
Maqueen Mechanic
Getting Started Guide
DFROBOT
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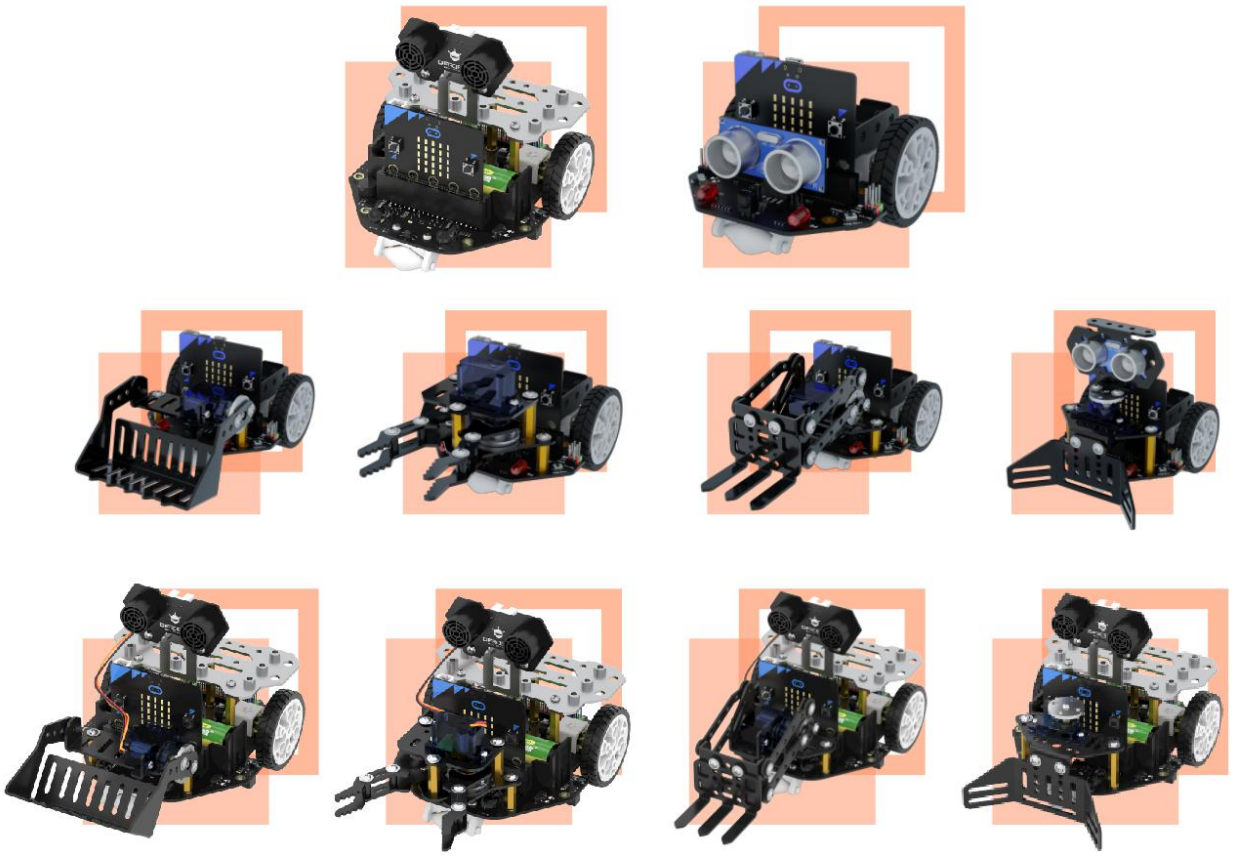
Content

Chapter1-Instruction to Maqueen Mechanic

Product Introduction

The Maqueen Mechanic Kit is a set of machine accessories that is compatible with both Maqueen Lite and Maqueen Plus, featuring simple operation and high playability. It can not only enhance the hands-on ability of children but also teach them knowledge related to machinery during the assembly process. When collocated the kit with Maqueen Lite or Maqueen Plus, this kit is well suitable for developing programming skills. It paves the way for every kid to realize his/her engineer dream!

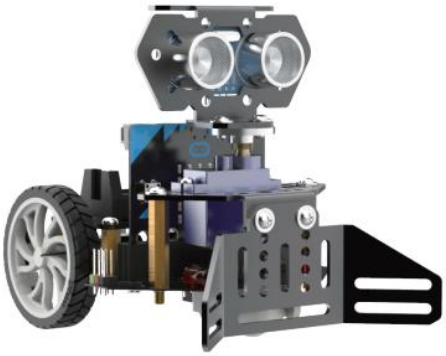


Note: this tutorial mainly introduces the collocation of Maqueen mechanic with Maqueen Lite.

Features and Functions

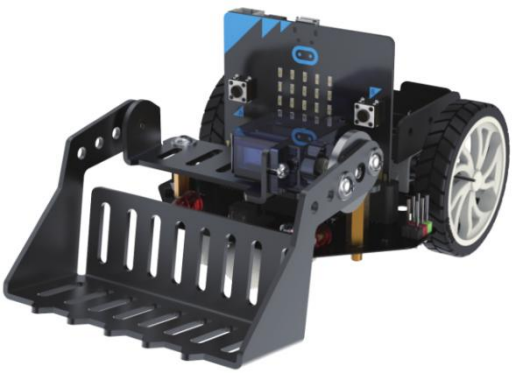
Maqueen Mechanic-Push

Maqueen Mechanic-Push is a kit of machine accessories that turn your Maqueen Lite into a bulldozer. It resembles a real bulldozer and can push obstacles away by using a trolley plate. What' s more, the ultrasonic sensors installed on the expansion bracket can rotate within 10~170°. This product can be used in scenarios such as Maqueen football game, pitch cleaning, and maze.



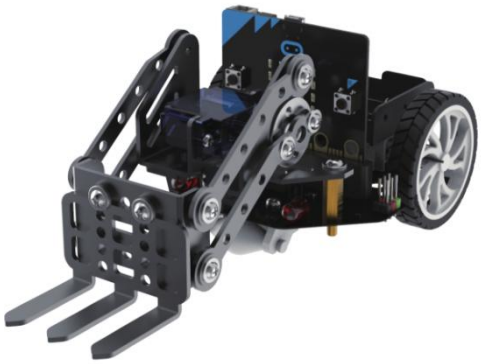
Maqueen Mechanic-Loader

Maqueen Mechanic-Loader is a kit of machine accessories that turn your Maqueen Lite into a loading machine. With a metal body similar to a loading machine, it can simulate the process of loading and unloading by the up and down function. This product can be used in expansion application scenarios such as loading and transportation, and engineering rescue.



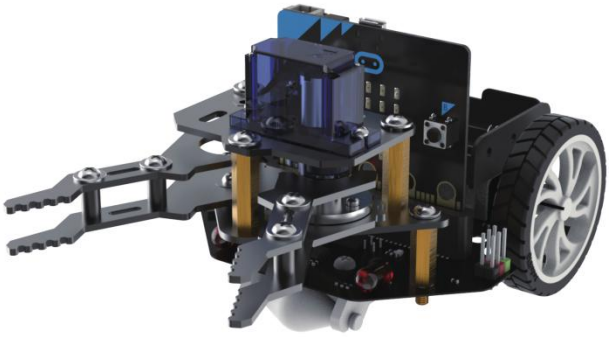
Maqueen Mechanic-Forklift

Maqueen Mechanic-Forklift is a kit of machine accessories that simulate the forklift movement through the principle of the mechanical arm. It resembles a real forklift. Installing it on the Maqueen Lite, you can control the up and down of the fork plate to place objects and simulate the operating of a mechanized factory.



Maqueen Mechanic-Beetle

Maqueen Mechanic-Beetle is a kit of machine accessories that turn your Maqueen Lite into a mechanical gripper. We call it Mechanic-Beetle because it resembles beetle very much. We can control the open and close of the gripper through a servo to realize the objects placing. This product can be used in the expansion application scenario such as object handover and goods sorting.

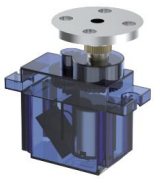


Note: in order to avoid the hardware damage of servo, it is recommended to operate the servo between 10-170°.

Installation Steps

● Maqueen Mechanic-Push

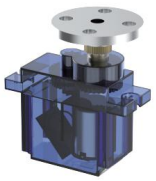
Bill of Accessories

			
Metal Trolley Plate X1	General Expansion Mount Board X1	Metal Pan-tilt-zoom Mount Plate X1	9g Metal Servo X1
			
M3*25mm Copper Pillar X2	M3*5mm Screws X10	M2.5*5mm Screws X5	4P Dupont Wires X1

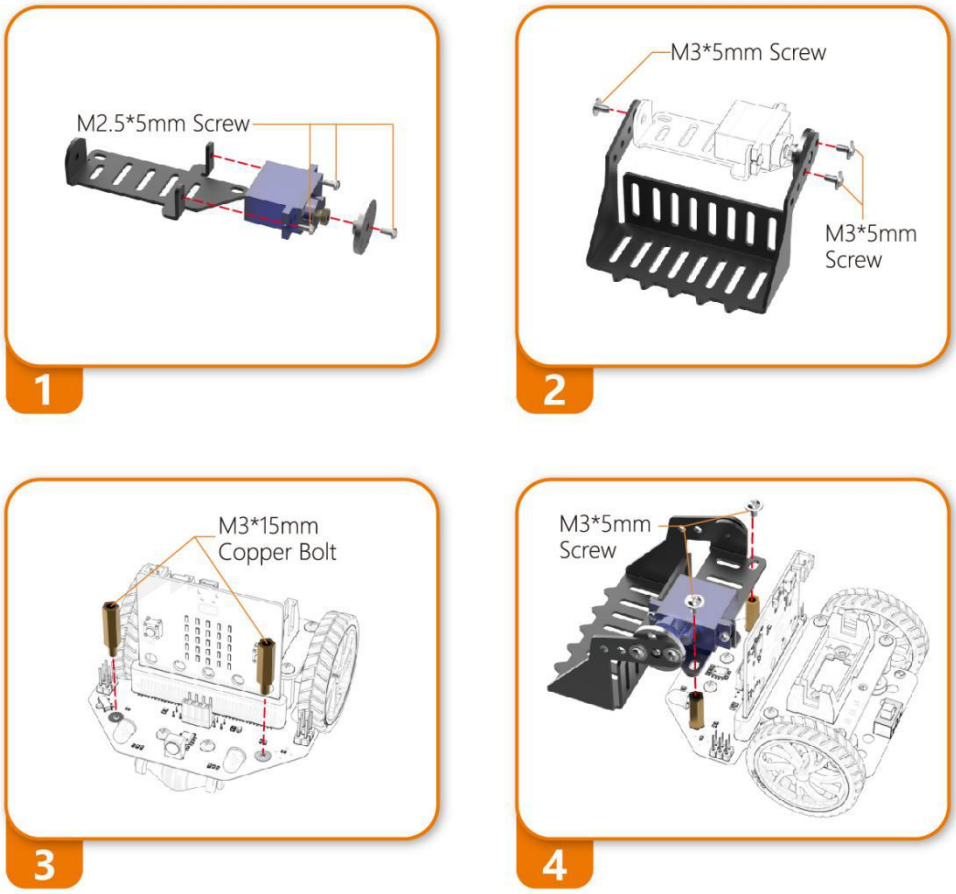
Installation Steps

● Maqueen Mechanic-Loader

Bill of Accessories

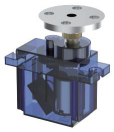
		
Loader Bucket X1	Loader Servo Panel X1	9g Metal Servo X1
		
M3*15mm Copper Pillar X2	M3*5mm Screw X8	M2.5*5mm Screw X5

Installation Steps

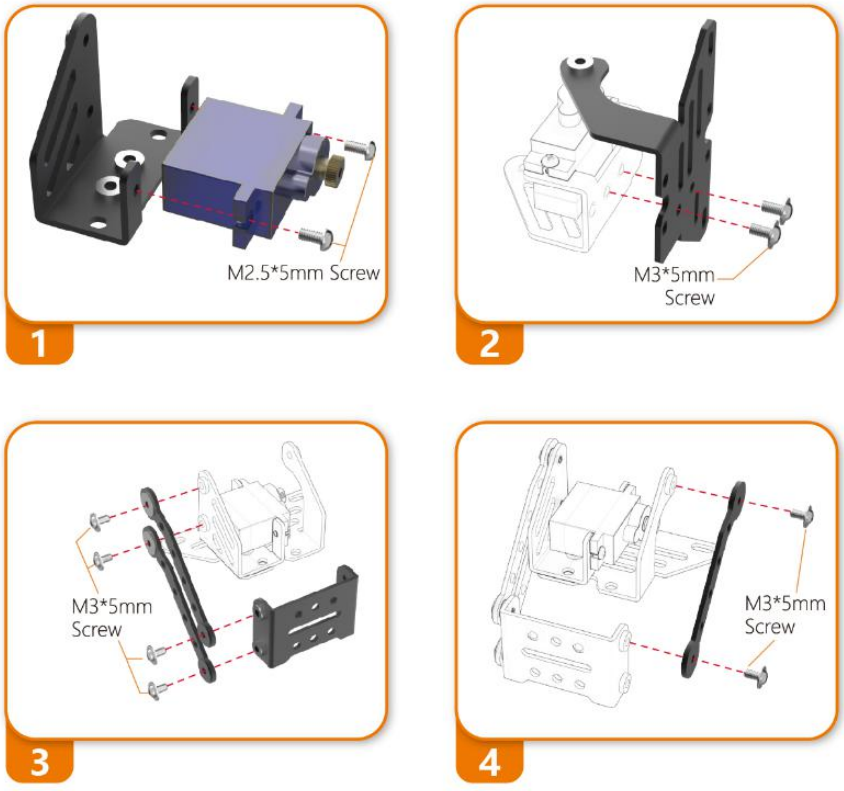


● Maqueen Mechanic-Forklift

Bill of Accessories

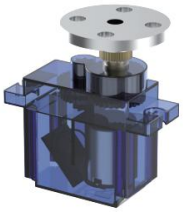
		
Forklift Plate X1	Arm Baseplate X1	Arm Servo Plate X1
		
Arm Plate X1	Arm Linkage X3	Servo Arm Linkage X1
		
9g Metal Servo X1	M3*15 mmCopper Pliiar X2	M3*5mm ScrewX18
		
M2.5*5mm ScrewX5		

Installation Steps

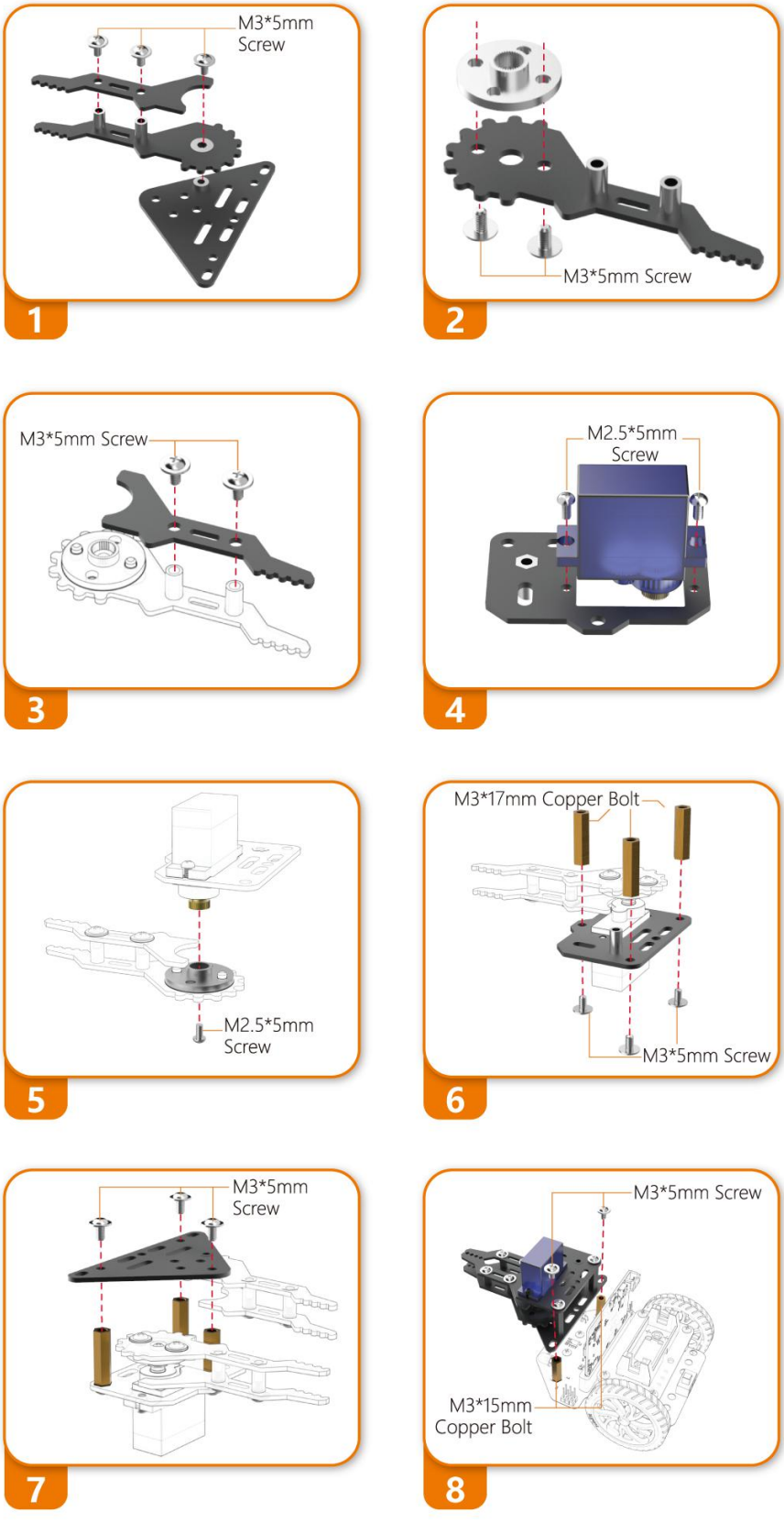


● Maqueen Mechanic-Beetle

Bill of Accessories

			
Gripper Upper Arm X2	Gripper Driven Forearm X1	Gripper Servo Forearm X1	Gripper Panel X1
			
Gripper Plate X1	9g Metal Servo X1	M3*15mm Copper Pliiar X2	M3*17mm Double-headed Copper Pillar X3
			
M3*5mm Screw X22	M2.5*5mm Screw X5		

Installation Steps



Chapter2 Programming on MakeCode

Here we assume that you have mastered how to use MakeCode to program the micro:bit. Therefore, we will mainly introduce the functions and programming methods of the Maqueen Mechanic. The basic usage of MakeCode will not be repeated.

Links and Library

Programming Platform of MakeCode: https://makecode.microbit.org

Maqueen Lite Library: https://github.com/DFRobot/pxt-maqueen

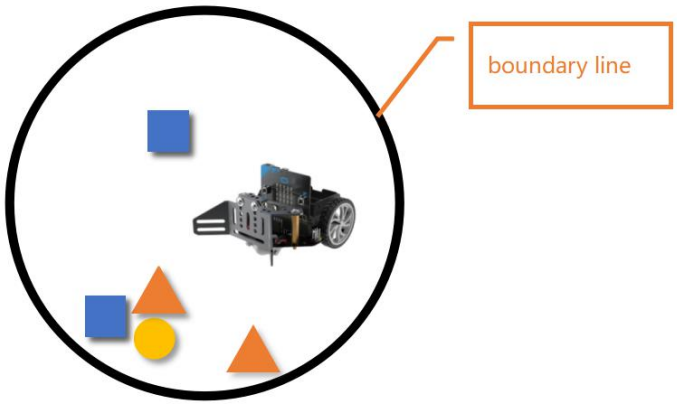
HUSKYLENS Library: https://github.com/tangjie133/pxt-huskylens

Note: the former 6 projects in this tutorial all use 3 AAA batteries, project 7 uses 1000mAh lithium battery.

● Project 1 Pitch Cleaner

1-1. Project Introduction

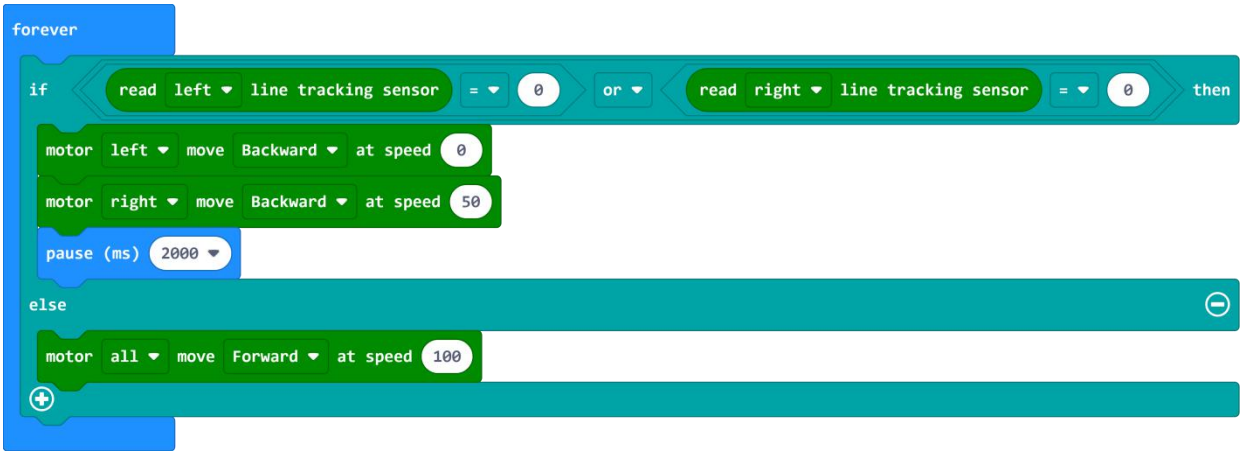
Put the Maqueen Mechanic-Push into the circle line-tracking map, turn on the power. The Maqueen Mechanic-Push will push the obstacles out the boundary line with moving within it. As the picture shows:



1-2. Program Link

https://makecode.microbit.org/_iEodTR6M09CE

1-3. Program Screenshot



Note: the power of the battery will affect the speed. If the speed is not ideal, you can adjust the motor speed value.

● Project 2 Maqueen Football Cup

2-1. Project Introduction

In this game, the organizers provide two different remote-control devices, IR and GamePad. The players can only pick one from them to control Maqueen Car.

2-2. Hardware Preparation

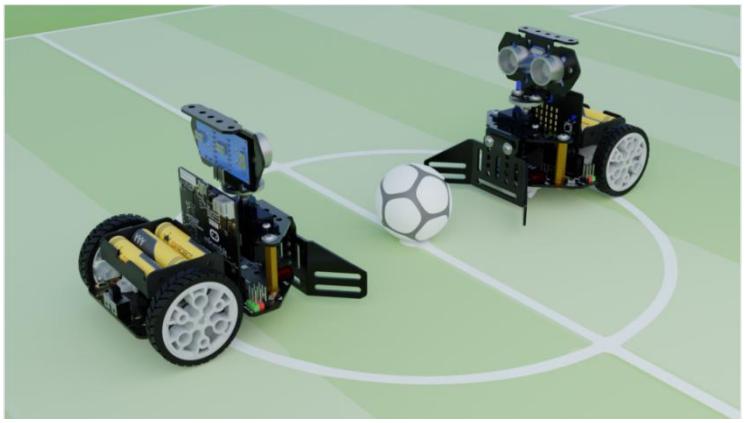
	
GamePad Remote Control X1	IR Remote Control X1

Game Rules:

① Select the starting location by drawing lots.

② It is allowed to have "physical" contact and collision, but players cannot touch the Maqueen car.

③ The first to push the football into the opponent's goal wins.



Note: the process of making the playing field will be discussed later.

2-3. Program Links and Screenshot

Mode1: IR Remote Control Maqueen Mechanic-Push

Introduction to IR Remote Control

Before controlling Maqueen car through IR remote control, we have to learn the corresponding decimal value of the buttons. As shown below:

IR Remote Button Value Table		
Character	value(hexadecimal)	value（decimal）
Red Button	0xff00	0
VOL+	0xfe01	1
FUNC/STOP	0xfd02	2
Double triangle/Left	0xfb04	4
Pause	0xfa05	5
Double	0xf906	6

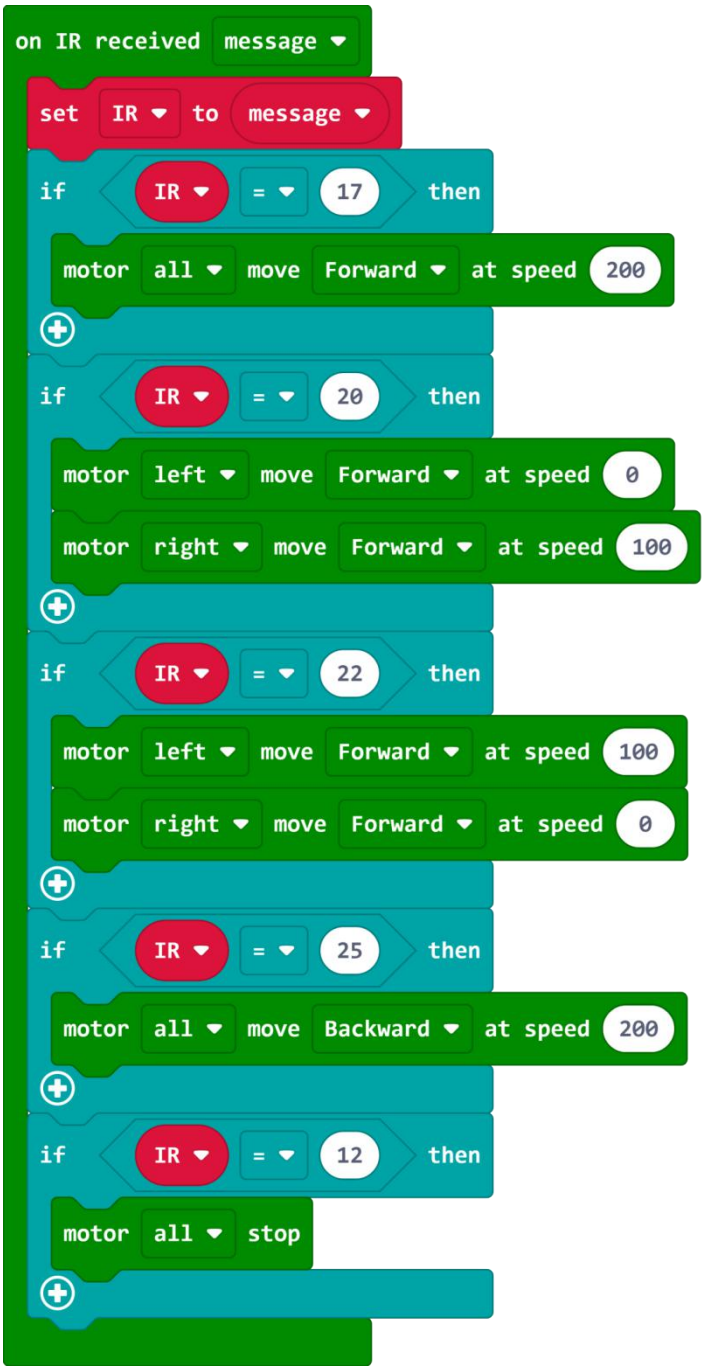
triangle/Right		
Triangle/Down	0xf708	8
VOL-	0xf609	9
Triangle/Up	0xf50a	10
0	0xf30c	12
EQ	0xf20d	13
ST/REPT	0xf10e	14
1	0xef10	16
2	0xee11	17
3	0xed12	18
4	0xeb14	20
5	0xea15	21
6	0xe916	22
7	0xe718	24
8	0xe619	25
9	0xe51a	26

The specific control methods of movements of the bulldozer through IR are shown as below:

IR Remote Characters（Button）	Movement
2	Forward
4	Left
6	Right
8	Backward
0	Stop

IR Control Program Links and Screenshot:

https://makecode.microbit.org/_isWXji5Y2Xvj

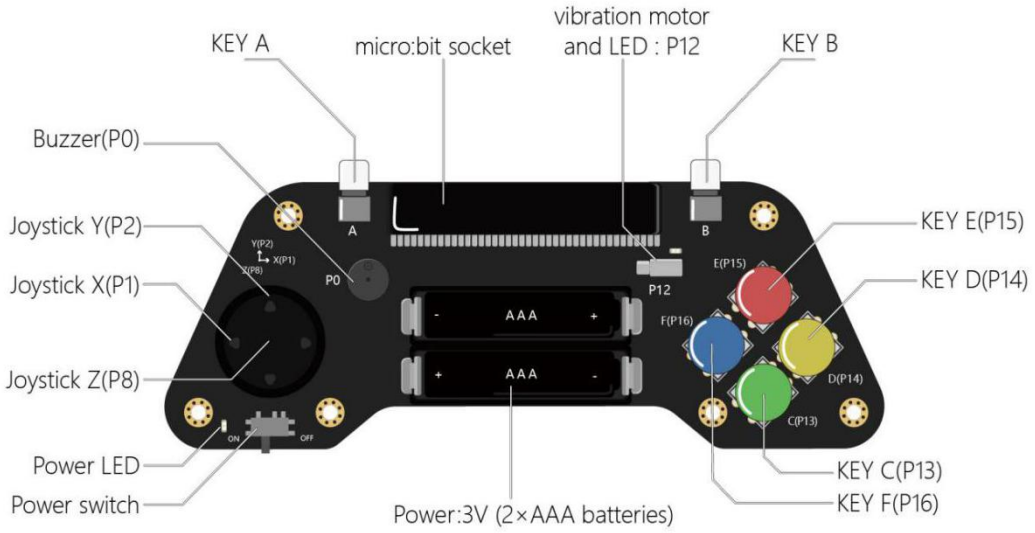


Mode2: GamePad Remote Control

Introduction to GamePad

GamePad is a micro: bit-controlled product designed with a joystick. The joystick uses a high-precision three-axis analog. You can use the joystick through coding and control the

direction and speed of Maqueen. And there are up to 7 programmable buttons (A, B, C, D, E, F, Z), you can use these buttons to achieve some interesting function control, or directly use the simplest switch control. Let's learn the GamePad remote control by Pin description diagram below.

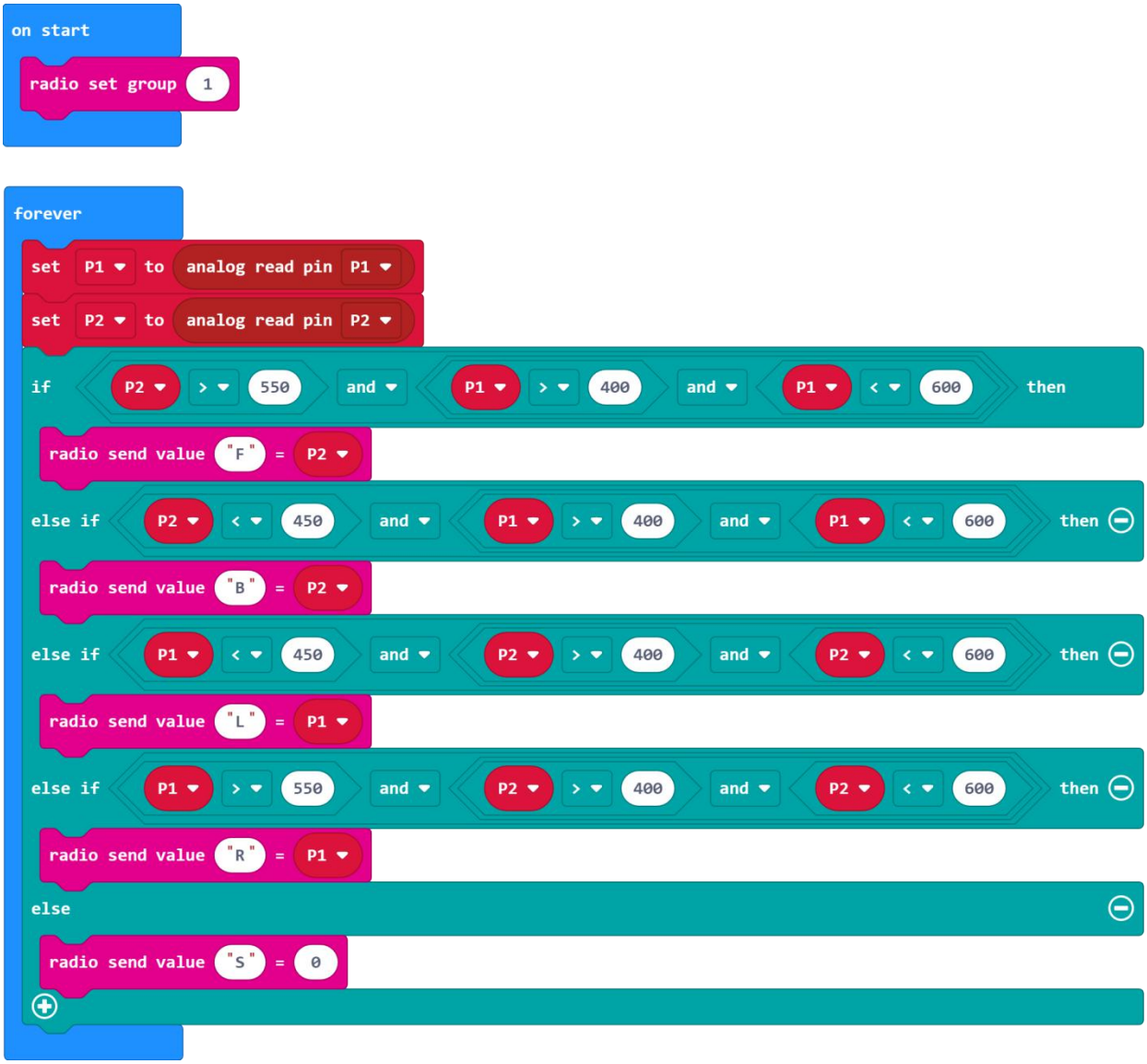


The following tells how to use the GamePad joystick to control the movement of a Maqueen car:

GamePad Joystick	Joystick Position	Movement
Up		Forward
Down		Backward
Left		Left
Right		Right
Middle		Stop

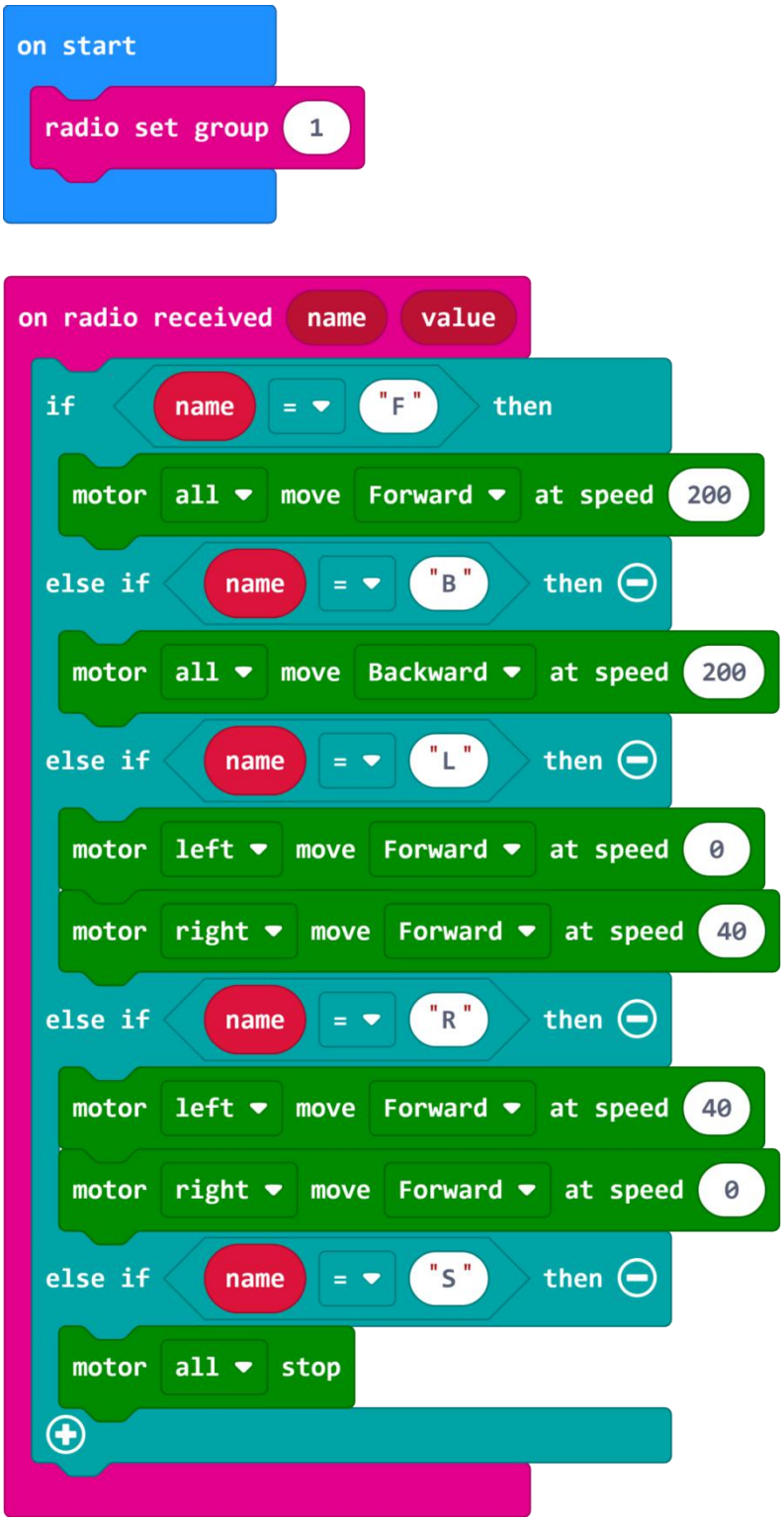
GamePad Remote Control End Program Link:

https://makecode.microbit.org/_d3WJ3w3cxWm5



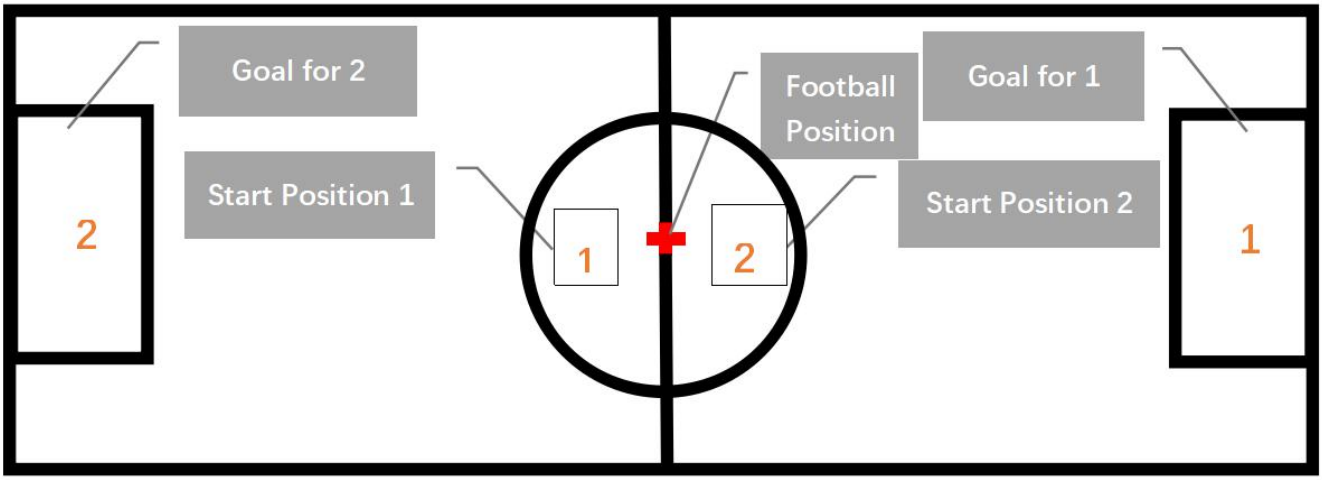
Maqueen Receiving End Program Link:

https://makecode.microbit.org/_cPYao5DtgamR



2-4. Effect Display

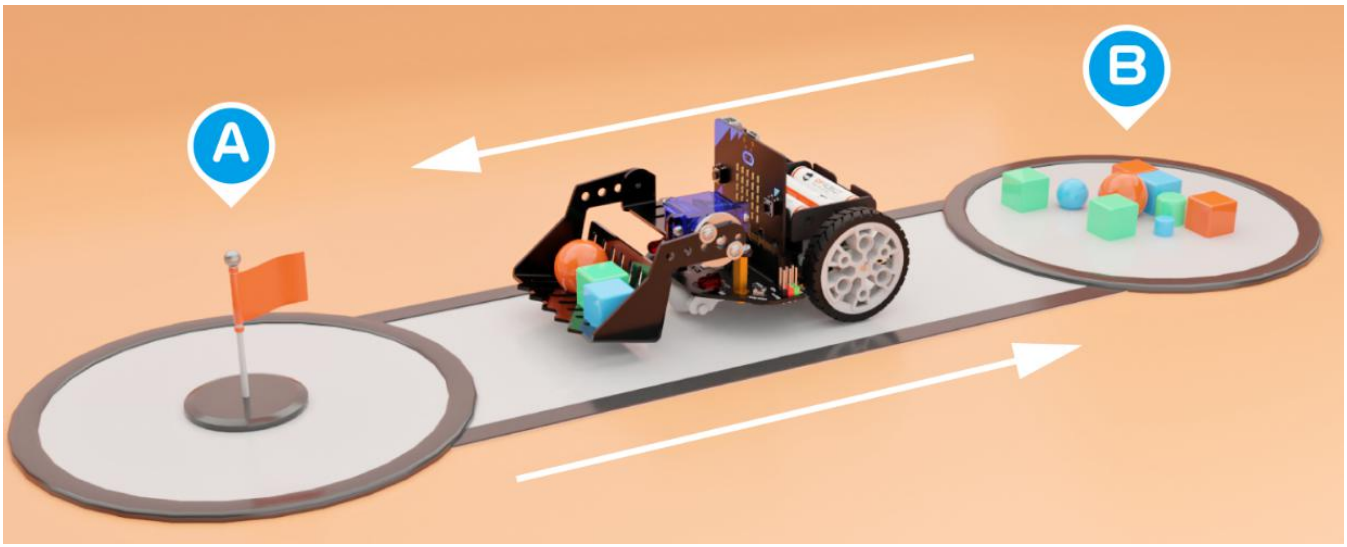
In this project, we can use electrical tape to make the competition field. Each car has its own starting position and goal position.



● Project 3 Little Loader Expert

3-1. Project Introduction

In this project, we mainly use IR to control the loader Maqueen to carry the goods from A to B through the loader bucket.



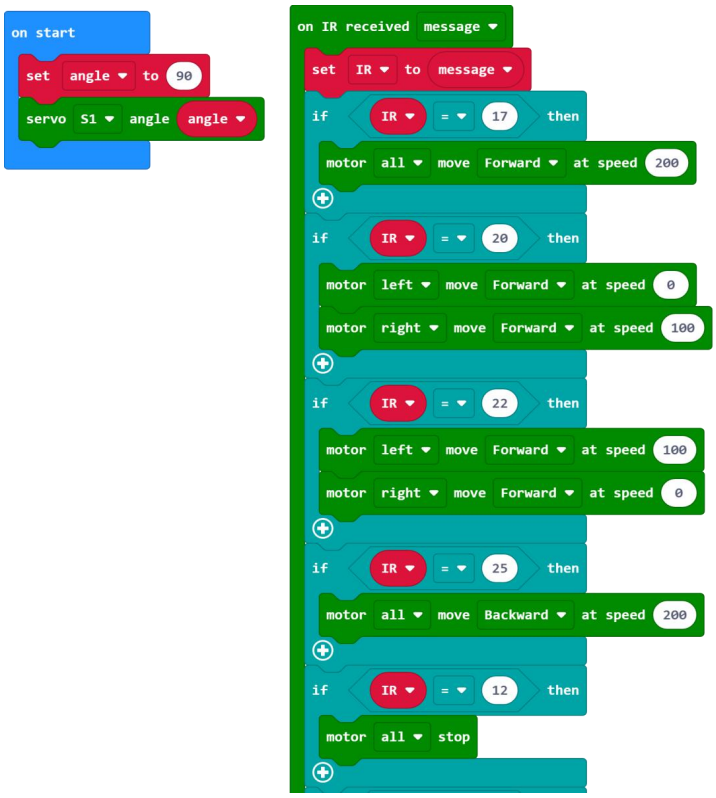
The specific control mode of the infrared remote control is as follows:

IR Remote Characters (Button)	Value (Decimal)	Movement
2	17	Forward
4	20	Left
6	22	Right
8	25	Backward
0	12	Stop
Triangle/Up	10	Loader bucket Up
Triangle/Down	8	Loader bucket Down

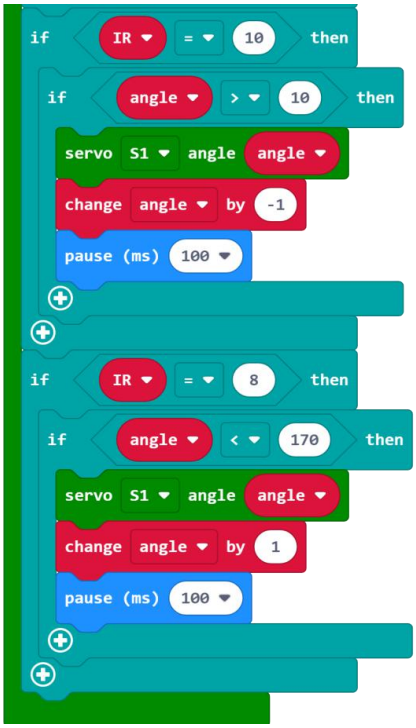
3-2. Program Link

https://makecode.microbit.org/_H3CA83c4xcKP

3-3. Program Screenshot



The procedure is not finished, continue to the next page.



Note: different installation methods may result in different initial angles of the servos. If the initial servo angle is not ideal, you can adjust it.

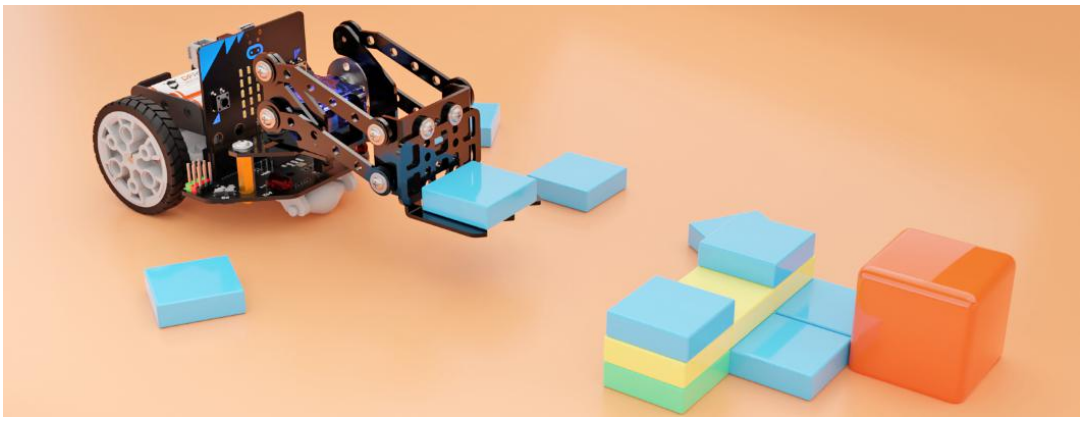
3-4. Effect Display

Press button 2 to control the Maqueen to go to point B, and press button 0 to stop the car. Press the upward triangle to control the upturn of the bucket, and load the goods. Press buttons 4 and 6 to control the Maqueen to turn around and return to point A (you can also press button 8 to control it to return to point A), and finally press the downward triangle to control the bucket to turn down and unload the goods.

Project 4 Forklift Worker

4-1. Project Introduction

Use the GamePad to control the forklift to stack scattered goods neatly as required. In this project, the joystick needs to be used to control the direction and speed of the forklift, and the buttons E and C will control the ups and downs of the forklift plate.



The specific control methods are as follows:

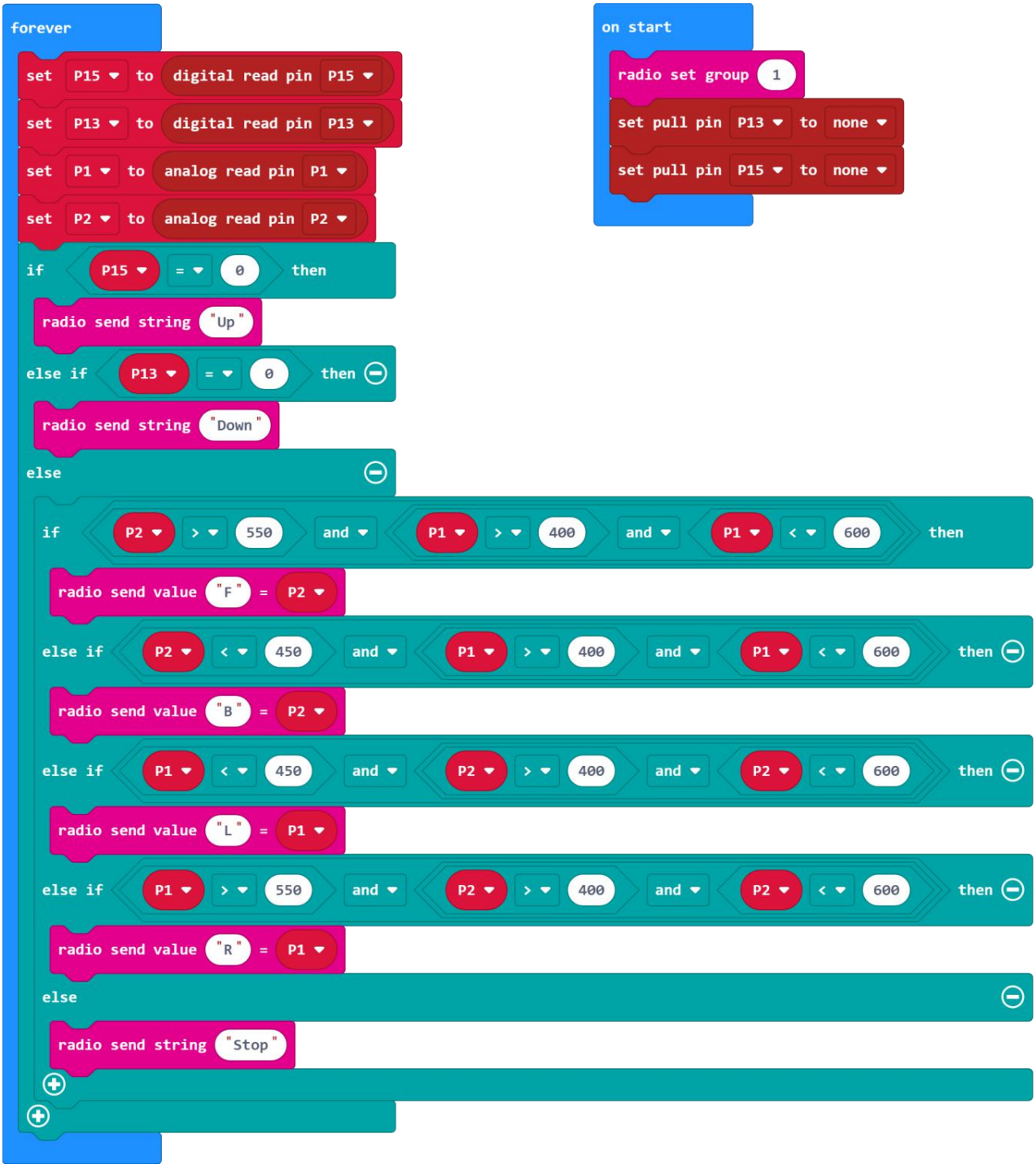
GamePad Joystick	Joystick Position	Movement
Up		Forward
Down		Backward
Left		Left
Right		Right
Middle		Stop
E	\	Fork Up
C	\	Fork Down

Note: The wider the joystick moves, the faster the Maqueen car runs.

4-2 Program Link and Screenshot

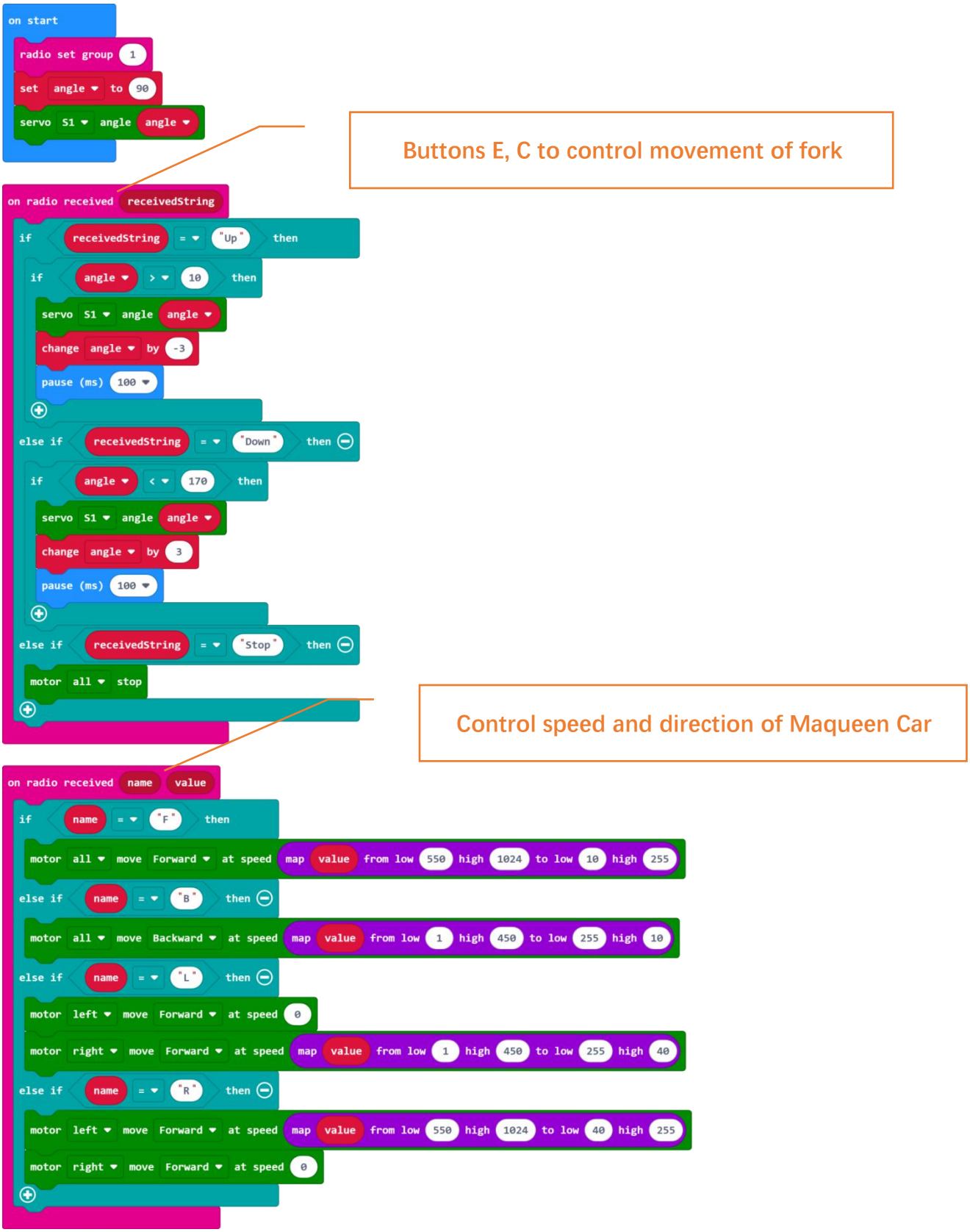
GamePad Remote Control Transmitting End – Program Link:

https://makecode.microbit.org/_Ux1EeH4myA8W



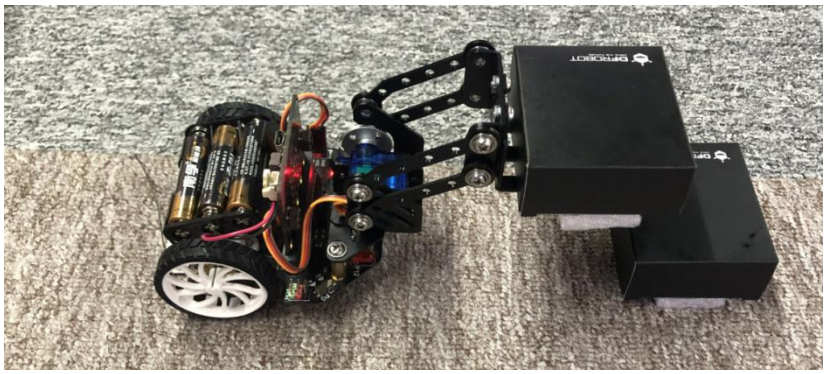
Maqueen Receiving End – Program Link:

https://makecode.microbit.org/_e2m0o5FYdUe1



4-3. Effect Display

It is easy to use the GamePad to control the forklift. Move the joystick up, down, left, and right to control the movement of the car, and use the buttons E and C to control the up and down of the forklift to stack the scattered goods neatly.



Note: the maximum height the forklift can reach is only 6cm, pay attention to the height when selecting the stacked goods.

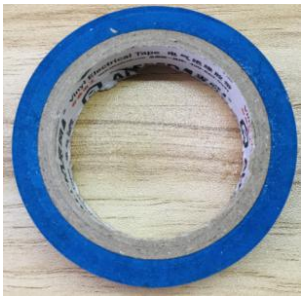
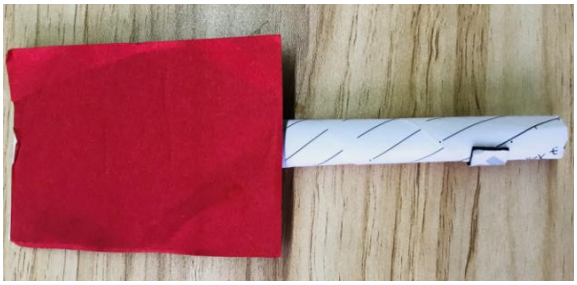
● Project 5 Railway Patroller

5-1. Project Introduction

If the Maqueen car detected that there is an obstacle on the way when patrolling, it uses the gripper to clamp and place it at a designated position. In this project, the line patrolling map and the assembled Maqueen Mechanic-Beetle need to be modified.

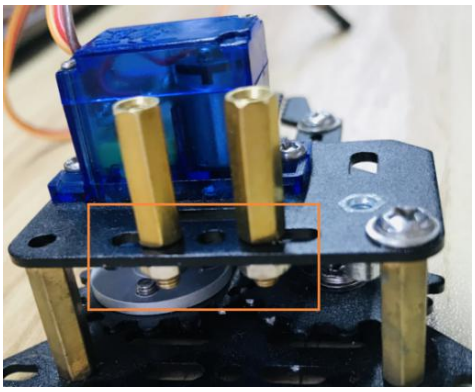
5-2. Hardware Preparation

	
Ultrasonic Sensor and 4P Dupont Wire X1, General Expansion Mount Plate X1, M3*15mm Copper Pillar X2, M3*5mm Nut X2, M3*5mm	Line-tracking Map X1

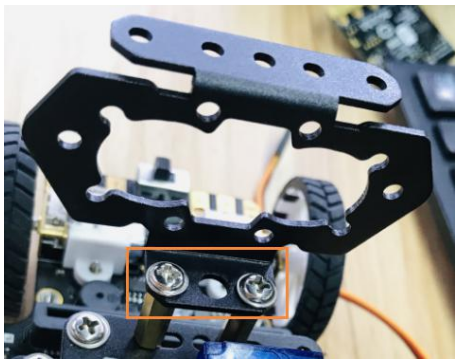
Screw X2	
	
Electrical Adhesive Tape X1	Handmade Obstacle X1

Note: the color of electrical tape can be selected freely except black.

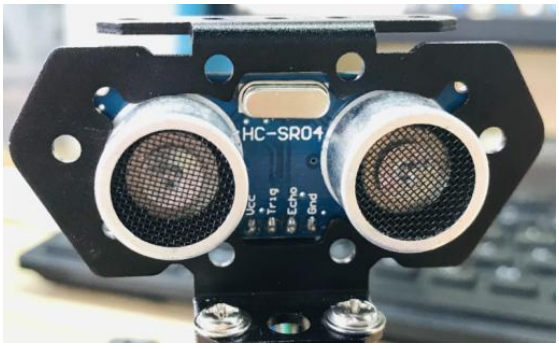
5-3. Modification Steps



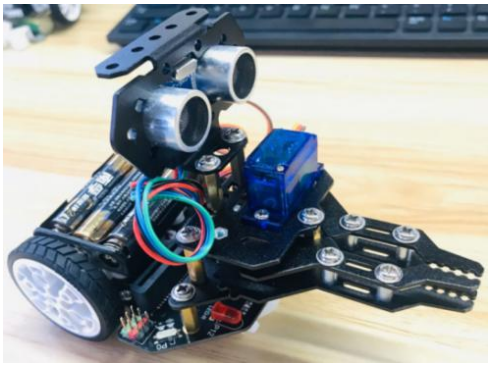
1. Lock the pillars on the panel with nuts



2. Install the ultrasonic expansion mount plate onto the pillar



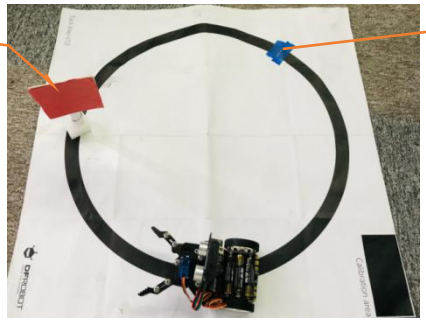
3. Install the ultrasonic sensor and connect it to the corresponding interface with 4P wire



4. Installation Completed

5-4. Scene after Assembly

Handmade obstacle: it can be placed on the trail in advance or placed in front of the Maqueen car when running



Placement position: tape the electrical tape to any position on the circle to simulate the position that the obstacle should be placed

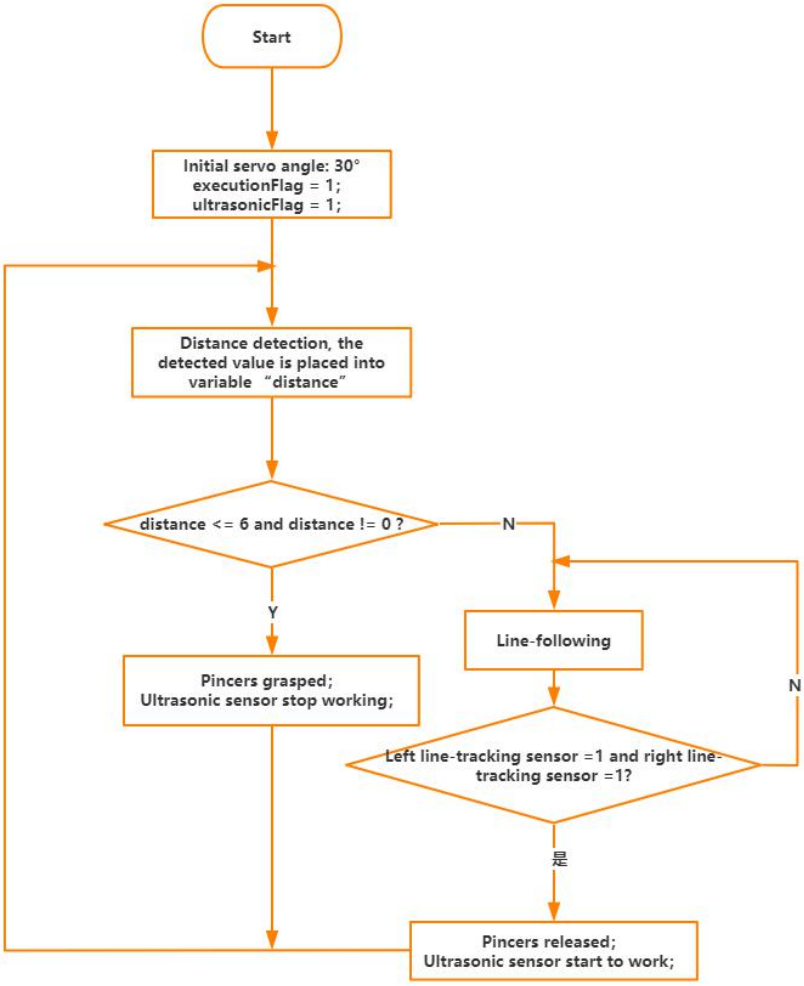
Note: the direction that the Maqueen car should be placed is shown in the graph.

5-5. Program Link

https://makecode.microbit.org/_2LzDMCR9CFJt

5-6. Flowchart

Here we use a flowchart to analyze what functions the entire program needs to realize.



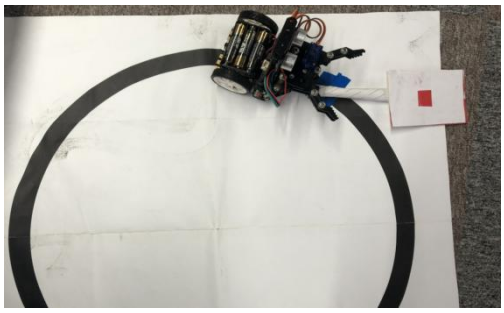
These are several situations the Maqueen will encounter when patrolling:

Diagram	Patrolling Sensor Situation	Output Value	Movement
	Left sensor detects black line Right sensor detects black line	Left Sensor = 0 Right Sensor = 0	Move Forward
	Left sensor detects black line Right sensor doesn’ t detect black line	Left Sensor = 0 Right Sensor = 1	Turn Left
	Left sensor doesn’ t detect black line Right sensor detects black line	Left Sensor = 1 Right Sensor = 0	Turn Right

5-7. Program Screenshot

5-8. Effect Display

When the Maqueen car detects obstacles in front of it during line-tracking, the gripper closes. Then it will transport the obstacle to the designated place and drop it, and continue driving along the line to detect if there are obstacles ahead.



● Project 6 Relay Race

6-1. Project Introduction

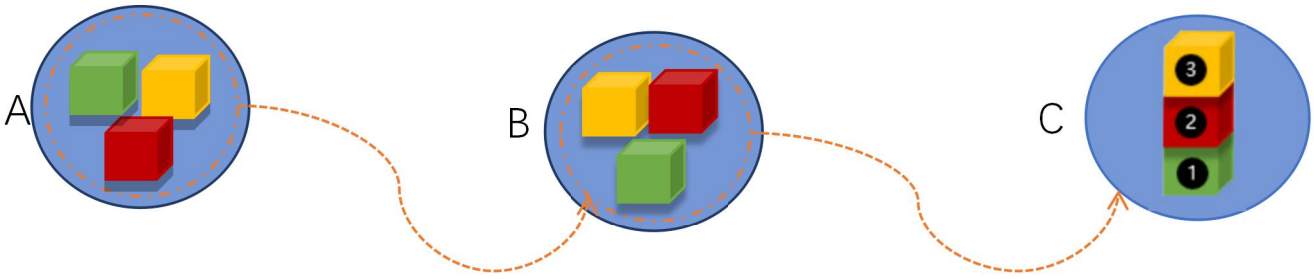
The relay team is composed of Maqueen Mechanic loader and Maqueen Mechanic forklift. The two robot cars are controlled by one GamePad and will cooperate to complete the relay race. Press button A, GamePad controls Maqueen loader; press button B, GamePad controls Maqueen forklift.

Game Rules:

① The relay race is divided into two stages, and you can arrange the starting position according to different tasks in the schedule. Stage 1: A-B (task: transport all three objects from point A to point B), stage 2: B-C (task: transport the three objects from point B to point C and overlap these objects in order of 1, 2, and 3). After completing the tasks of the two stages, it will be considered successful only when the two Maqueen cars have reached point C (point A is the starting point, point B is the relay point, and point C is the endpoint).

② During the game, the players cannot touch Maqueen Car.

③ The one who takes the shortest time to complete all tasks wins

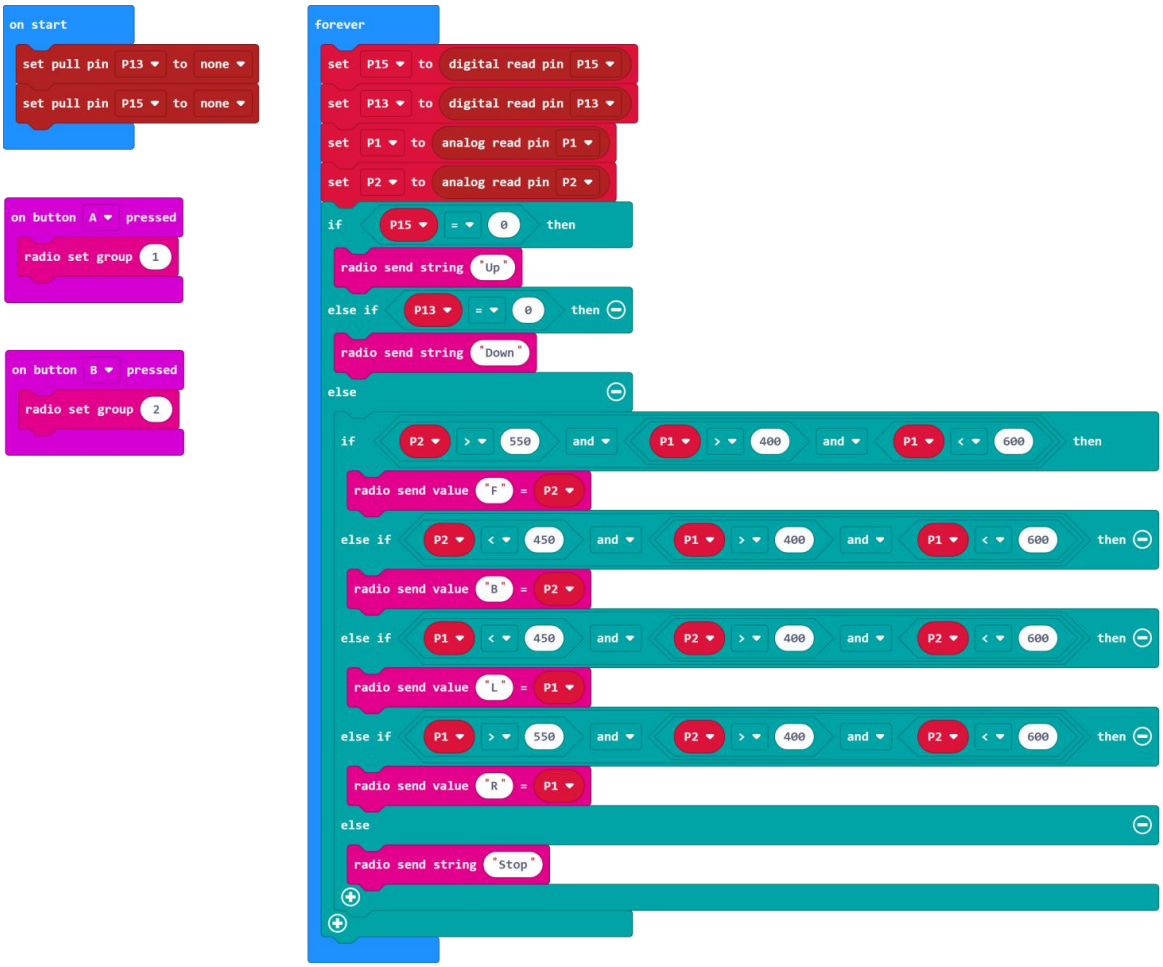


Note: Only when the first car transports all objects to the designated area B, can the second car start.

6-2. Program Link and Screenshot

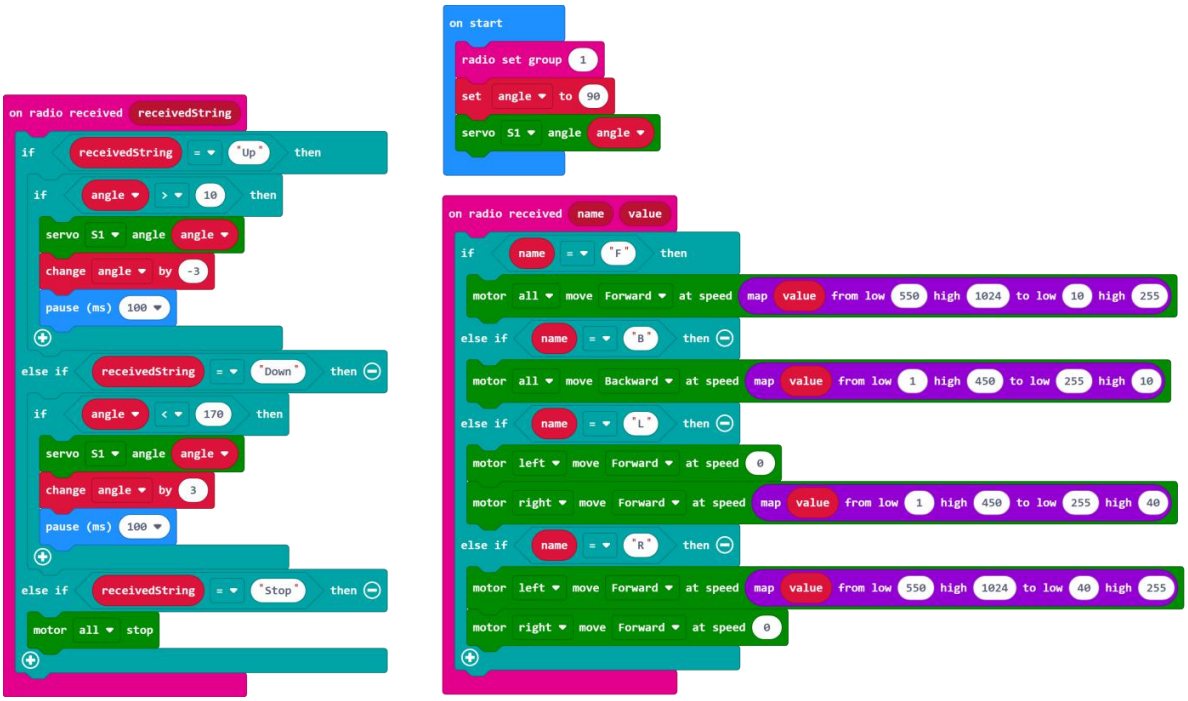
GamePad Remote Control End – Program Link:

https://makecode.microbit.org/_eaydWsAapaHY



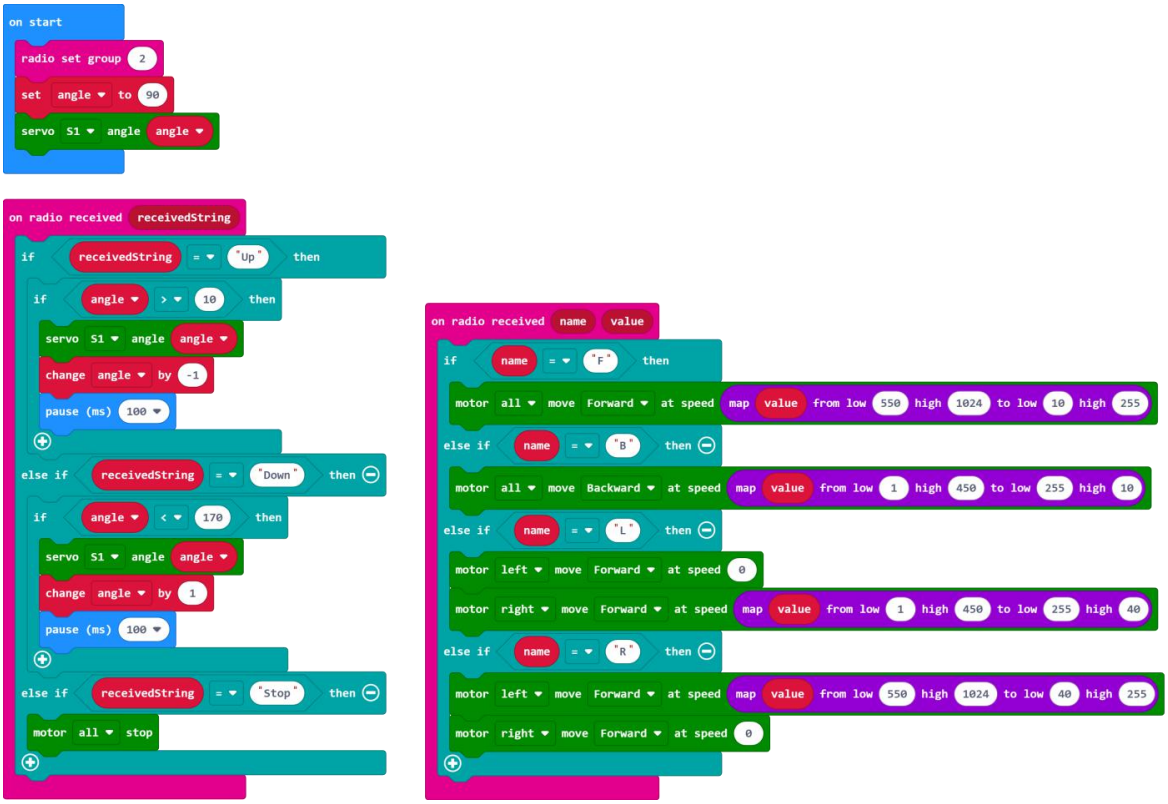
Maqueen Mechanic Loader Receiving End – Program Link:

https://makecode.microbit.org/_4Di8h3R555rw



Maqueen Mechanic Forklift Receiving End – Program Link:

https://makecode.microbit.org/_CkVduYFjHhjX



6-3. Effect Display

In this project, we put the loader at point A to finish the first part, and forklift at point B to finish the second part. As shown below:

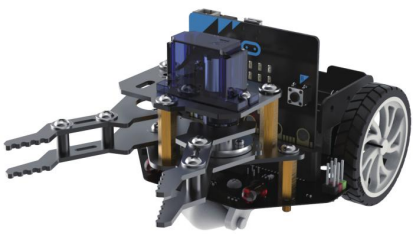
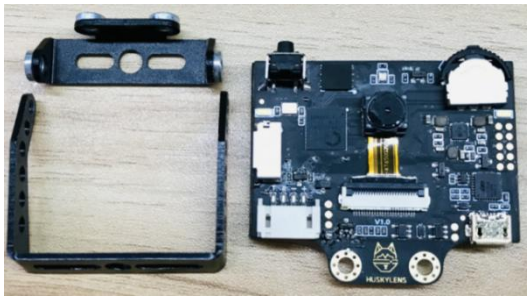
● Project 7 Sorting Manipulator

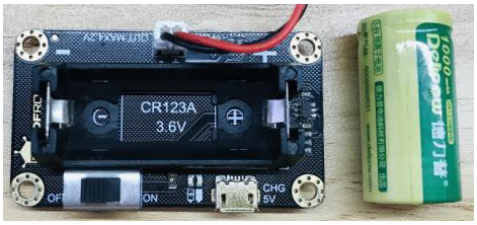
7-1. Project Introduction

This project mainly uses the color recognition function of HUSKYLENS to place objects of different colors recognized into the corresponding areas. For example, if the color of the recognized object is red, the object will be placed into the left area; if it is blue, place it into the right area.

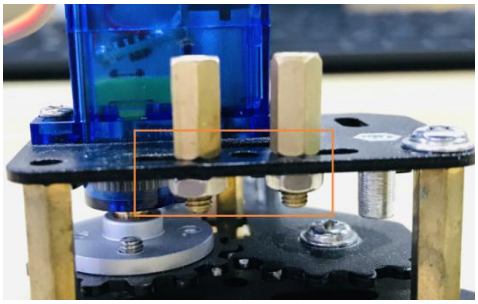
Note: this project should use 1000mAh lithium battery.

7-2. Hardware Preparation

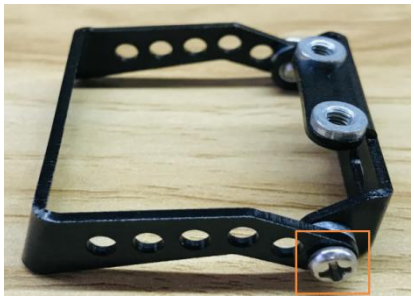
	
Maqueen Mechanic-Beetle X1	HUSKYLENS + Expansion Holder X1

	
M3*15mm Pan Head Screw X4 M3*8mm Copper Pillar X2 M3*5mm Nut X2	4Pin IIC Sensor Connecting Wire X1
	
lithium battery X1 1000mAh lithium battery X1	M3*5mm Pan Head Screw X8 M2.5*5 Screw X2
	
Red Card X1, blue Card X1	

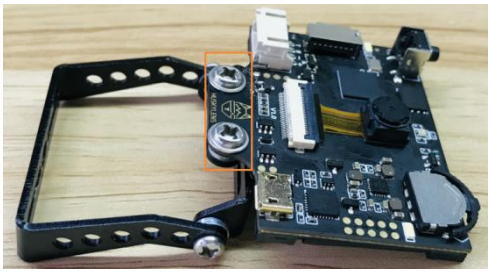
7-3. Installation Steps



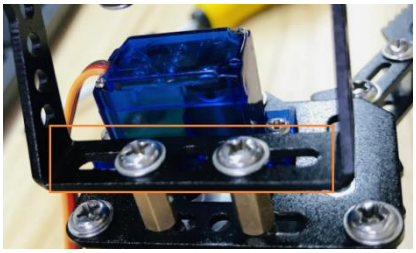
1. Lock the pillars on the panel with nuts



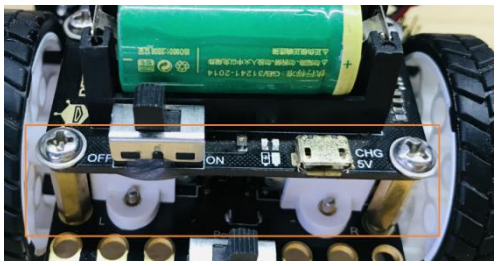
2. Install the expansion holder withM2.5*5 screws



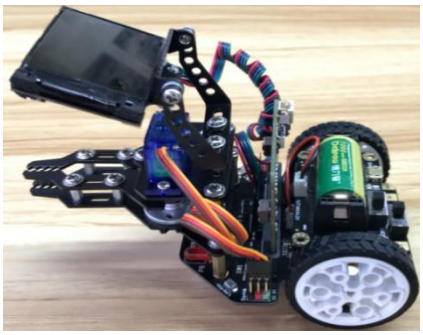
3. Install HUSKYLENS on the expansion holder with M3*5mm screws



4. Lock HUSKYLENS on the pillars with M3*5mm pan head screws



5. Lock the battery box on the Maqueen with pillars and screws



6. Installation completed

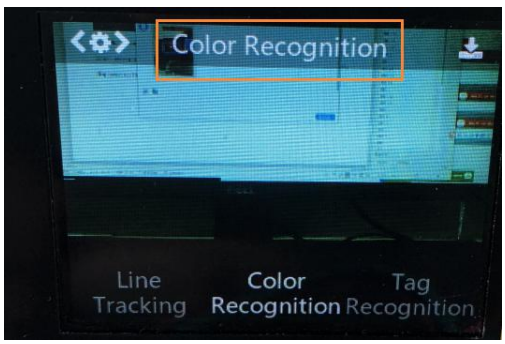
7-4. Color Learning of HUSKYLENS

HUSKYLENS sensor employs the built-in algorithm to identify the ID of different colors and feed them back to the main controller board by learning and recording different colors.

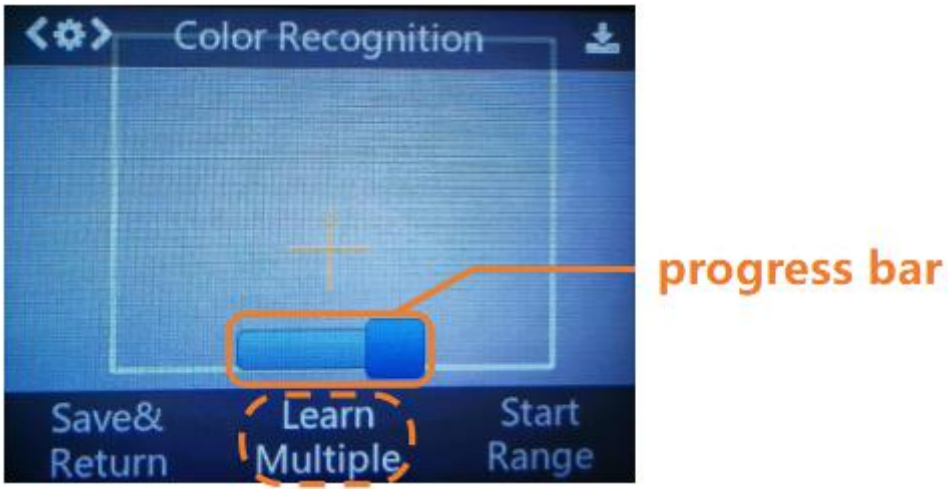
The HUSKYLENS sensor is set by default to learn, recognize and track only one color, but we can set it to recognize multiple colors.

1. Choose "Color Recognition" function

Dial the function button to the left until the word "Color recognition" is displayed at the top of the screen.



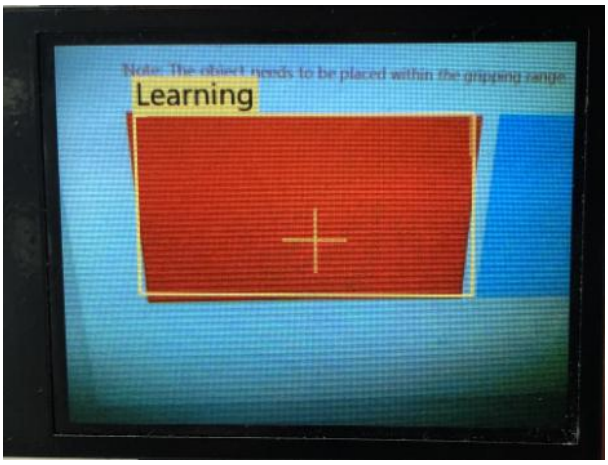
Long press the “function button” to enter the parameter setting of the color recognition function. Dial the function button until "Learn Multiple" is displayed, then short press the function button, and dial to the right to turn on the "Learn Multiple" switch, that is, progress bar turns blue and the square icon on the progress bar moves to the right. Then short press the function button to confirm this parameter.



Dial the function button to the left until "Save & Return" shows. And the screen prompts "Do you want to save the parameters?" Select "Yes" in default, now short-press the function button to save the parameters and return automatically.

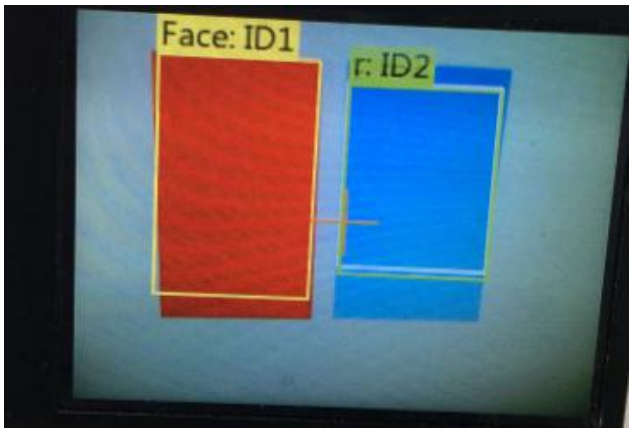
2. Color Learning

Point the “+” symbol at the color, long press the "learning button" to learn the first color. Then release the "learning button", a message "Click again to continue! Click other buttons to finish" will be displayed. Please short press the "learning button" before the countdown ends if you want to learn another color. If not, short press the "function button" before the countdown ends, or do not press any button to let the countdown ends.



3. Color Recognition

When encountering the same or similar color blocks, a frame with an ID will be automatically displayed on the screen, and the size of the frame is the same as the size of the color blocks.

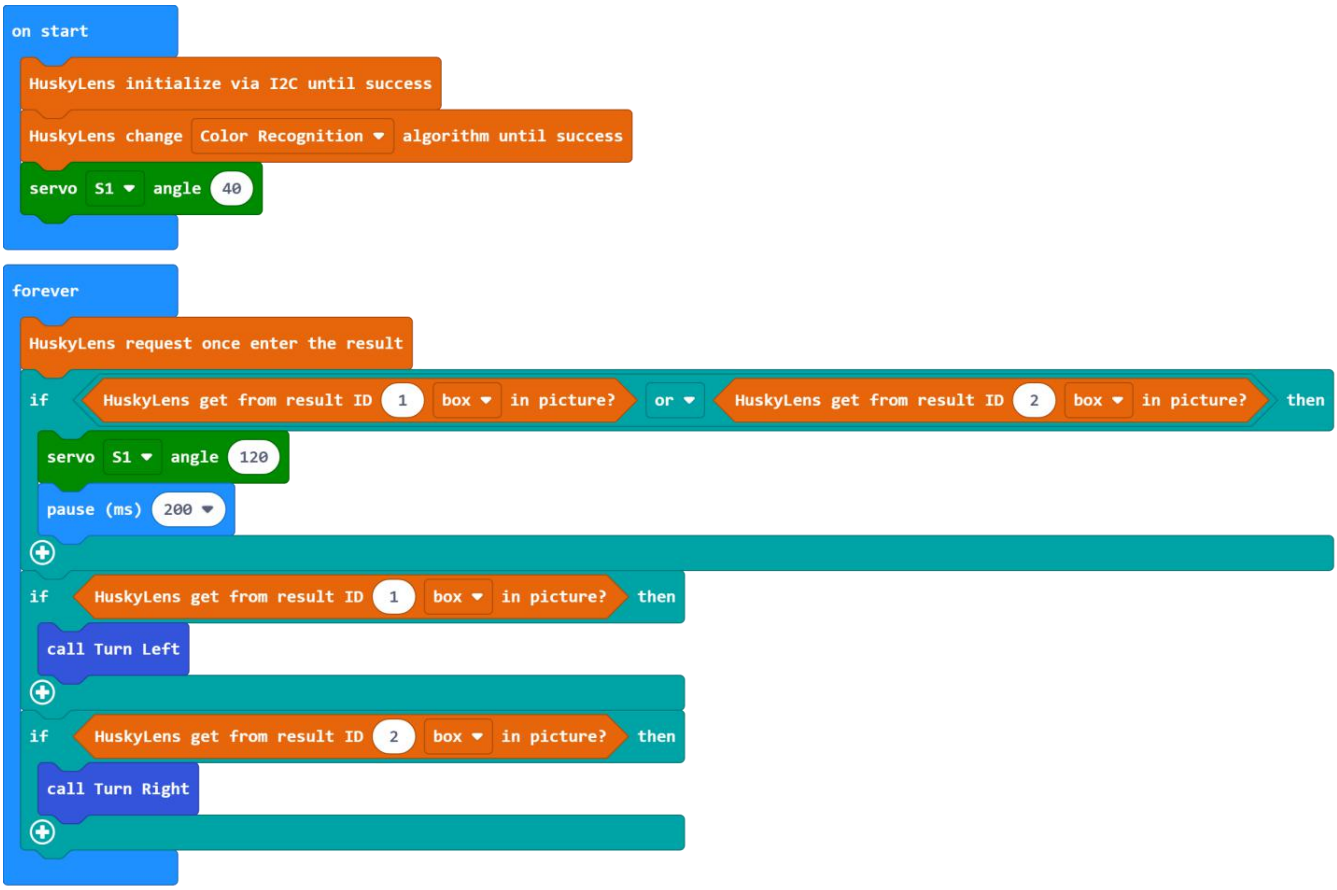


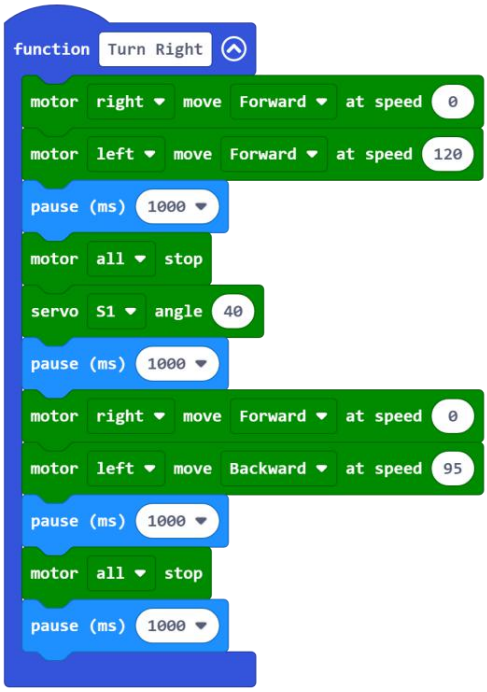
Note: Color recognition is greatly affected by ambient light. Sometimes HUSKYLENS may misidentify similar colors. Please try to use the sensor in environments with unchanged and suitable ambient light

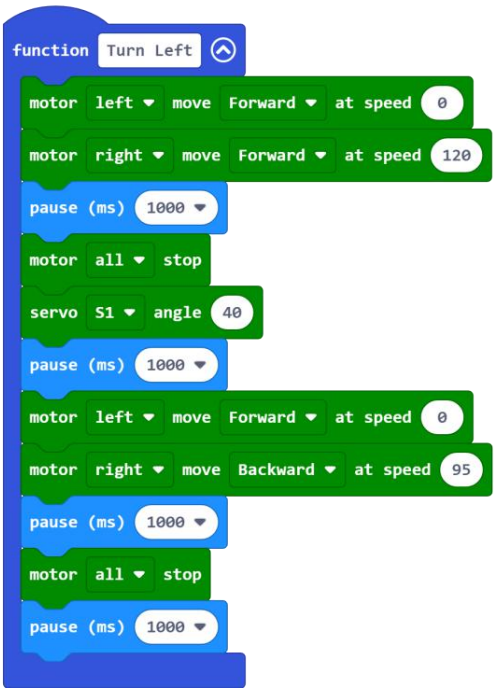
7-5. Program Link

https://makecode.microbit.org/_DADUjjTvsED1

7-6. Program Screenshot

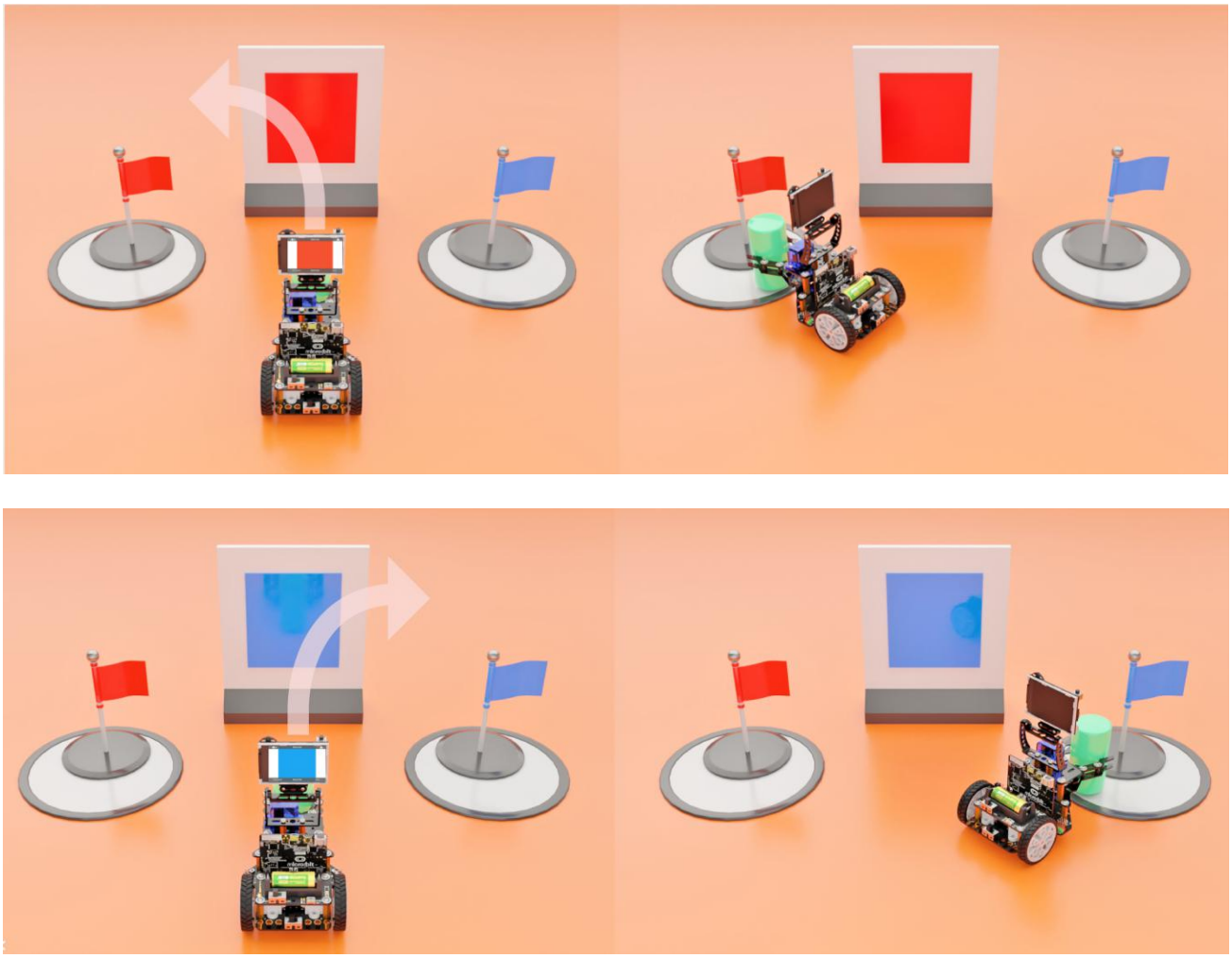






7-7. Effect Display

If the color detected is red, the Maqueen car turns left and places the object in the red area on the left; if it is blue, turns right and places the object in the blue area on the right.



Note: The object needs to be placed within the gripping range.