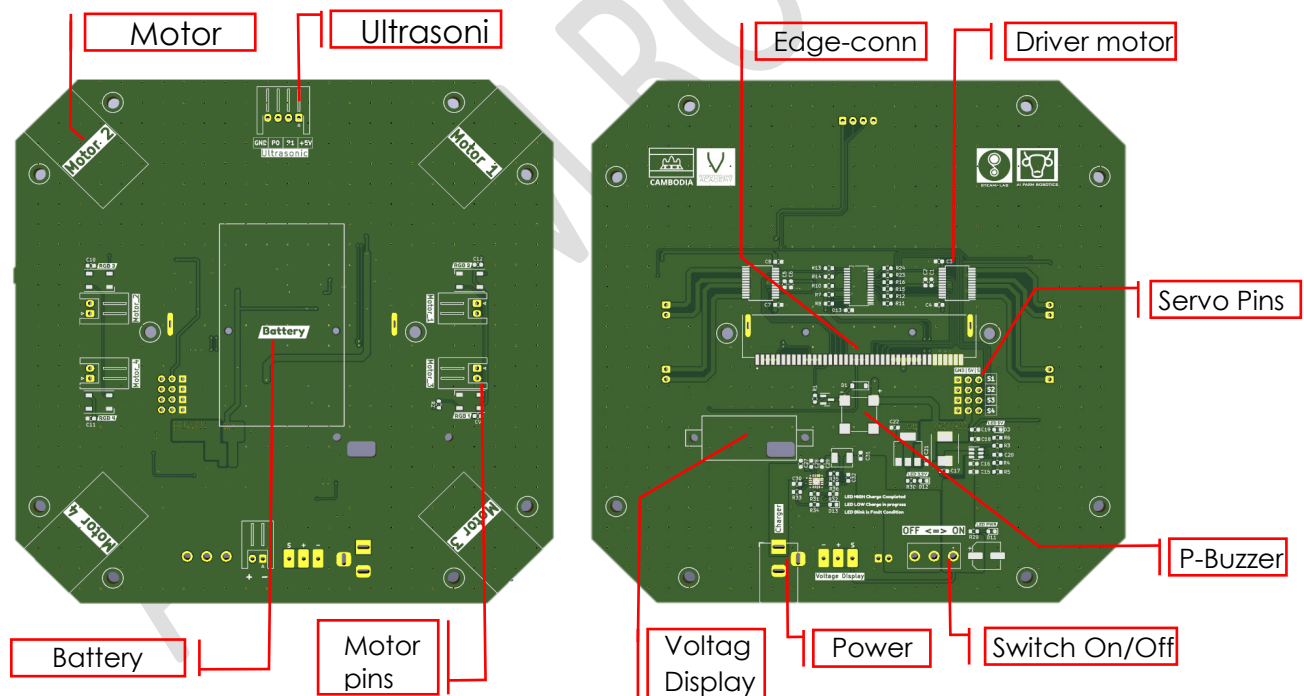- **Note: PCA1 address 0x40 for motor DC & 0x41 for Servo motor.**

For more details, please see GitHub:

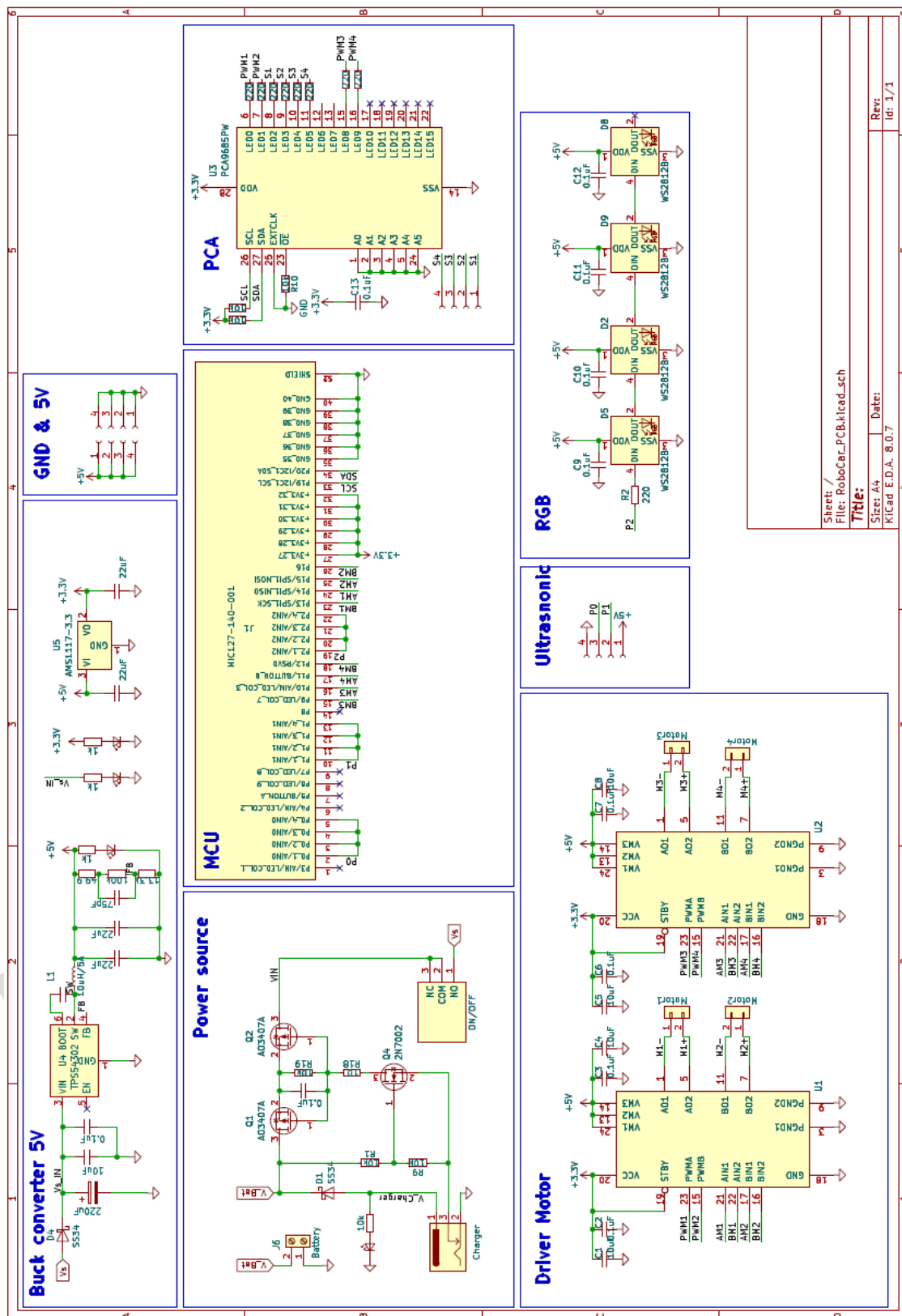https://github.com/MENG-Vathanak/ROBOCAR_CONTROL

Power supply:

- *This RoboCar is powered by battery (7.4V - 8.4V max).*
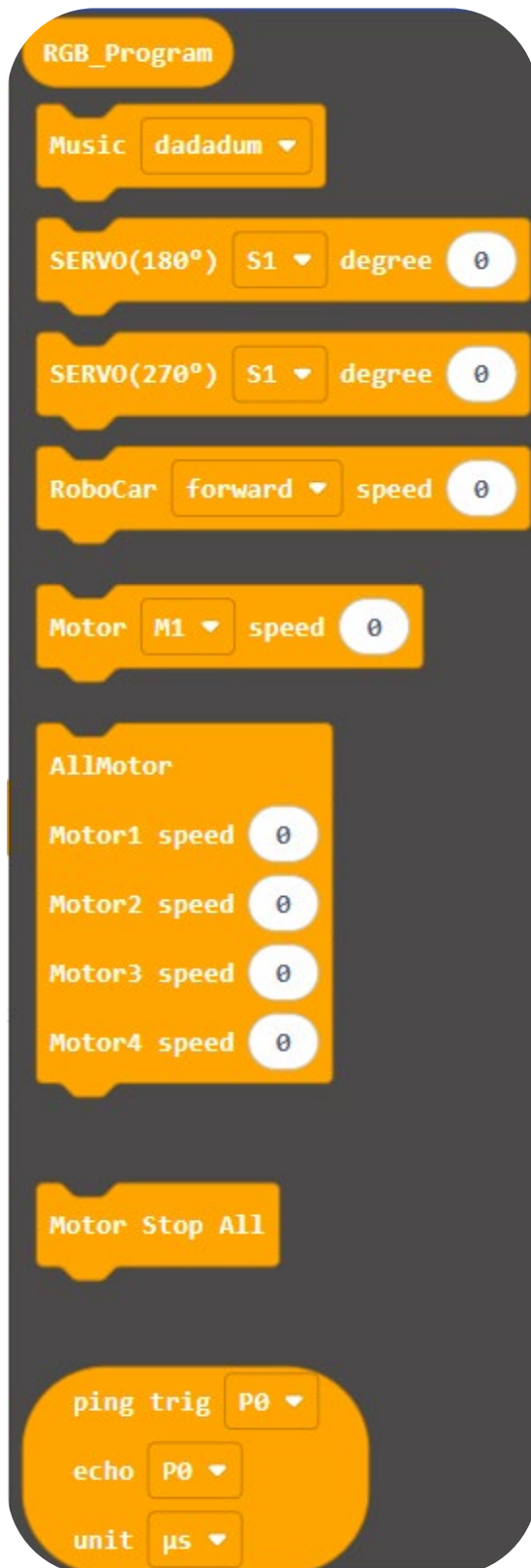
7.2. PCB`s RoboCar

RoboCar PCB Main functions

Schematic: Schematic`s RoboCar

7.3. Library

1. **RGB_Program**: *Control RGB light on RoboCar can be switch to many colors such as Red, Blue, Green…See example.*

2. **Music(dadadum)**: *this block can be control and choose many sounds in microbit.*

3. **Servo (180 & 270) degree**: *This block use to control servo motor which can turn to 180degree and 270 degrees.*

4. **RoboCar (forward) speed**: *This special one on RoboCar to control the movement forward, backward, leftside, or rightside… with speed (0- 255).*

5. **Motor (M1) speed:** *This block use to control the movement of each motor if you want to test the direction of motor with speed.*

6. **AllMotor:** *This block can be similar to Num 5, but this block can be added to all motor at the same time.*

7. **Motor Stop All**: *To stop all the movement of motor we can use this block.*

8. *Pin trig [P0]*
   Echo [P1]
   Unit [cm]: Is the block that we use to control with module ultrasonic that we have built on RoboCar.

- *RoboCar`s library, this library provides a set of tools easily program and control RoboCar using MakeCode for Microbit. This library was built to support such as Music, Servo 180 and 270degree, 4 wheels control movement such as (Forward, backward, leftside, rightside, rotateright, and rotateleft…), Each motor control with speed, all motor control with speed, and stop functions, Sensor Integrations, and Support wireless communication and advanced robotic_feature.*
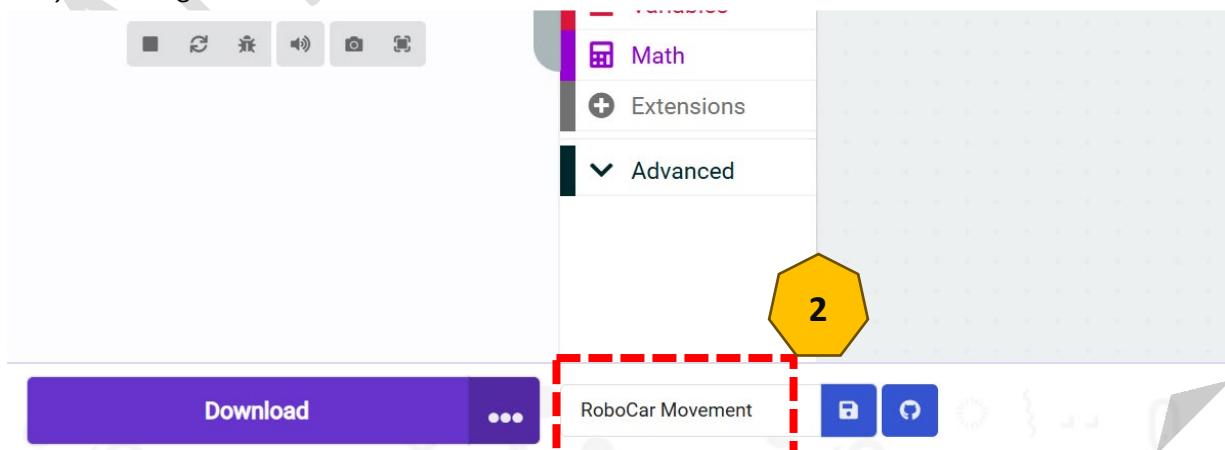
Library RoboCar installation:

- *Open the plat form such google chrome, safari, firefox, Opera, Brave.*

(**recommended Google Chrome**) *and go to* https://makecode.microbit.org/
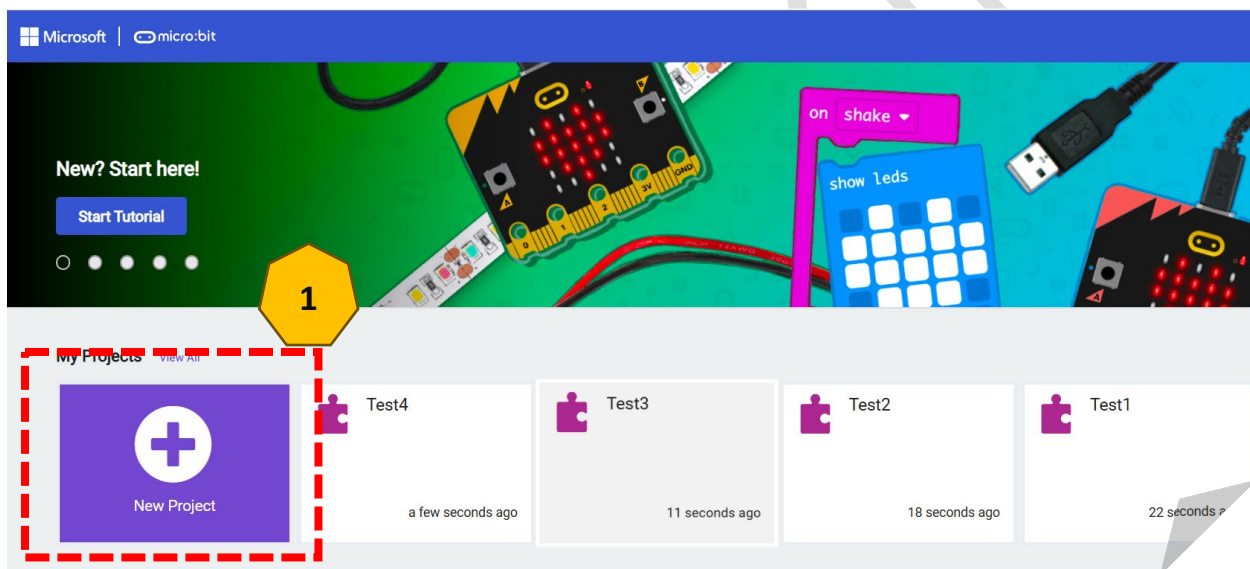

- *Click [+New Project], then name the new project to "e.g RoboCar Movement" and you will get the tab below:*

- *after create the project and named it already, go to "**EXTENSION**" follow to [Number 3] and you will see the slide below, go to search bar "Search or enter project URL…" follow to [Number 4].*
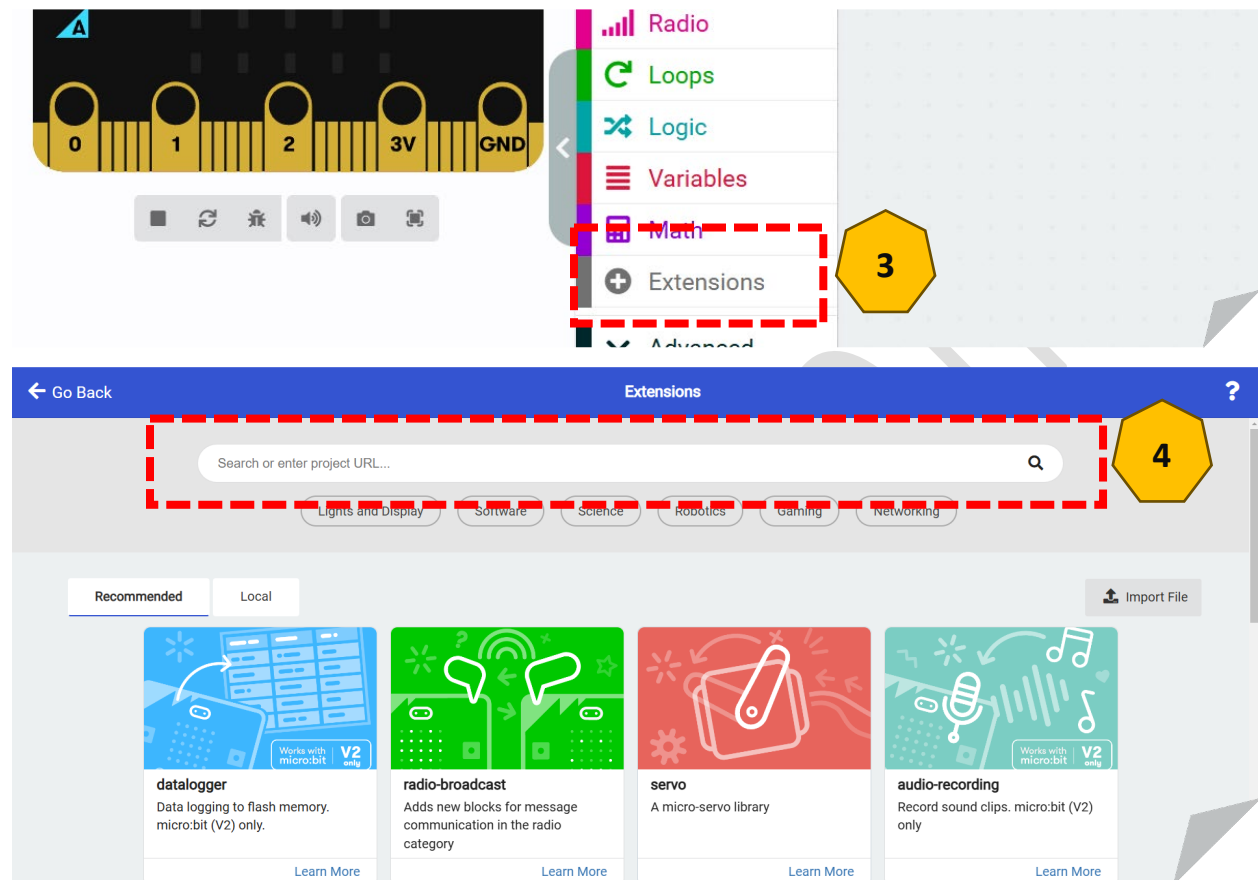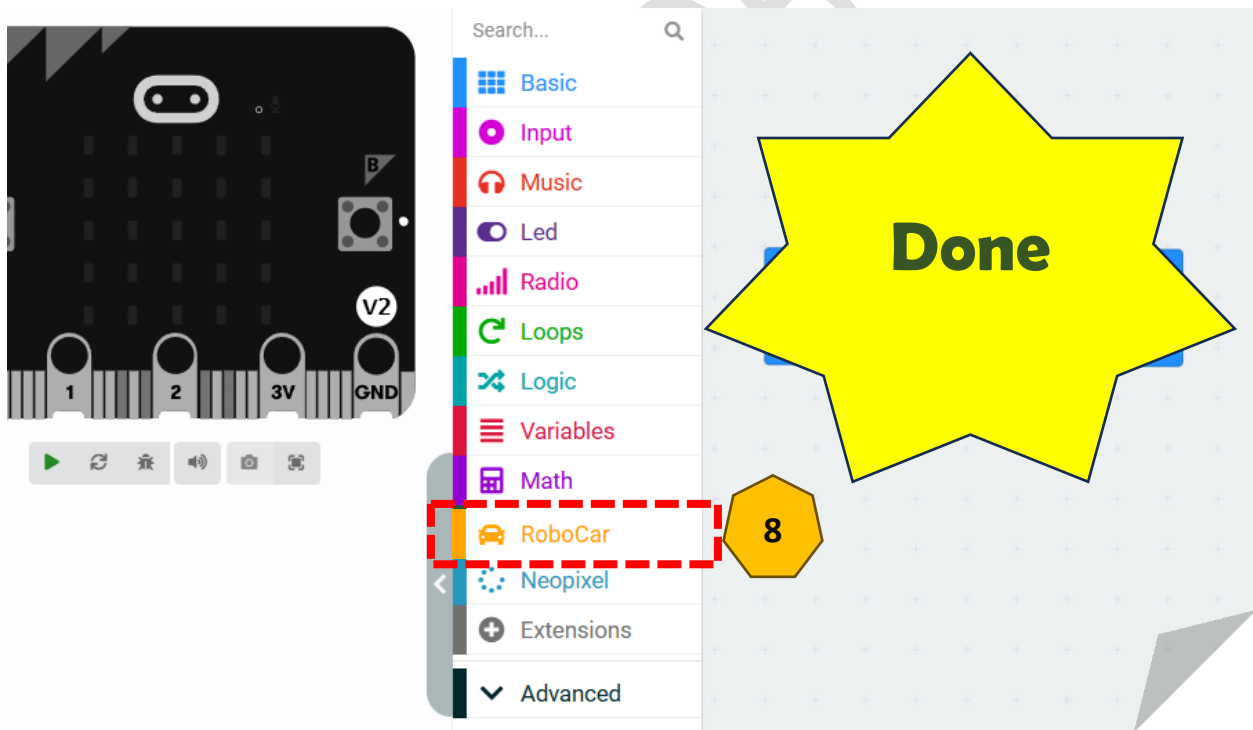

- *click on search bar, copy and paste this repo into search bar as figure below:*
  <u>https://github.com/MENG-Vathanak/ROBOCAR_CONTROL.git</u>
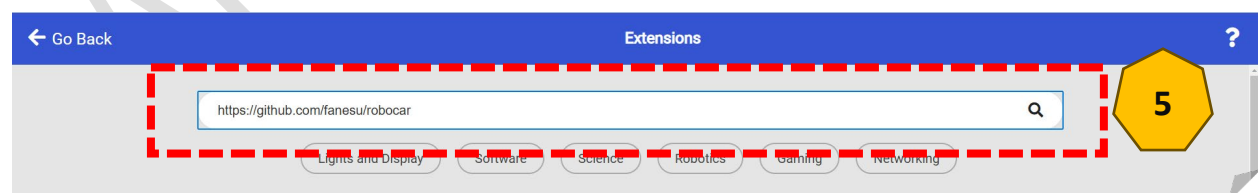
- *click "search" or this sign* 🔍 *then you will see the extension, then on click on the extension again. follow to [number 6] and [number 7].*
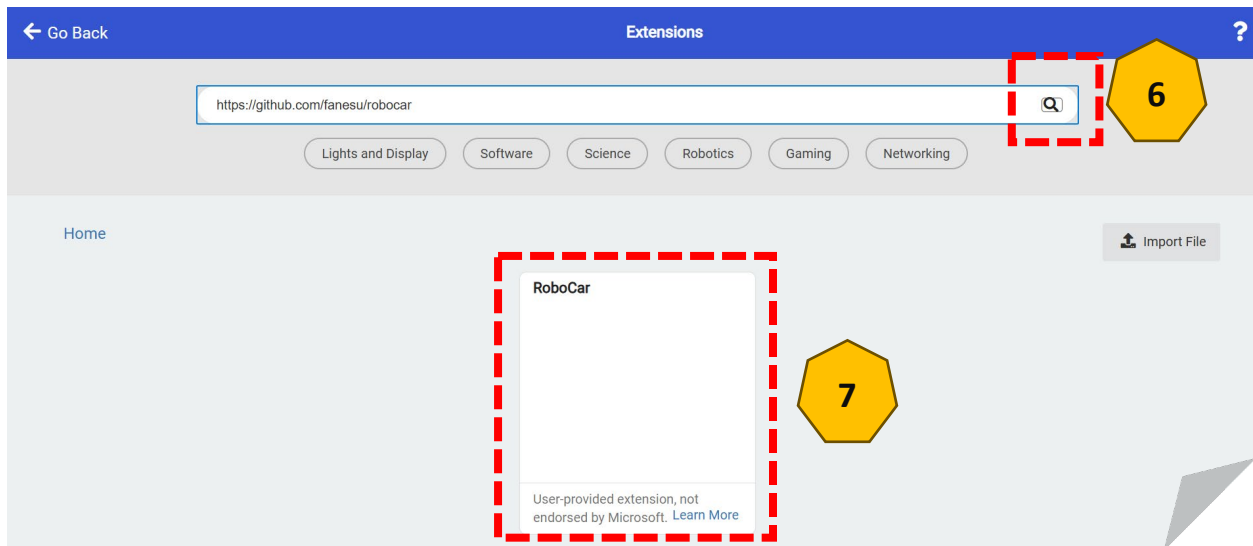
- *After clicked, the extension will be added and you will see:*

- *Click on RoboCar, and you will see the extension.*

Noted: The extension added into the project can be used for only one project, next time you create the new project add the extension as the process again.

Overview of RoboCar`s Library

- *In the library, RoboCar has 9 blocks which is having different function such as:*
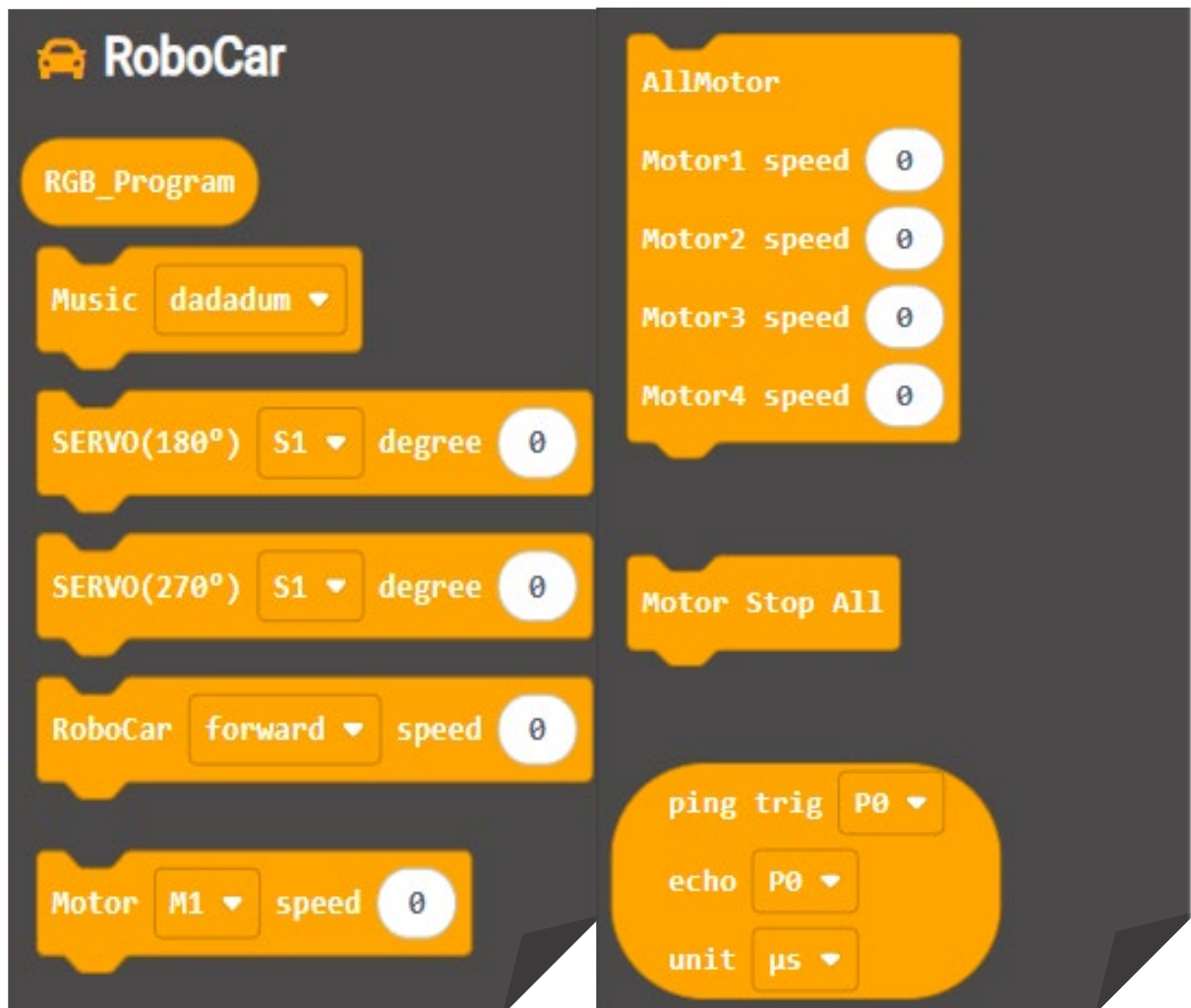
- *RGB Car program: control the RGB light built in RoboCar*
- *Music: play the "Music list" with the passive buzzer in RoboCar.*
- *Servo (180) and (270): control the servo motor with up to 4 servo motors*
- *RoboCar [Movement] speed (0): control the movement of 4 wheels omni with already set the directions (10 movements)*
- *Motor [M1] speed (0): this block was built to control the direction of each motor by changing the motor pins (M1, M2, M3 and M4) with speed (-255 to 255)*
- All motor: this block is use to control the 4 motors at the same time with speed and directions.
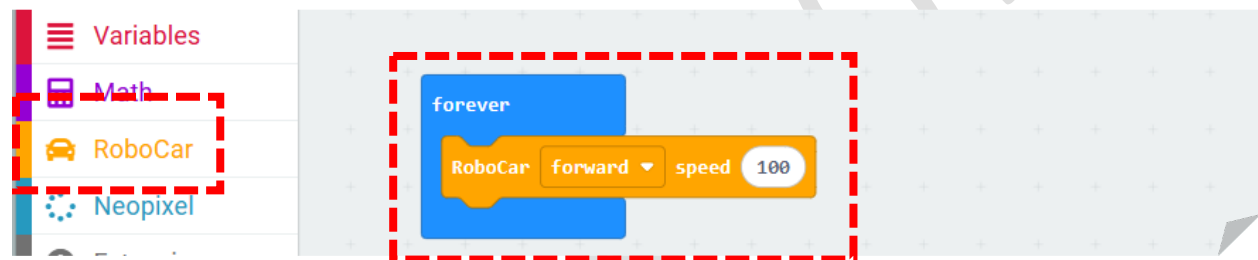
- *Motor stop all: use to stop all motor movements*

Program and Download process:

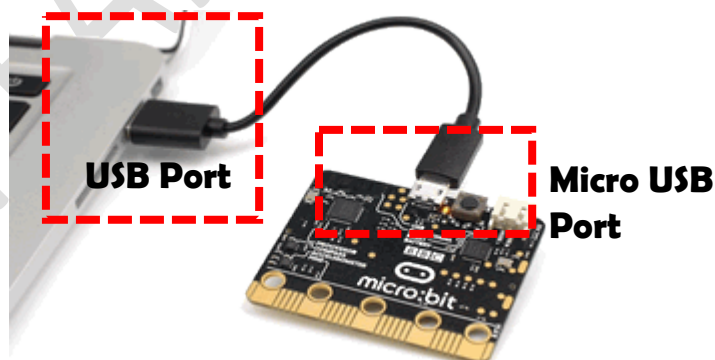*Let`s dive into the example of RoboCar and Download process*
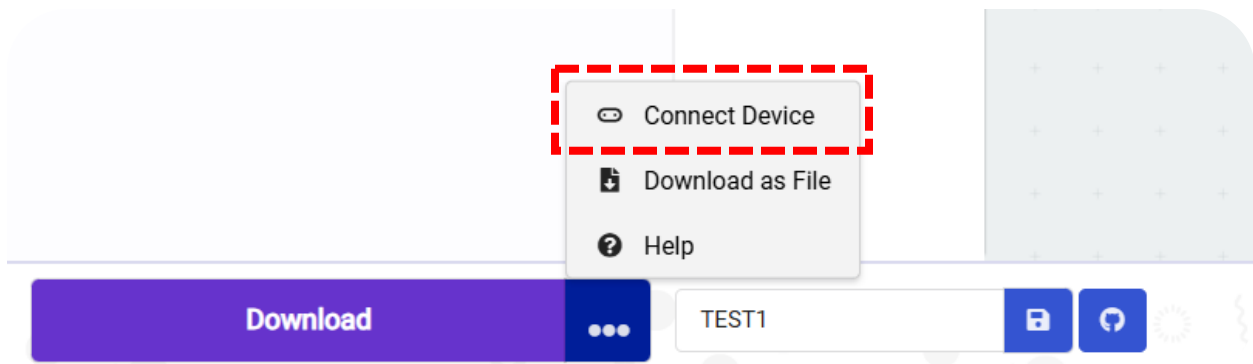
- *DC motor Control*
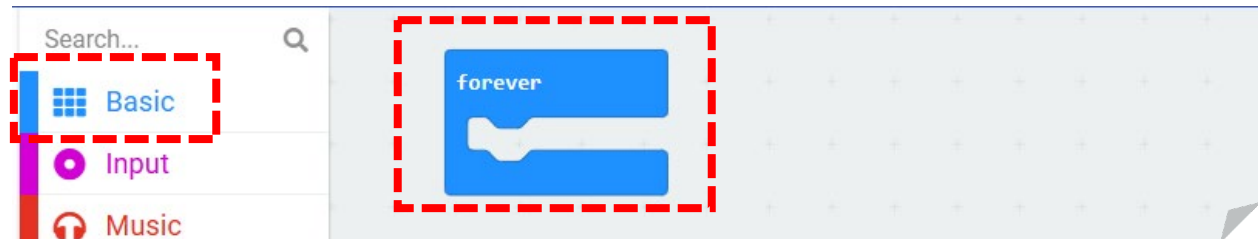
- Drag the "Forever" from basic extension to area block code

- *Drag the "RoboCar" forward speed (100) that you just added into "Forever" block as the figure above.*

- *Next, plug your USB to your computer and the Micro-USB to MicroBit:*
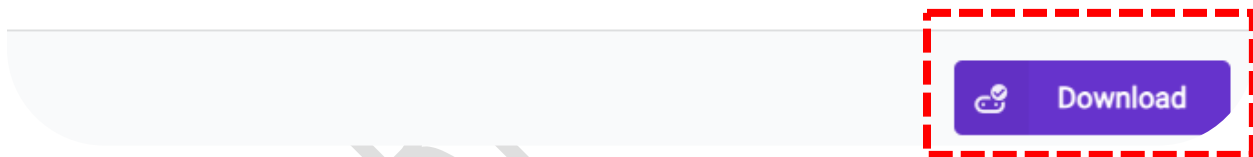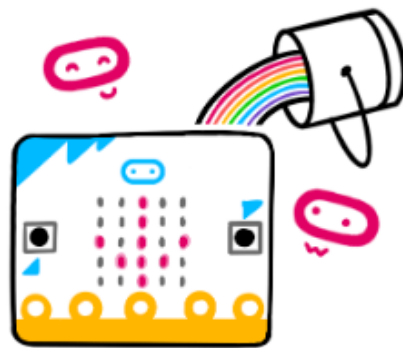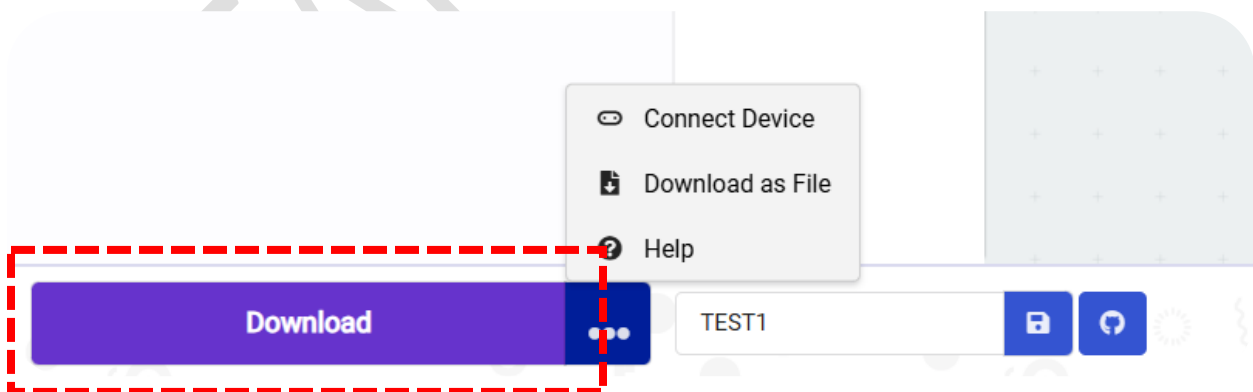

- *Then "connect the device " follow:*

- *After showing this* **"Your microbit is conneted!..."**

Your micro:bit is connected! Pressing 'Download' will now automatically copy your code to your micro:bit.

- *Click the* **"Download"** *or*

- *Note: Always check your internet connection and USB if download errored!*

8. Project
Let`s get start with the example of RoboCar

The code will move the car forward for 2 second and then goes backward for 2 seconds

Example 1

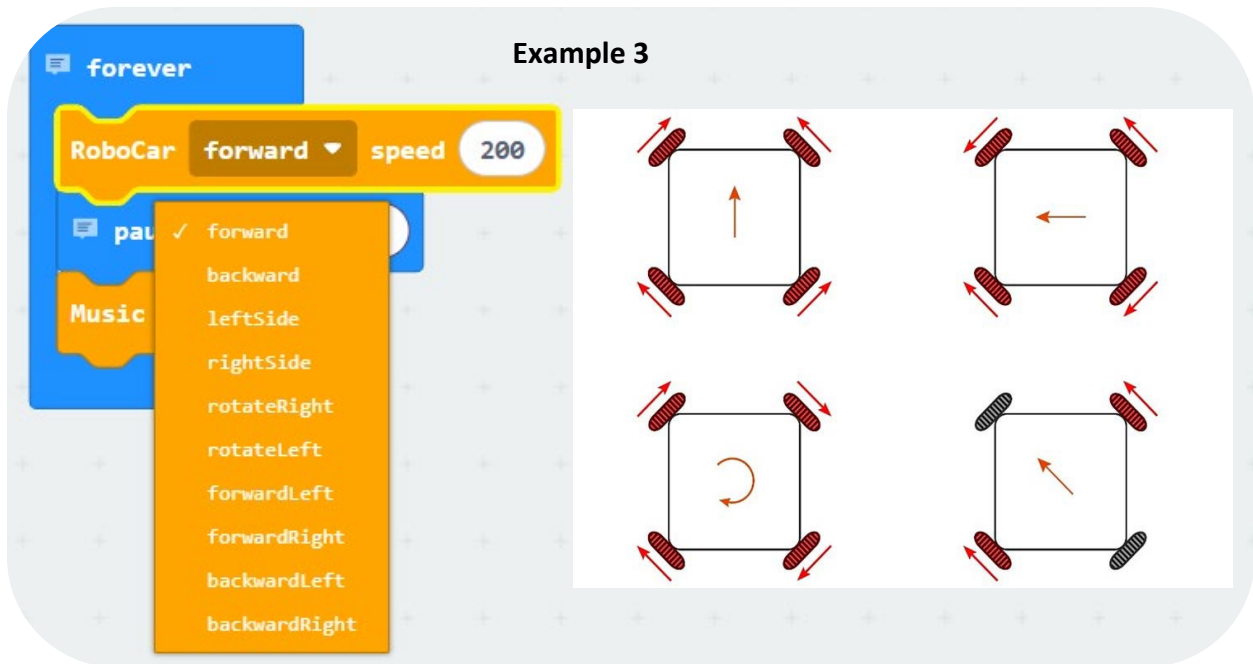- *Move the car forward and backward automatically for 2 seconds.*

The code will move the car forward for 2 second and then play the music DADADUM.

Example 2

- *Move the car forward for 5 seconds then play the music name dadadum.*

Example 3

- *Switching mode of **RoboCar**, there Switching mode of RoboCar, there **10 movements in RoboCar**. If you want to control it you have to set the front of RoboCar. So, you can easily set the direction and control the RoboCar. Example in this point I have set the Micro:bit as front or face of the car and I have to control the forward of the RoboCar.*
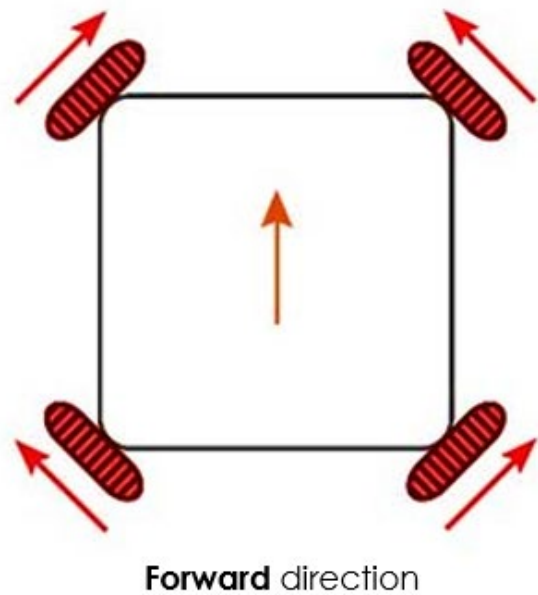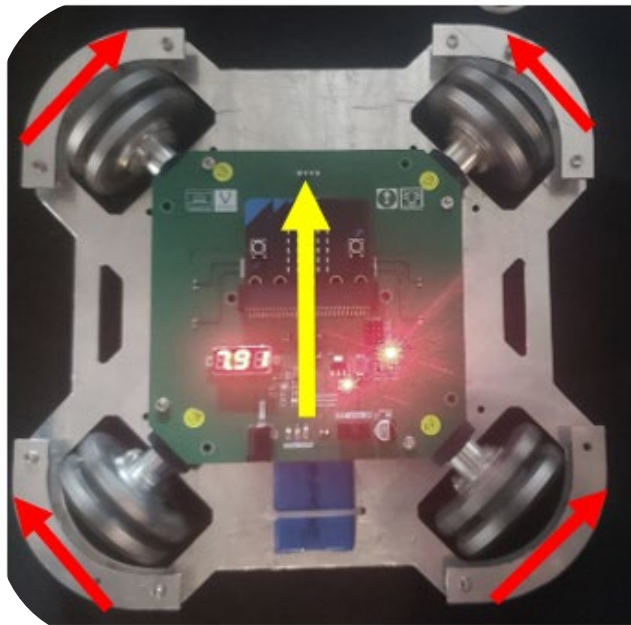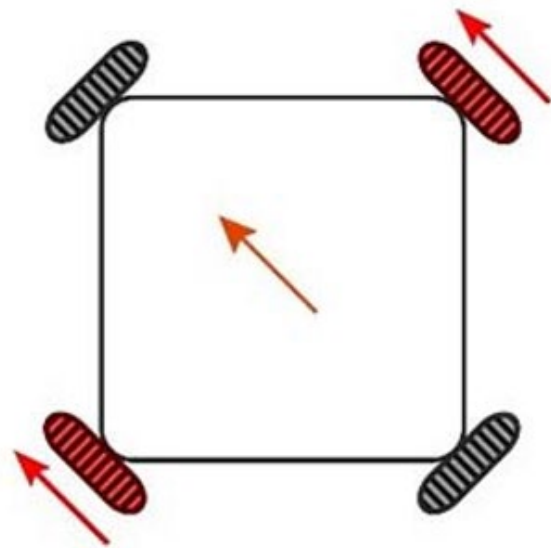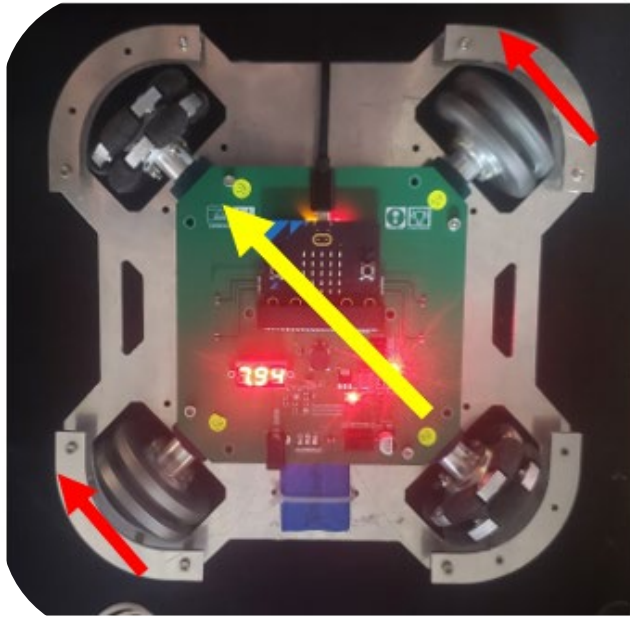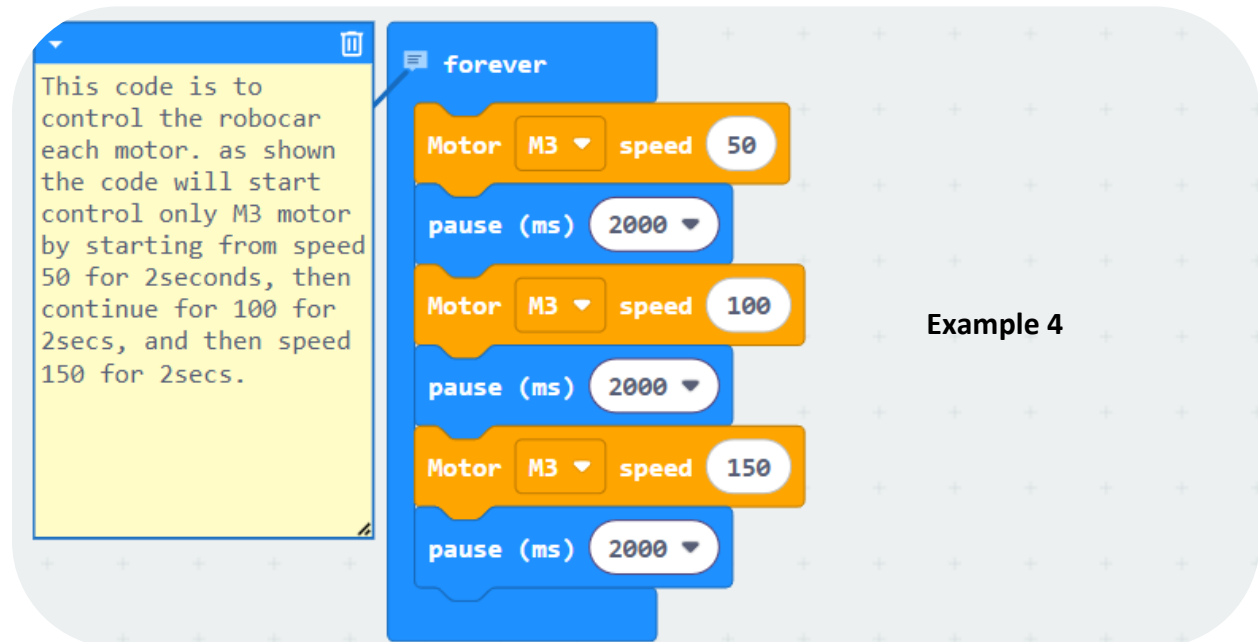

Forward direction

Forwardleft direction
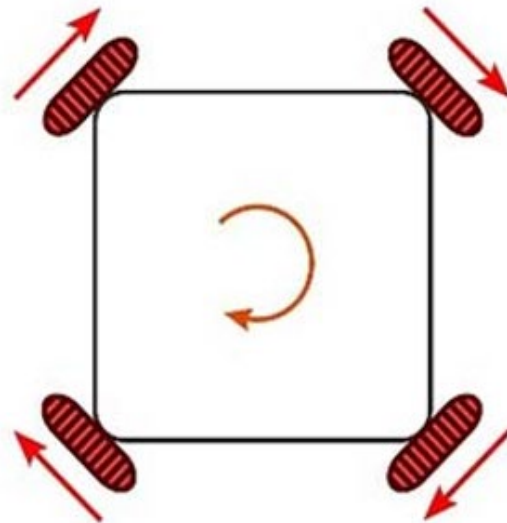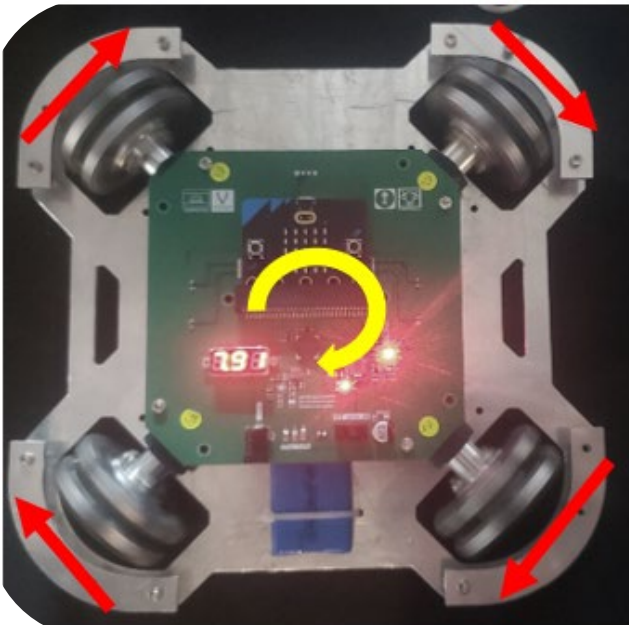
RotateRight direction

- *These are some movements for robocar which is already prepared for the movements such as Forward, Forwardleft, and RotateRight as you can see in the figure above.*
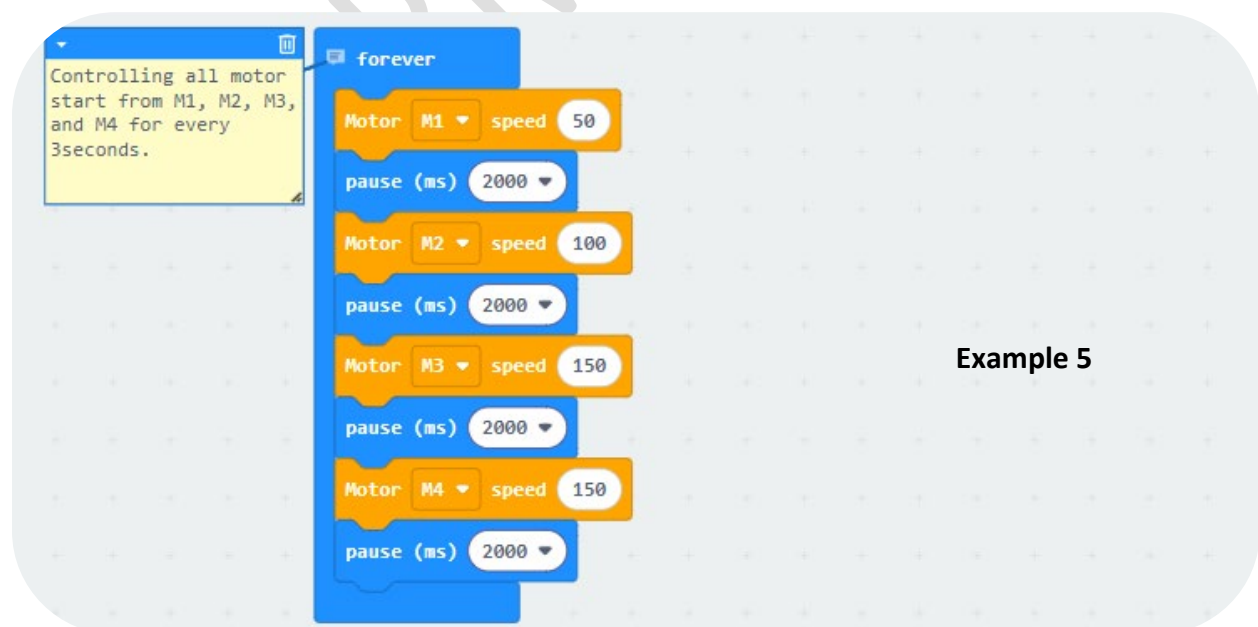
Note: make sure to test and double on Motor wire connection, if we connected it wrong the movement and direction will change. As for those 10 movements.

Each Motor control:

This code is to control the robocar each motor. as shown the code will start control only M3 motor by starting from speed 50 for 2seconds, then continue for 100 for 2secs, and then speed 150 for 2secs.

Example 4

- *In this code, show the M3 motor control by changing the speed with delay 2000ms.its start from speed 50 for 2 sec then continue to 100 then 200. We can change this Motor number select the **[M1, M2, M3 and M4]** of each motor.*
In this block you can control all 4 motors with different direction and speed to any movement and speed by yourself.
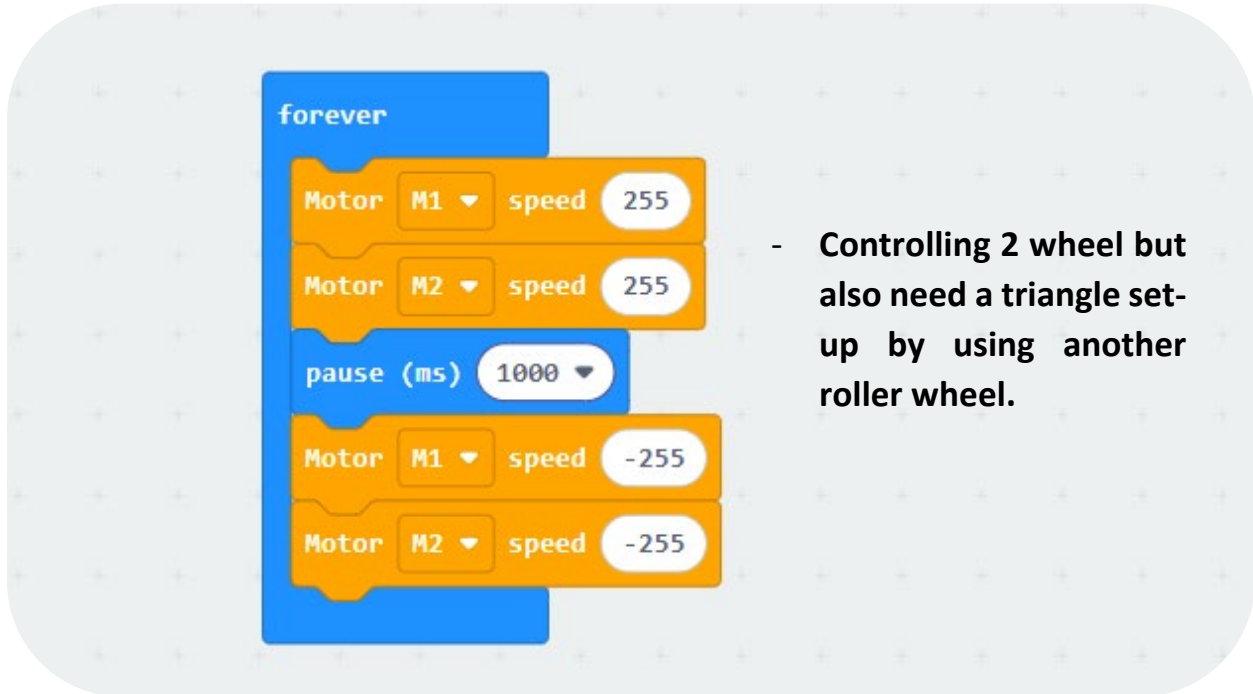
Motor 1, 2, 3, and 4 control:

Controlling all motor start from M1, M2, M3, and M4 for every 3seconds.

Example 5

Differential Motor controls

As the example we are going to control two wheel called differential control or one side (two wheels motor control).

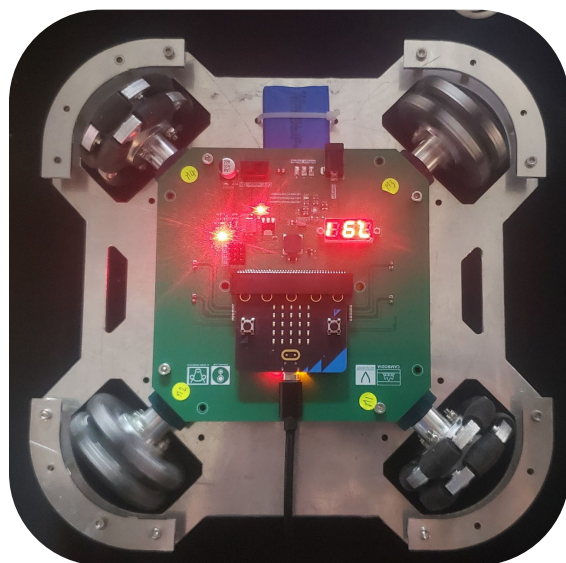- **Controlling 2 wheel but also need a triangle set-up by using another roller wheel.**

Radio control with RoboCar

- *Controlling 2 microbit which is working as transmitter and another one is receiver.*
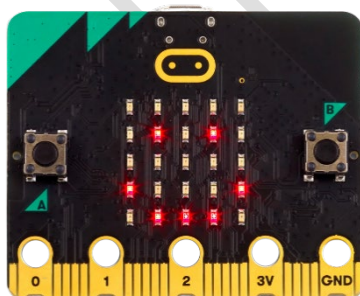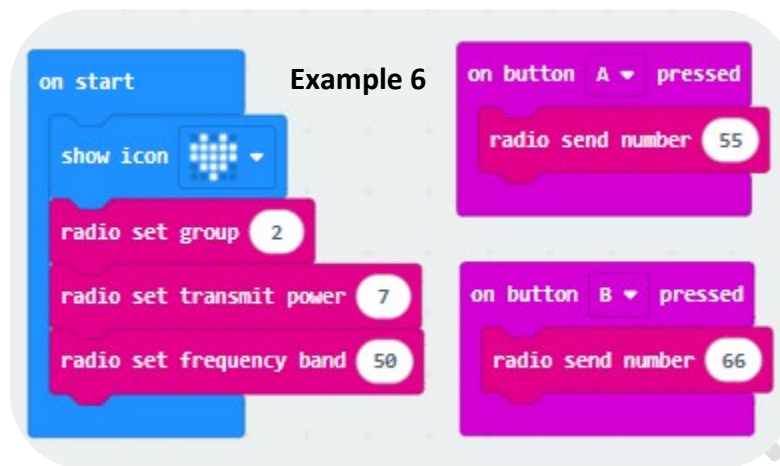

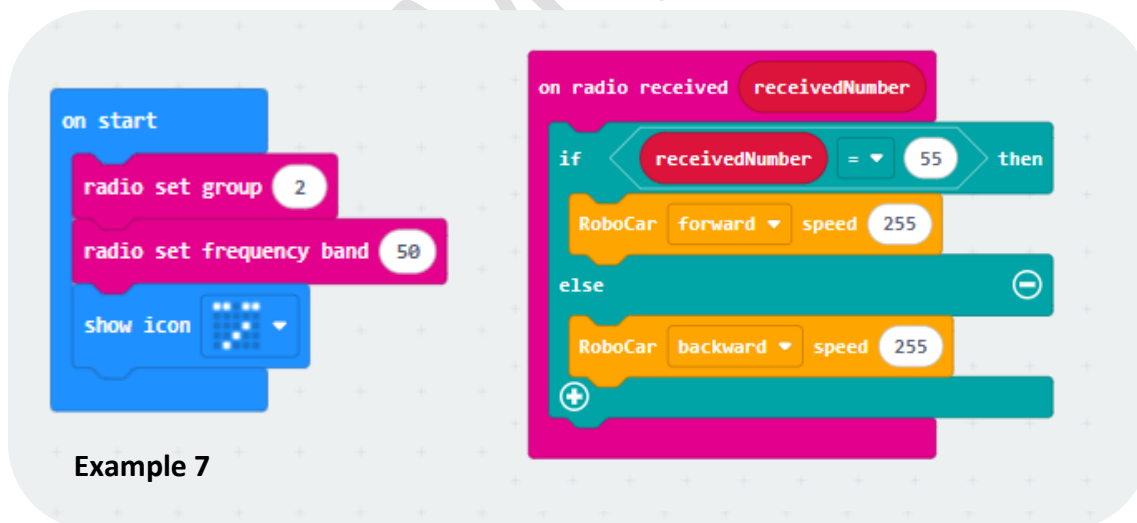**Transmitter** → *Radio Control* → **Receiver**

- *Code: download the code below to transmit*

Transmit code

- *Set the group to 2, with transmit power 7, and frequency 50.*
- *The button A and B pressed set the radio send number 55 and 66.*

Receiver code:

Example 7

- *Set group and frequency the same as transmit, use on radio received (received number) because if we used radio send string the received radio should be Received string too.* *But at this point we used radio send numbers (55 and 66) So, the we used "On radio received number".*

Project RoboCar with Yahboom remote control

Yahboom Remote control

- *This was aim to control the **RoboCar with Joystcik** by radio function. The joystick controlled the movements of RoboCar such as Forward, backward, leftside, rightside, BWright, BWleft, FW right, and FWleft. The joystick also controlled the speed of RoboCar by mapping from joystick value.*
- *For YahBoom Remote control please see: http://www.yahboom.net/study/SGH*
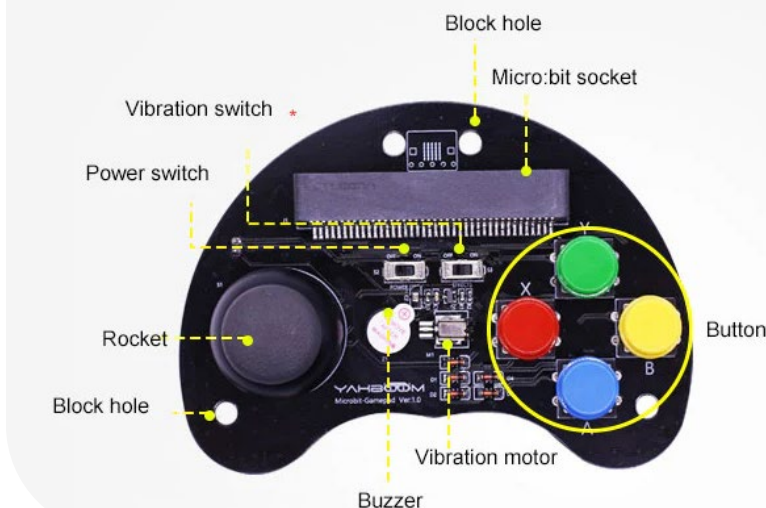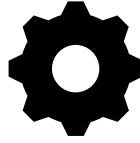

- *For more tutorial link please see: http://www.yahboom.net/study/SGH*
- *For program, please copy and paste this link into Google chrome*
  The Transmit code (TX): https://makecode.microbit.org/_Y5Fd6ydWFDhX
  The Receive code (RX): https://makecode.microbit.org/_JftcMF6dgJkm
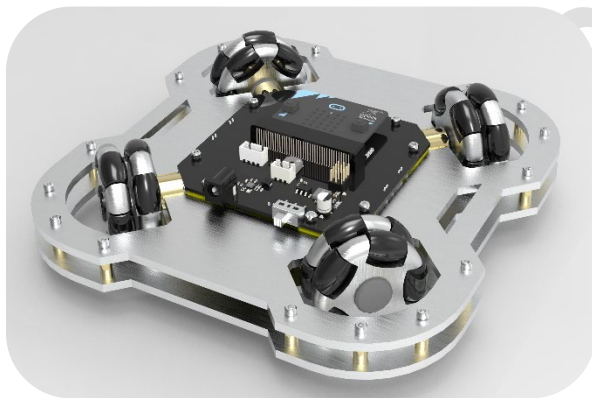
Transmit code

Receive code

Note: every shared link has already added the extension into the project. But if you want a new project creating by yourself, please add the new extension.
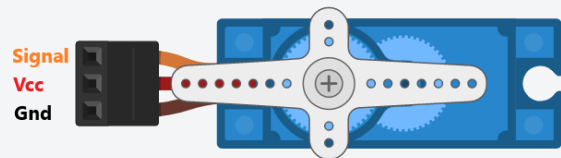**EXTENSION**: *https://github.com/MENG-Vathanak/ROBOCAR_CONTROL.git*

Servo motor

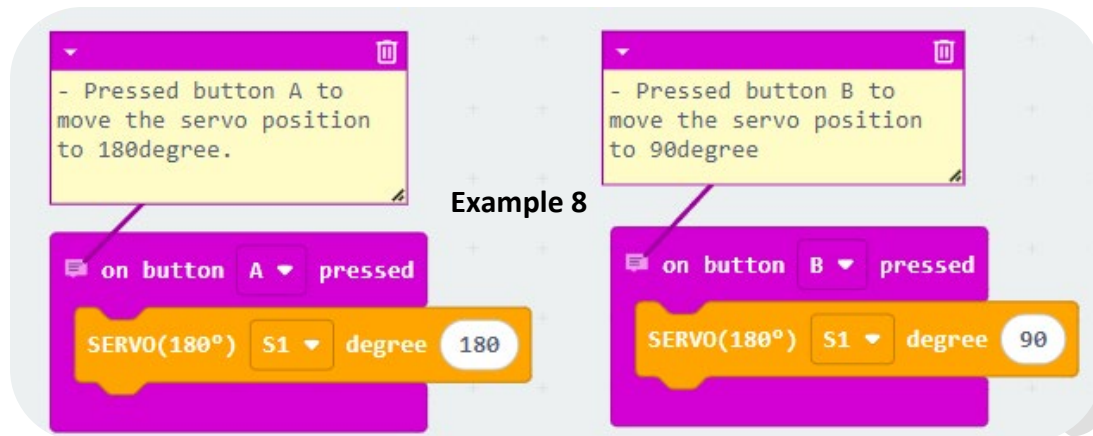*We have built-in the driver servo motor which is allowed us to control 4 servo motor on RoboCar.*


- *On RoboCar PCB has provided 5 pins of servo motors, connect the all 3 pins as:*
- *Connect:*

  + Signal to S pin on RoboCar

  + VCC to (+5V)

  + GND to GND

- *By following this code below, you will:*

Example 8

- By following this code, you can move the servo between *0-180 degree* with 4 servo motors at the same time. Furthermore, we also have an extension which is supported by servo motor *(270degree).* This extension can be used with a servo motor that is 270 degrees.

RGB control

- On *RoboCar* we also built the RGB on PCB. So, to control the RGB on *RoboCar* let`s start with the code below:
  the code is controlled by button A and B

Example 9
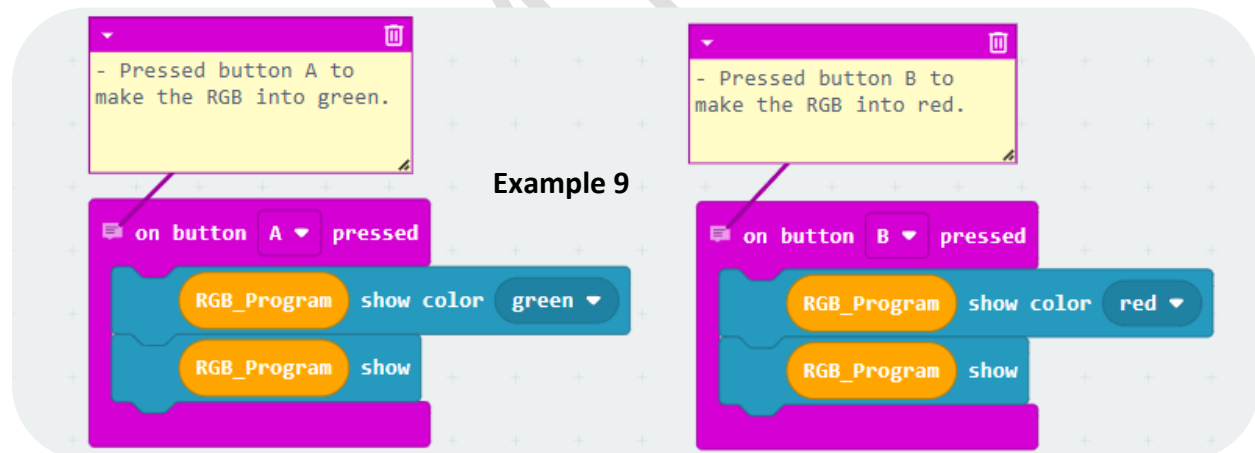
Ultrasonic control

- is our part in *RoboCar.* Anyway, ultrasonic has the same pin with the P0 of speaker on Micro:bit. To avoid conflict the code should be:
- Before using ultrasonic we have to make sure that is not connect the same pins as speaker or anything else to avoid conflicts.
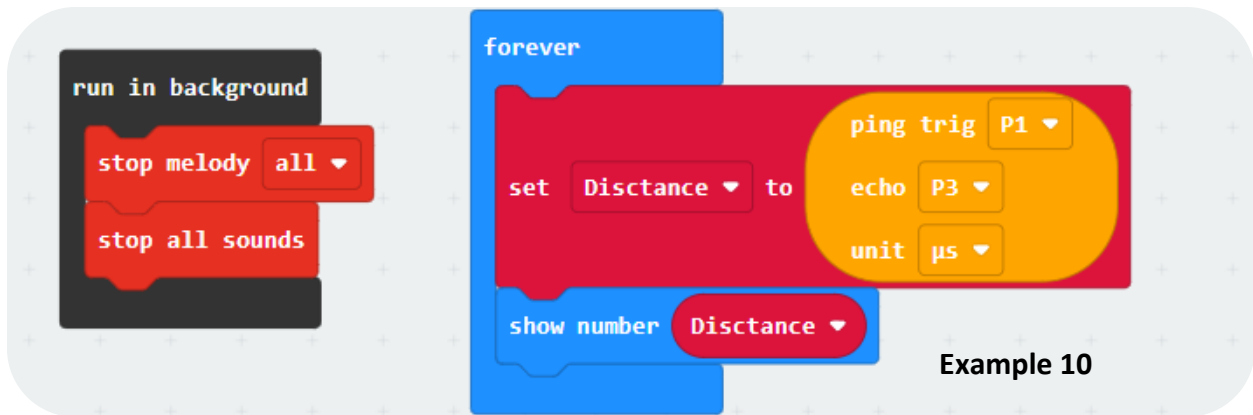
Example 10

- *Run in background in [example above] is to put all music and sound to low effects without blocking the main program execution.*

REFERENCE

- *For more Features reference please see: [1]*

- *To start the project please see: [2]*

- *To find more informtion about RoboCar: [3]*

- *To find more information about YAHBOOM remote please see: [4]*

- *To find more Doc of Microbit please see: [5]*

- *To add RoboCar extension please use this Repo: [6]*

- *Wikipidea: [7]*

- *Full video instruction of connecting Microbit please see: [8]*

- *About Microbit Pins Please go to: [9]*

- *About Direction Omni Wheels please see: [10]*