STEAM

Roboblog

Fostering DIY Ability and Programming Thinking

Creative Robot

Engineering Workshop

Preface

In 1984, Comrade Deng Xiaoping, China's former great leader said that "the popularization of computers must start from the children". Computer education has gradually entered the eyes of Chinese people since then. Today, computers can be seen everywhere in our life. "Artificial intelligence-based programming education" is a product of the educational philosophy that advances with the times.

Q-scout is an intelligent educational robot that incorporates the concept of STEM education. It is also a key to unlocking children's computer thinking. This book aims to guide the children who like Q-scout to find their own key to open their door to computer thinking.

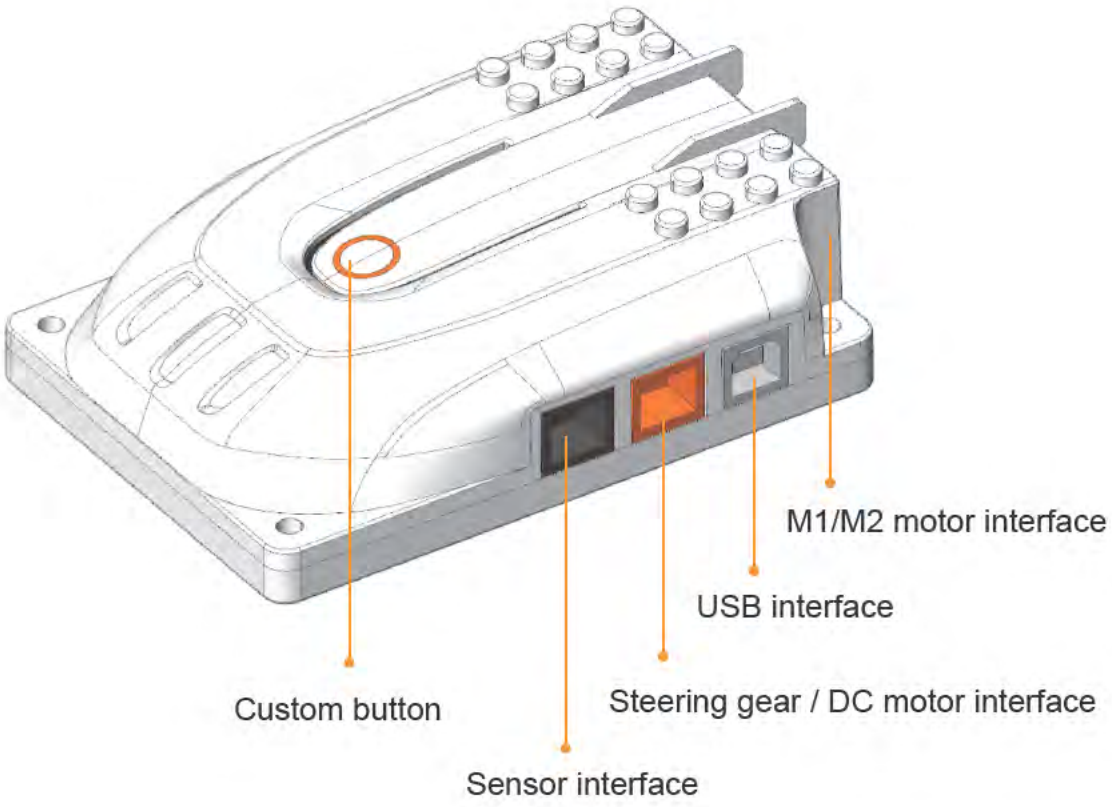
It contains explanations of the sensors installed in Q-scout, the use of custom programming in the app and new gameplays and functions that go beyond. We hope that kids create their own Q-scout through learning and have a unique buddy!

Table of Contents

Introduce Q-scout

Q-scout is an intelligent robot that can emit colorful lights and play wonderful songs. The line tracking sensor installed on it allows it to travel along the line and become a little patrol guard ready at all times! There is also an ultrasonic sensor mounted on it that glows with colorful lights which can detect obstacles in front, making Q-scout prepared to avoid obstacles in advance. Next, let's check out this mysterious Q-scout!

Learn about the programs

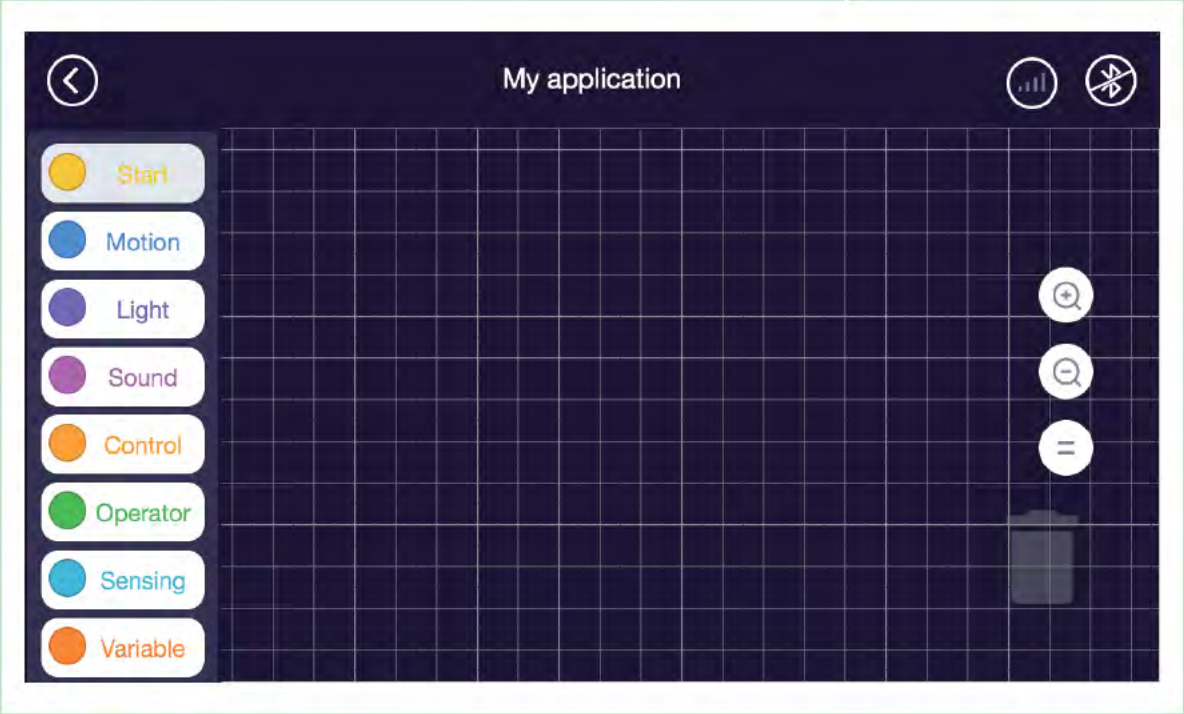


The motherboard is the Q-scout's brain with a Bluetooth module. After we connect the motherboard with the phone via Bluetooth, the commands are sent to the motherboard which then send the commands to each sensor and motor. It also incorporates colorful RGB lights, a buzzer that can make sounds and a small button that can be programmed freely.

Learn about the programs

Understand the programming interface

- Function: You can drag the module freely on the grid interface to edit the program and send the program to the motherboard via Bluetooth.
- How: Drag and drop the module on the left to edit the program; the first icon in the upper right corner is for Bluetooth connection through which you can connect the phone to the motherboard and send the edited program commands to the brain of Q-scout.

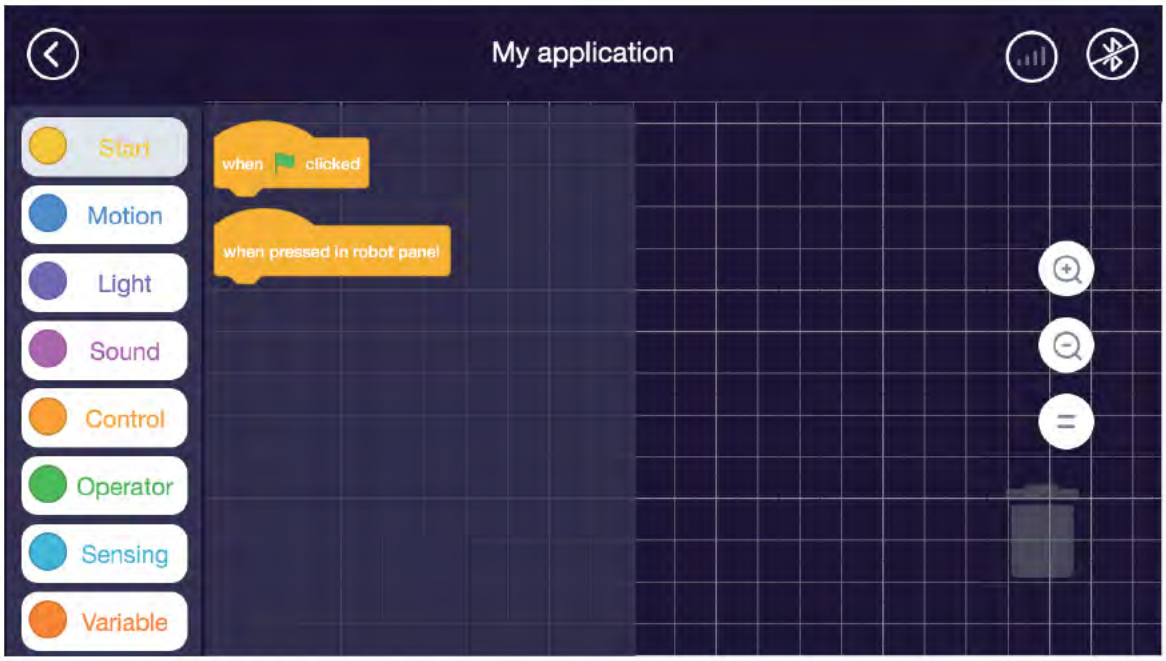


Learn about the programs

"Start" module

- Function: It contains two initial statement block for the program that must be added to the program.

- How: It can only be placed at the beginning of the program. The "When is tapped" module starts the program when tapping the module on the phone; the "Press the button on the top of the motherboard" module starts the program when pressing the custom button on the motherboard. Drag the module to the program interface as needed.

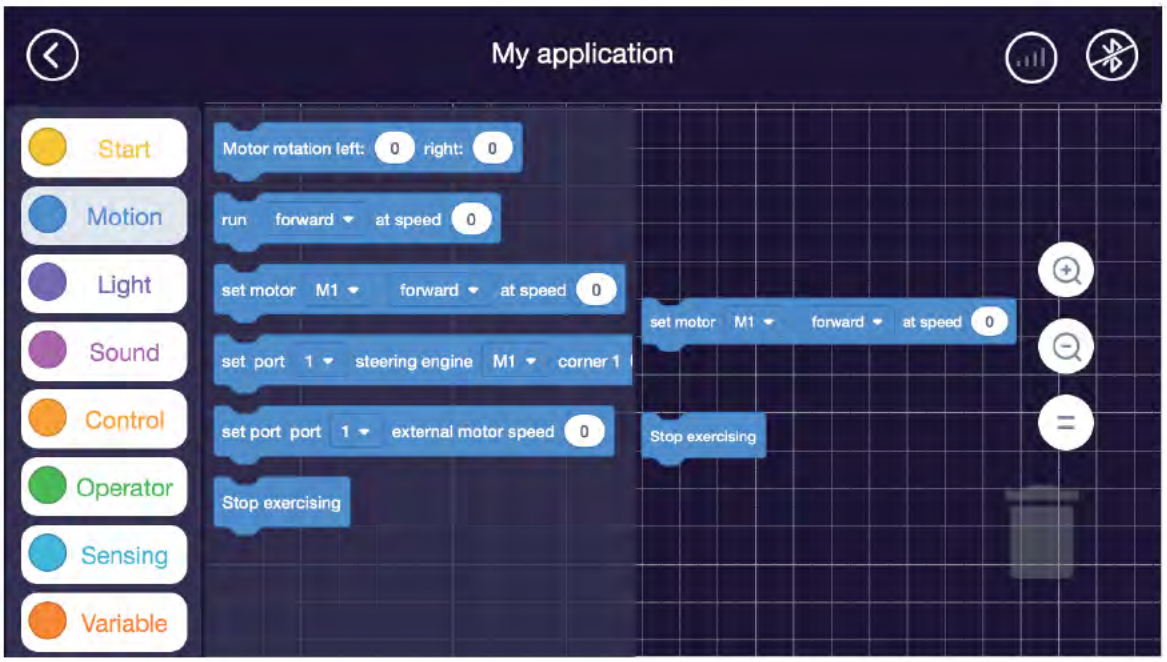


Learn about the programs

"Motion" module

- Function: It contains the statement blocks that can control the rotation and stop of the motors connected to the motherboard M1 and M2 interfaces.

- How: M1/M2 are settings for the program start port. Forward/backward are settings to make the motor rotate clockwise/counterclockwise. Speed () is to set the motor speed, and Speed (0) or "Stop moving" module are to set the stop. Insert the module into the initial statement block and set as needed.

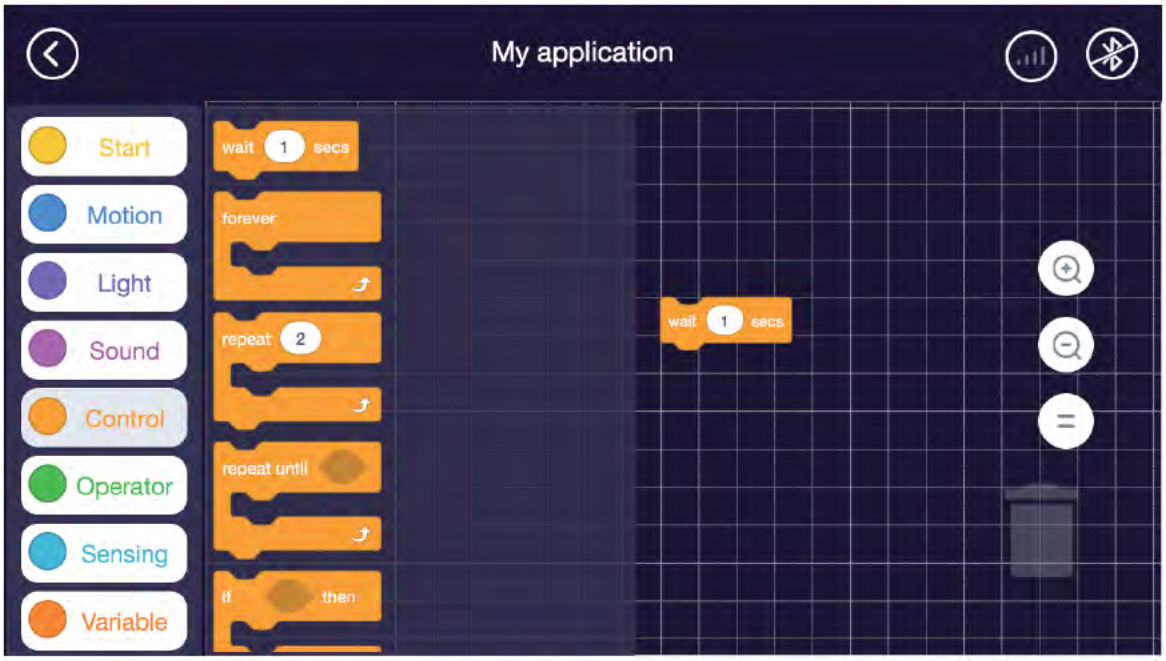


<Note: Q-scout's motor is easier to start running at a speed above 50>

Learn about the programs

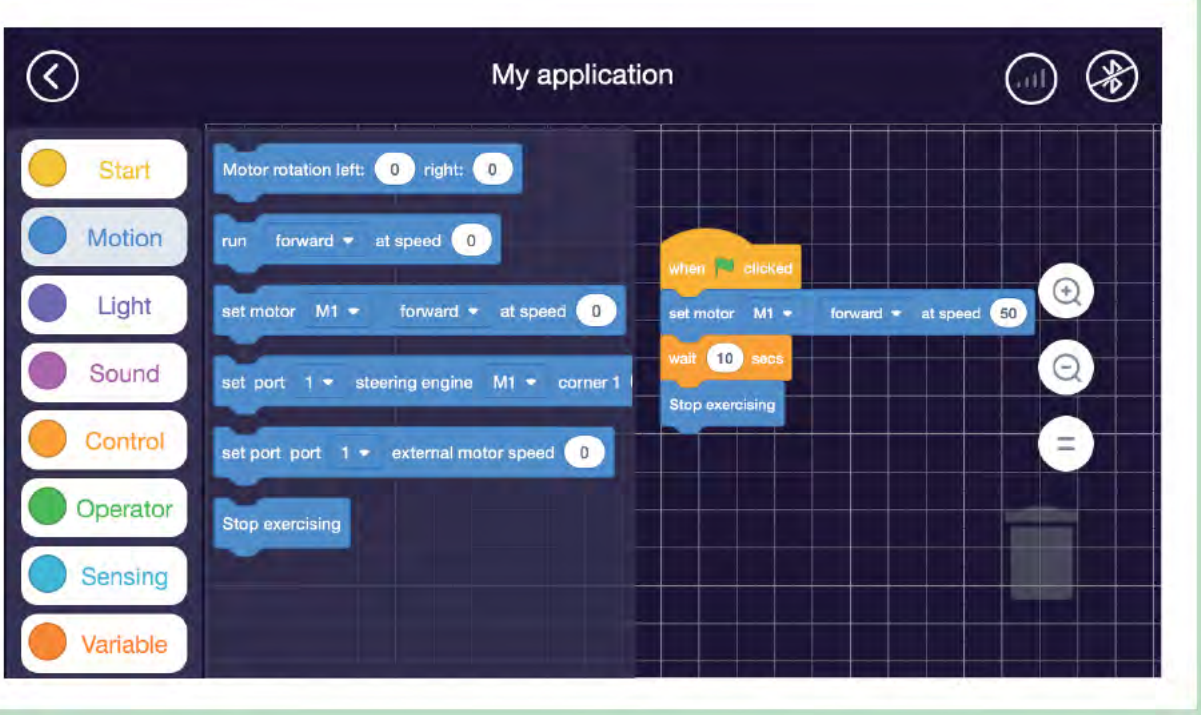
"Control" module

- Function: It contains a statement block that sets the execution time for the next program:" Wait () second(s)".
- How: Insert it between the previous program and the program, and set the start time of the next program. Insert the module into the initial statement block and set as needed.

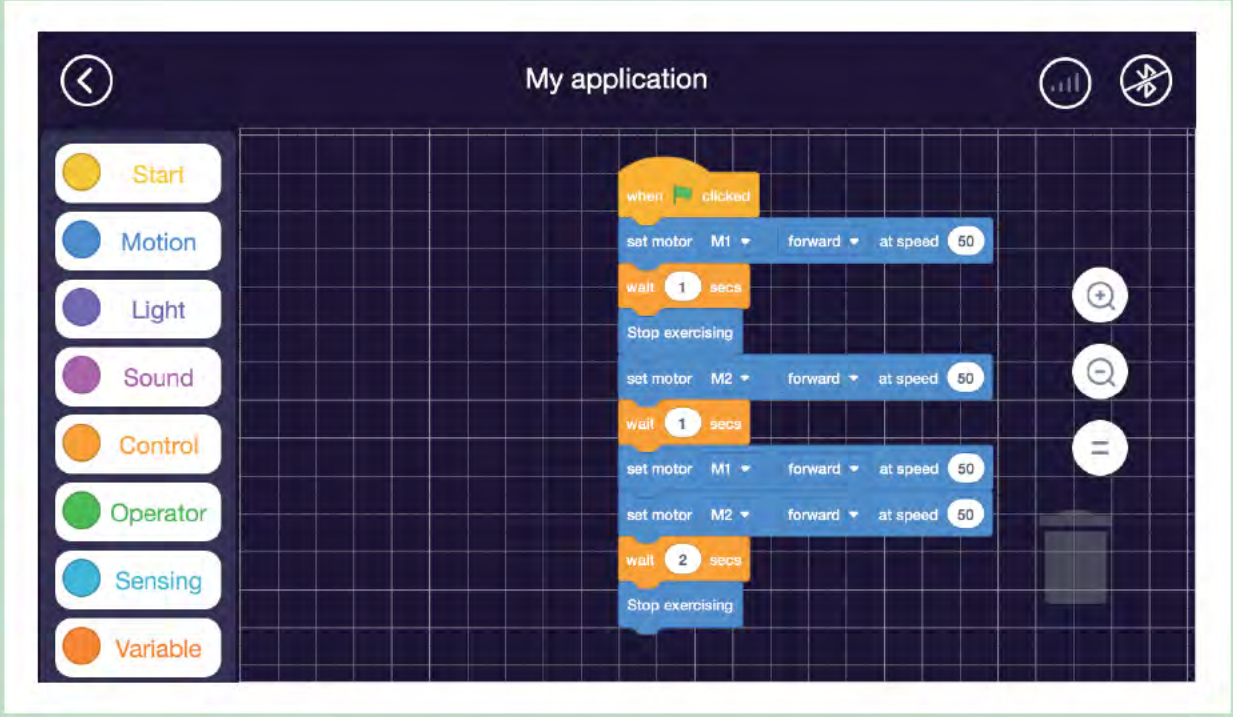


Try it yourself

Try setting it up and see what happens to your Q-scout!



Let's dance


My application
Start
Motion
Light
Sound
Control
Operator
Sensing
Variable
when clicked
set motor M1 forward at speed 50
wait 1 secs
Stop exercising
set motor M2 forward at speed 50
wait 1 secs
set motor M1 forward at speed 50
set motor M2 forward at speed 50
wait 2 secs
Stop exercising

What did you learn?

Motor interface

M1/M2 (forward)
At the speed of (0)

Execution time of the next program

M1/M2

Motor stops

Wait () second(s)

Complete the evaluation

Little Racer

Racing on the track at high speed is a very dangerous thing, especially if the track is crooked, but it is an excellent way to let the driver show his outstanding driving skills. Now let's learn how to be a racer and direct our Q-scout in race games!

Stories in life

We sometimes see cars with "2WD" or "4WD" marks. Actually, "2WD" is short for 2-wheel drive which means 2 wheels are connected to the engine to provide power, while "4WD" is for 4-wheel drive which means 4 wheels are connected to the engine to provide power. In general, 4WD vehicles require more energy than 2WD ones. But in a severe environment, it's harder for 2WD vehicles to drive than 4WD ones.

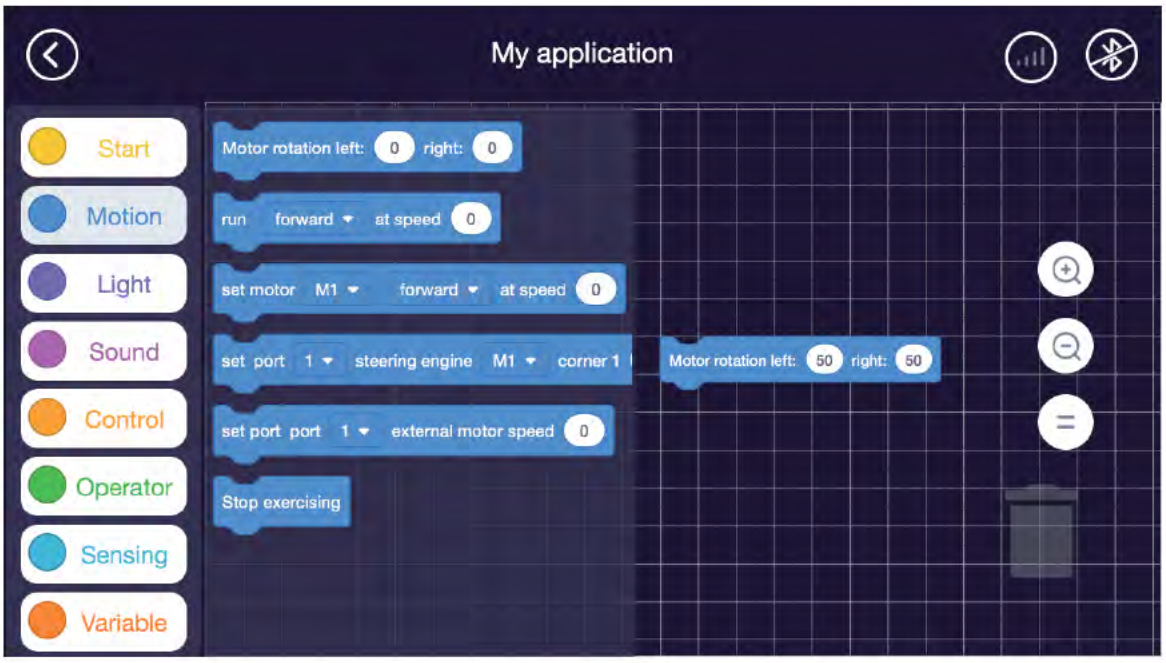
Many commonly seen cars are generally 2WD. Some are front-wheel drive and some are rear-wheel drive. 2WD vehicles are driven by the two wheels connected to the engine. For the rest wheels, if it's a front-wheel drive car, they are pulled forward, if it's a rear-wheel drive car, they are pushed forward. And our 2WD Q-scout is front-wheel drive.

<Snowland-crossing vehicle>

Learn about the programs

Q-scout moves forward

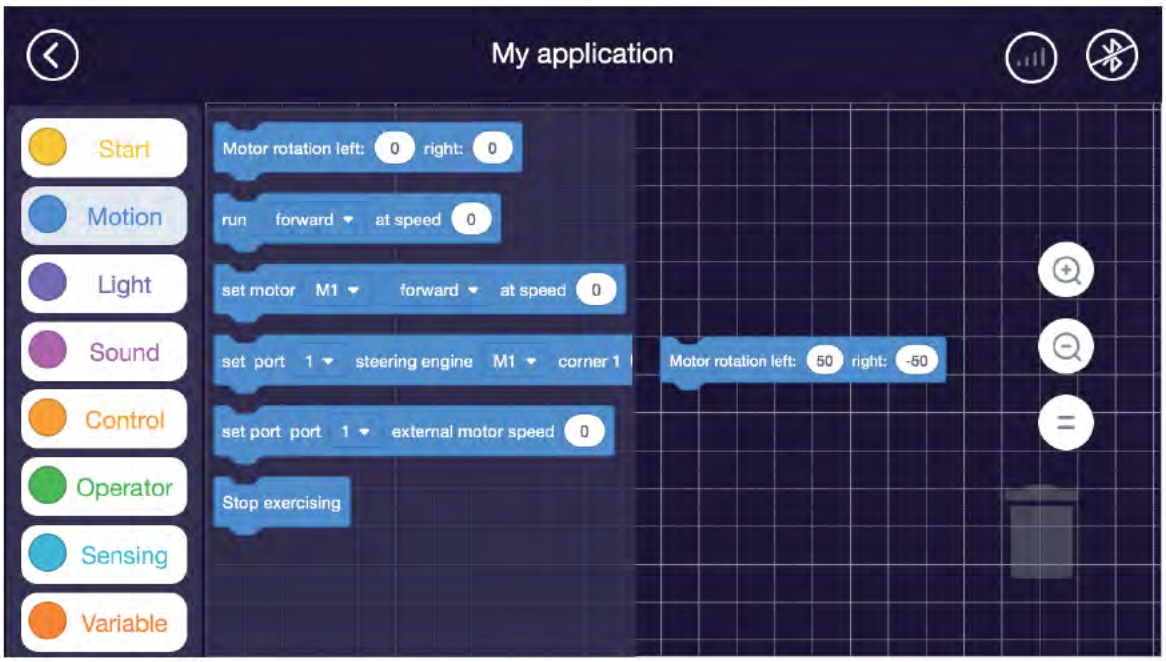
- Function: Set the rotation direction of the left and right motors to make Q-scout move forward.
- How: Adjust the left and right motor speed to an identical value between 50 and 100.



Learn about the programs

Q-scout turns right

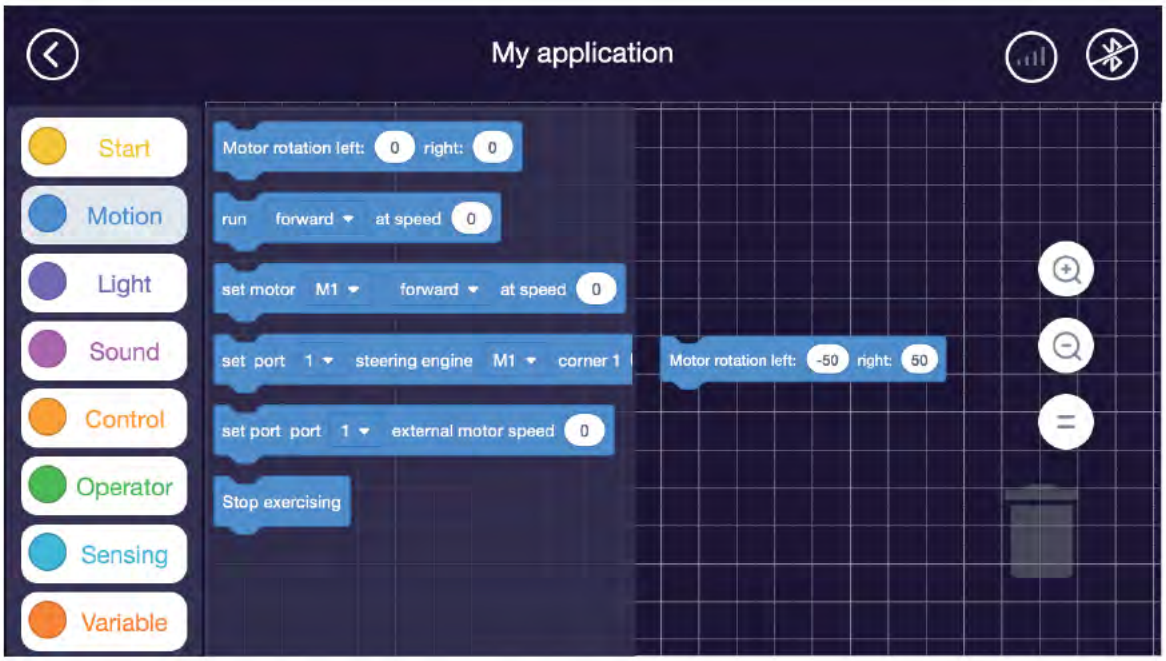
- Function: Set the rotation direction of the left and right motors to make Q-scout turn right.
- How: Adjust the left motor speed to a value between 50 and 100 and the right motor speed to between -50 and -100. The values are in the same number and one is positive and the other negative.



Learn about the programs

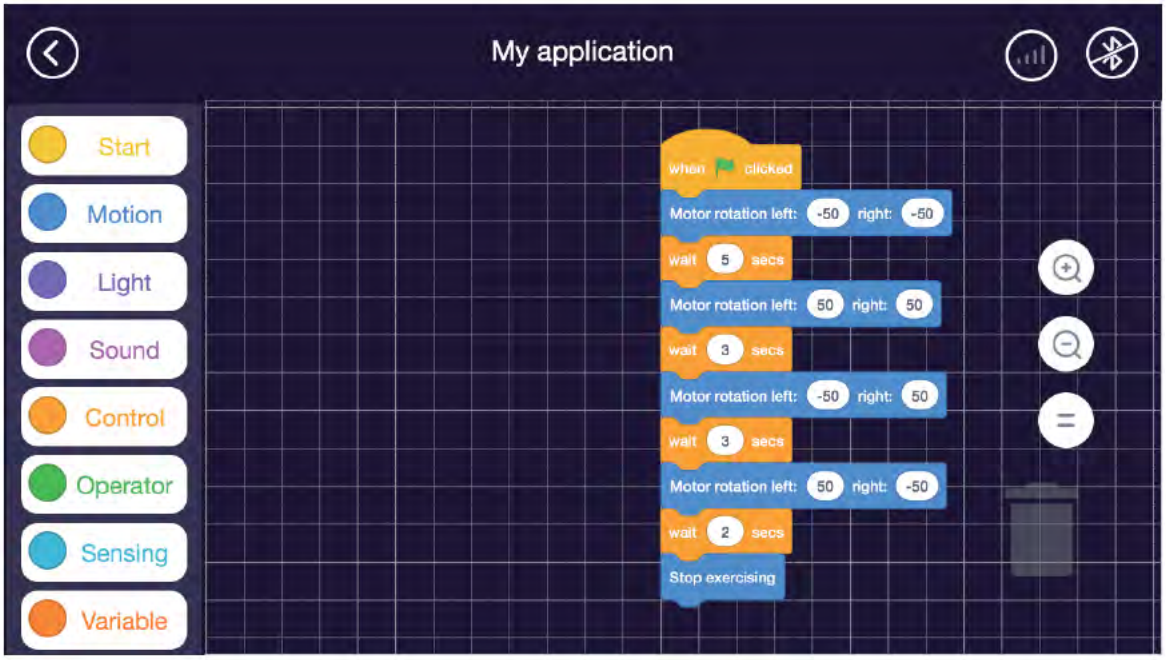
Q-scout turns left

- Function: Set the rotation direction of the left and right motors to make Q-scout turn left.
- How: Adjust the left motor speed to a value between -50 and -100 and the right motor speed to between 50 and 100. The values are in the same number and one is positive and the other negative.



Try it yourself

Try setting it up and see what happens to your Q-scout!



Game competition

Drive along the yellow line from the starting line to the finishing line and see who is the fastest Q-scout racer!

<Map for reference only>

What did you learn?

Write down what kind of functions a future car in your mind should have.

Complete the evaluation

Little Musician

Besides turning into a powerful racer, the magical Q-scout can become a great musician to play the music in our hearts. Now let's direct Q-scout to come up with a wonderful song!

Stories in life

It's believed that everybody has their own favorite songs, instruments and singers whose concerts they want to go watch. Common instruments in our life include piano, guitar, etc. What are the differences between them?
A piano is a played instrument that consists of keys and metal-string soundboard. The performer presses the keys on the keyboard which touch the small felt-wrapped hammers in the piano, and the hammers then tap on the steel-wire strings to make a sound. The piano needs regular care and maintenance to ensure unchanged tones.
A guitar is a plucked string instrument that consists of only six strings. The performer plucks the strings to cause vibration which makes the sound, and by pressing different positions on the strings, different sounds can be made.

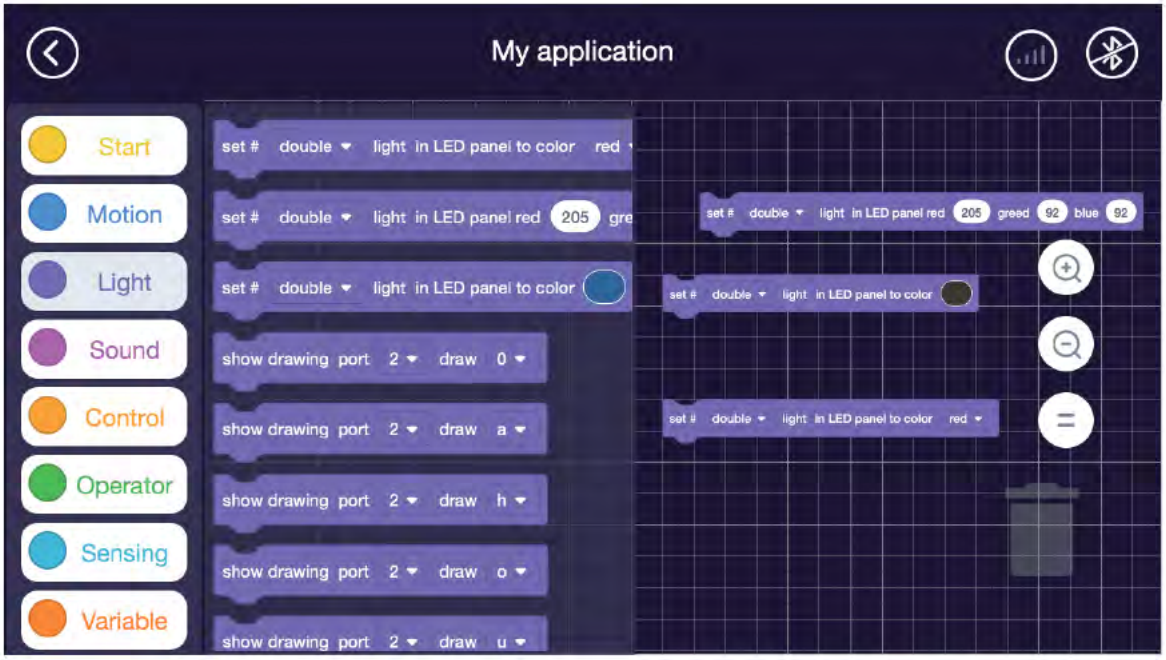
<Guitar-playing kid>

Learn about the programs

"Light" module

- Function: It contains command modules for adjusting on-board light color, brightness, and saturation.

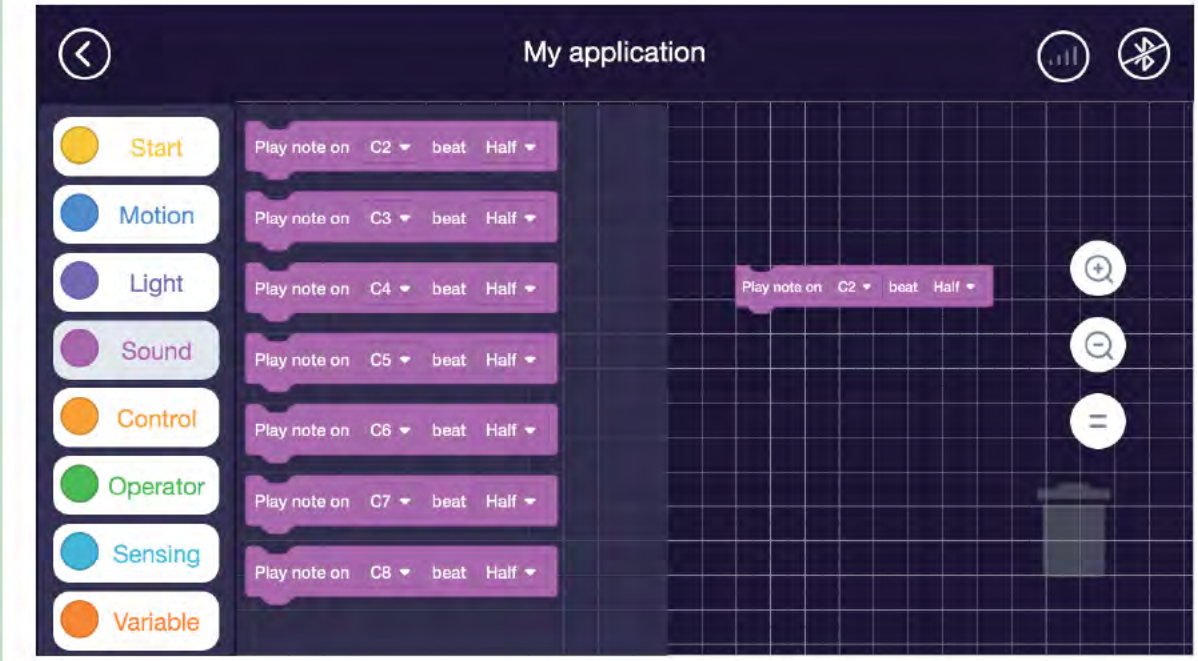
- How: Place it below the initial statement block. "Double lamp/left lamp/right lamp" can be used to set which lamp is on. The color of light can be directly set to "red, yellow, green". You can set values in "red (), green (), blue ()" to change the concentration of the three primary light colors to create more beautiful colors. You can also set the brightness and saturation of different light colors to make Q-scout brighter and cooler.



Learn about the programs

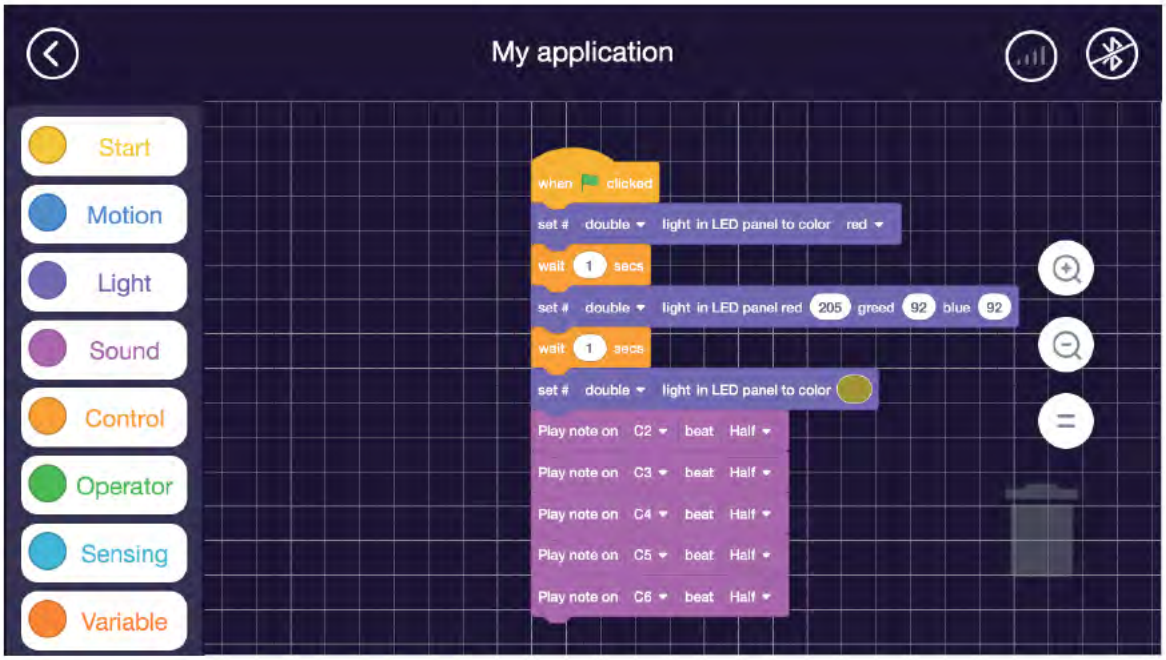
"Sound" module

- Function: It contains a module that enables the buzzer to make a sound in various pitches and beats: "Play tone () at the beat of ()".
- How: Place it below the initial statement block, and arrange "Tone ()" and "Beat ()" in sequence to create pleasant music.

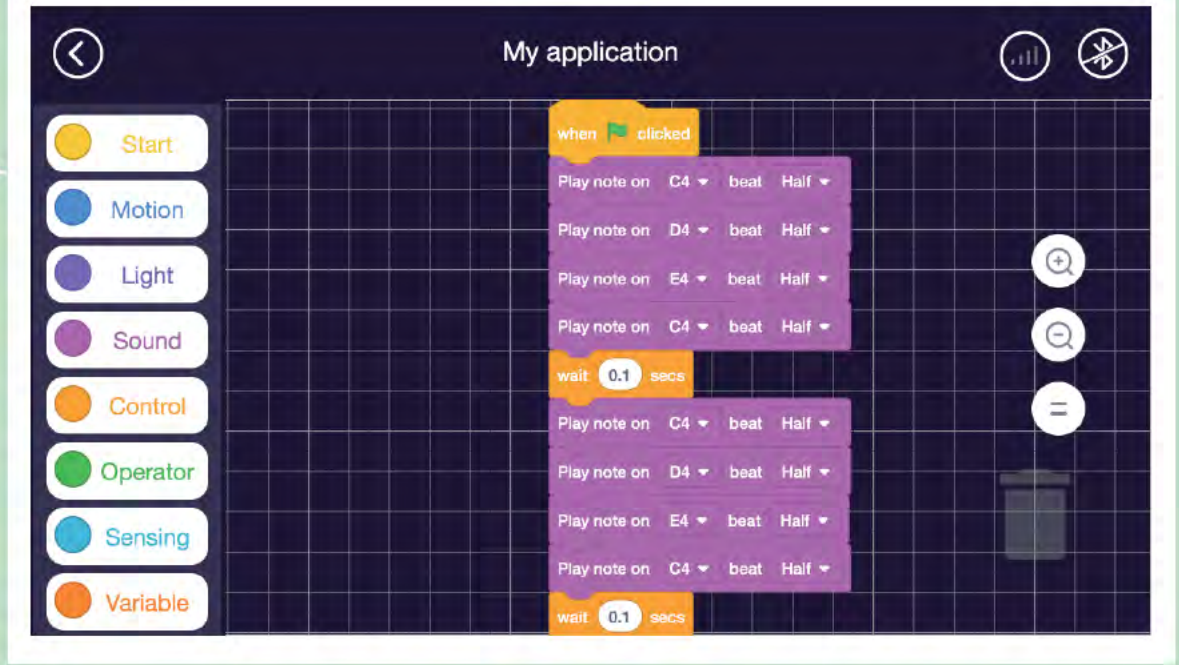


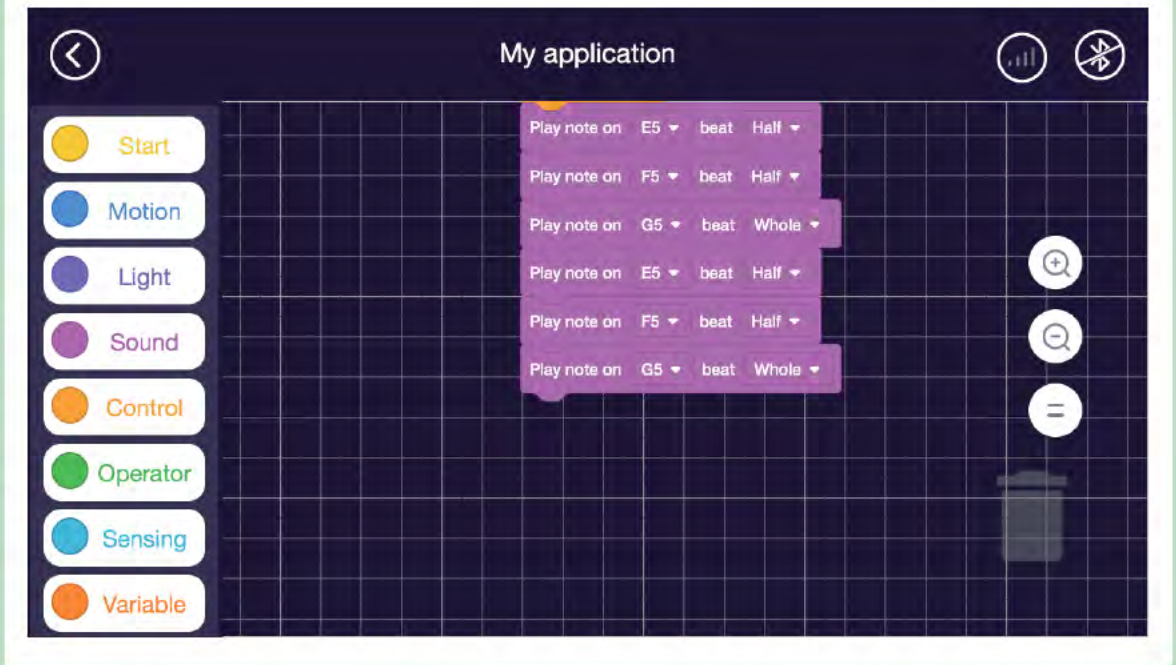
Try it yourself

Try setting it up and see what happens to your Q-scout!



Let's compose a song





What did you learn?

Check out who can first play Twinkle Twinkle Little Star with Q-scout!

Complete the evaluation

Get out of the Maze

Getting out of a maze is a very difficult game. It has very high requirements for our memory, observation and logic ability. Now let's try to cross the maze with our good partner Q-scout!

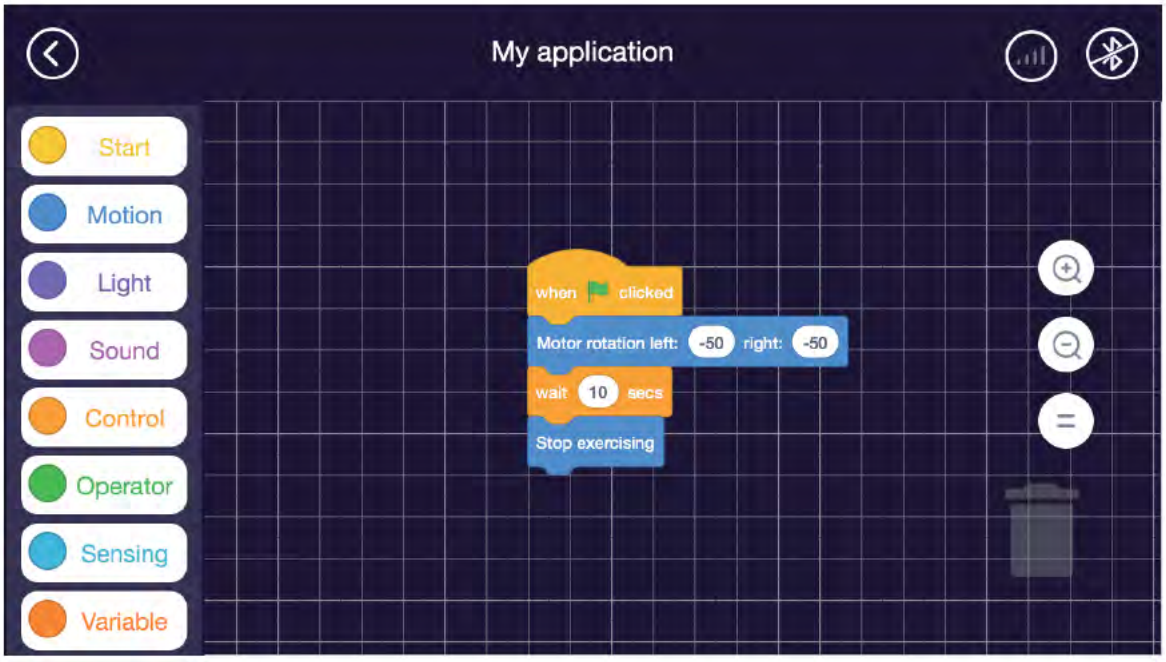
For average people, a maze is mysterious and a manifestation of the ancient wisdom and can only be seen in uninhabited places in movies. Besides mazes, the mysterious ancient Egyptian pyramids are better embodiment of ancient wisdom.

Called one of the "eight major architectural Wonders of the world", pyramids can be found throughout Egypt and the Americas. The enormous architectural planning, heavy construction materials, exquisite channel design and the perfect combination of mathematics and architectural design all show the wisdom of the people in ancient times.

Learn about the programs

Set straight travel distance

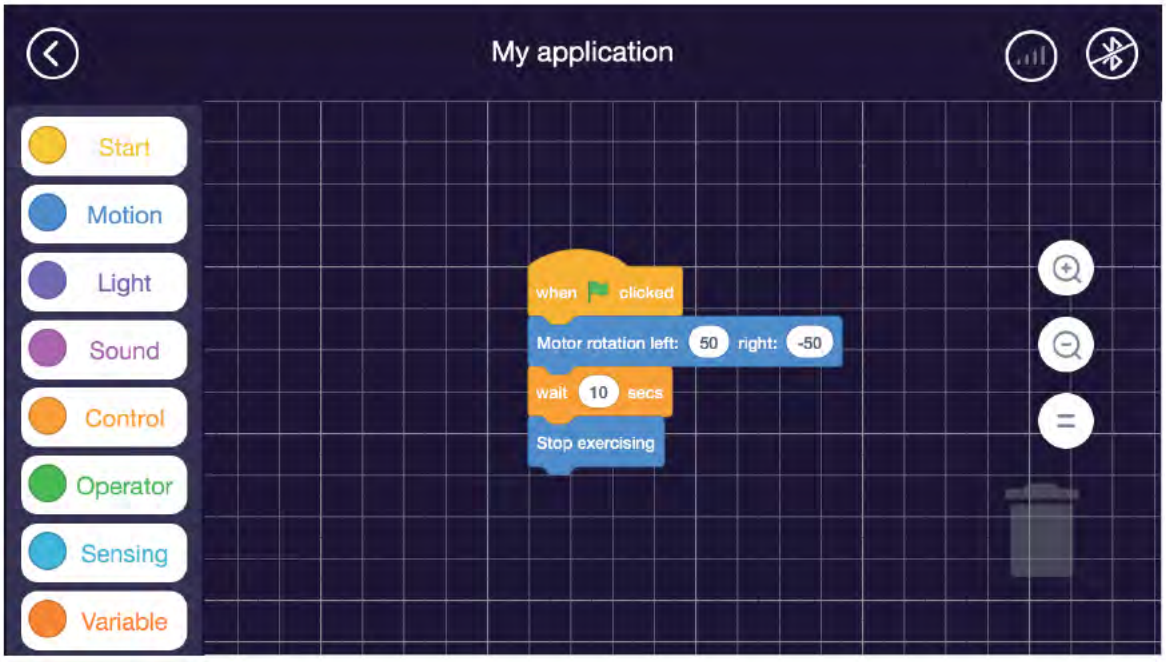
- How: Set the motor speed and running time to control the travel distance.
- Usage: Set the left and right motor speed to the same value between 100 and 50 or between -100 and -50. Make the running time for both motors identical to allow straight travel. The speed and time can be set according to the actual distance.



Learn about the programs

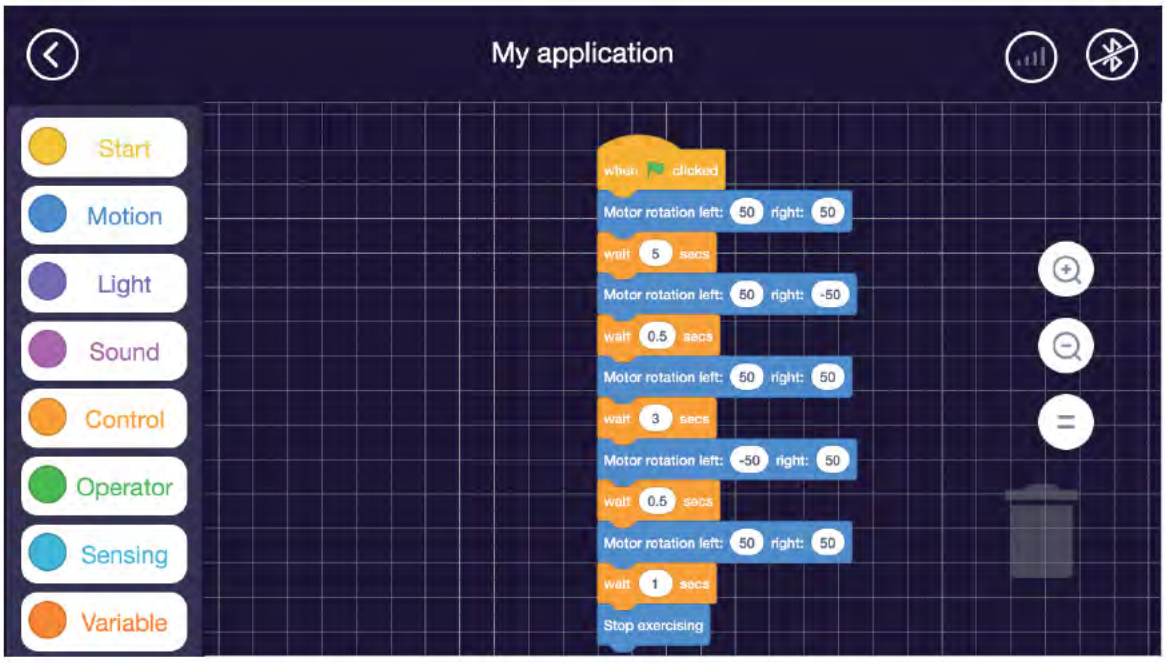
Set travel distance for left and right turns

- How: Set the motor speed and running time to control the travel distance.
- Usage: Set the left and right motor speed to values in the same number between 100 and 50 or between -100 and -50 (one positive and one negative) to allow left and right turns. The speed and time can be set according to the actual distance.



Try it yourself

Now let's make our Q-scout get to move flexibly!



Get out of the maze

<Map for reference only>

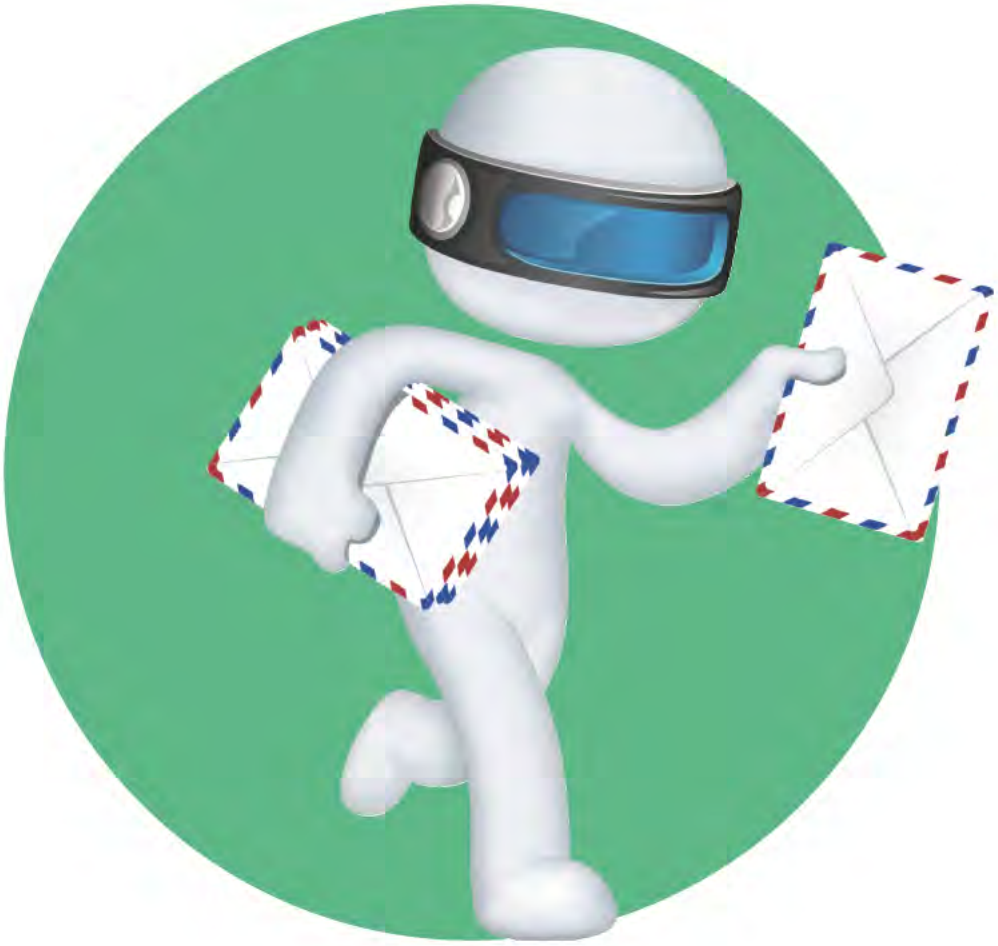
What did you learn?

Can you now control your Q-scout flexibly? Use it to get out of more mazes!

Complete the evaluation

Little Musician

Express delivery is an indispensable part of our current era. For example, we can quickly send the carefully selected gifts to friends through express delivery. Now let's turn Q-scout into a cute courier and make it send gifts to friends!



Stories in life

Many new professions are emerging over time, and many other professions are falling. With the rapid development of the domestic express delivery industry, the distance for transactions and communications among people has been continuously shortened, and the cultural differences between the north and the south have also been reduced.

The express delivery vehicles we often see in life include trucks and motorbikes. What's more, as the demand for express delivery time becomes higher and higher, and the volume of shipments continues to increase, aircrafts are used for express delivery too.

An aircraft is lifted by the fixed wing and thrust by the propulsion device. Compared with other vehicles, it is not affected by the terrains, so the shortest path can be chosen and the speed can be increased.

Learn about the electronic parts

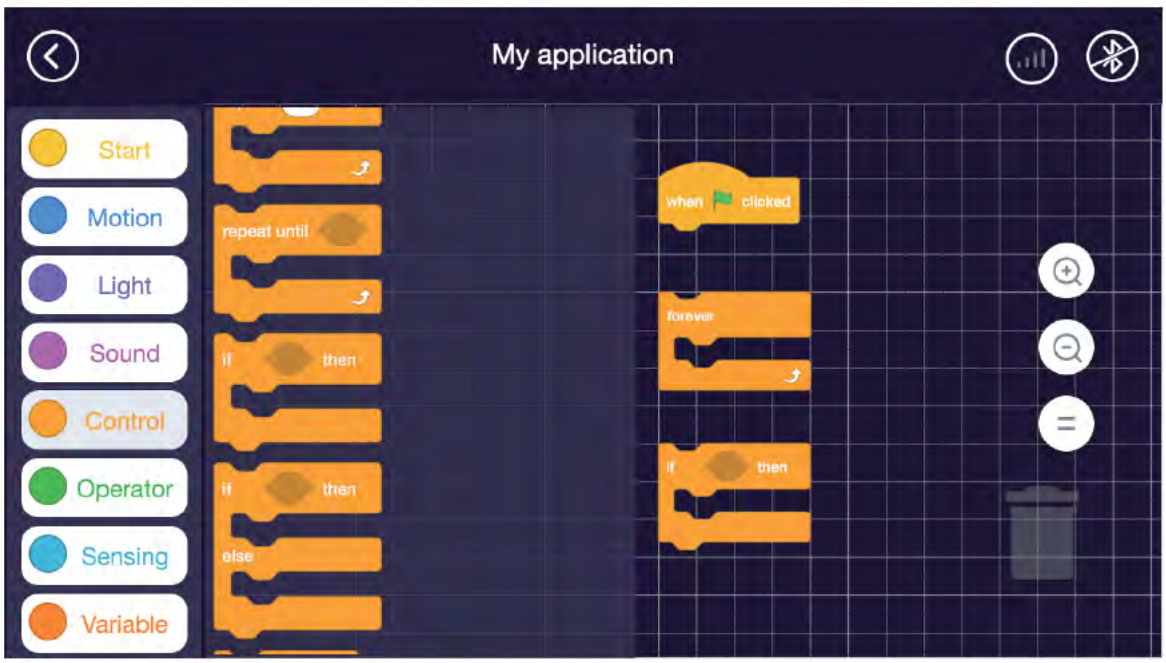
A custom button is a push switch that can be programmed to different functions. When the button is pressed, the circuit is turned on to run the program according to the requirements set by the function edited for the program.

Learn about the programs

"Control" module

- Function: It contains conditional statements such as "if... then..." and "if... then... and other..." as well as loop statements such as "Loop continuously", "Repeat execution () time(s)" and "Repeat execution until ()".

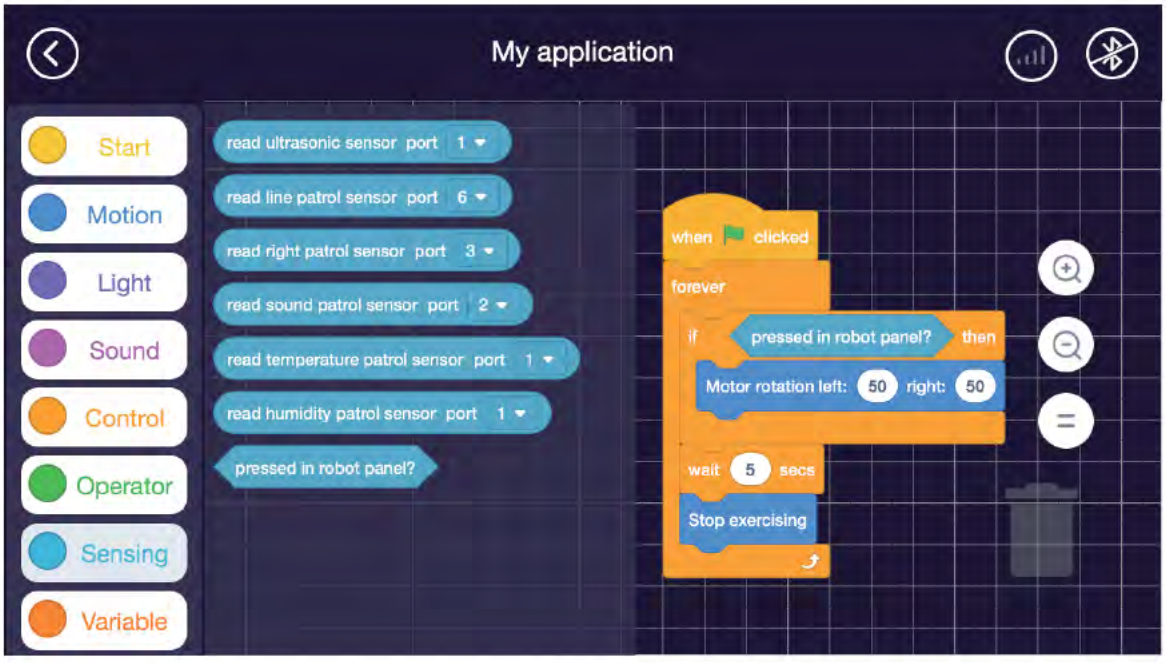
- How: Drag and drop the conditional statement module below the initial statement block and arrange them as needed; loop statement block is divided into infinite loop, limited loop and out-of-loop modules.



Learn about the programs

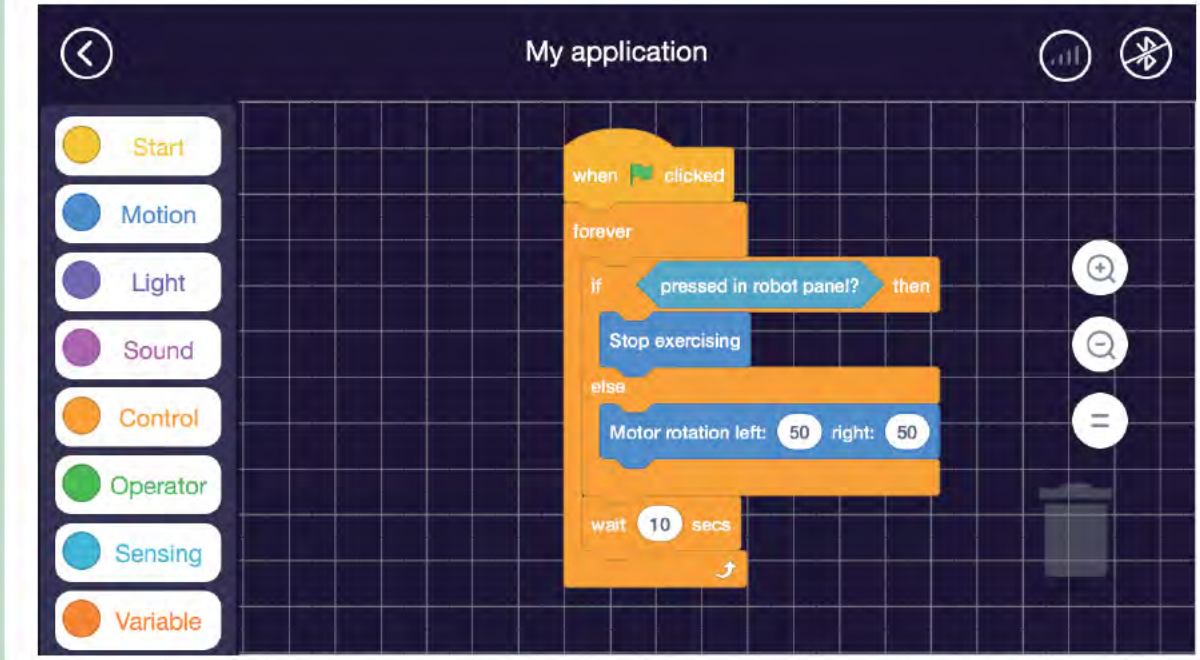
"Sensor" module

- Function: It contains the top button module.
- How: Drag and drop the top button module to the conditional statement module and place them below the start statement block.



Try it yourself

Try setting it up and see what happens to your Q-scout!



Let's join together

Join relay race with buddies! See which group of buddies are the fastest!

What did you learn?

1. What does an infinite loop command do besides allowing the program to repeat execution?

2. What is the difference between "if..." and "if... or..."?

Complete the evaluation

Patrol Guard

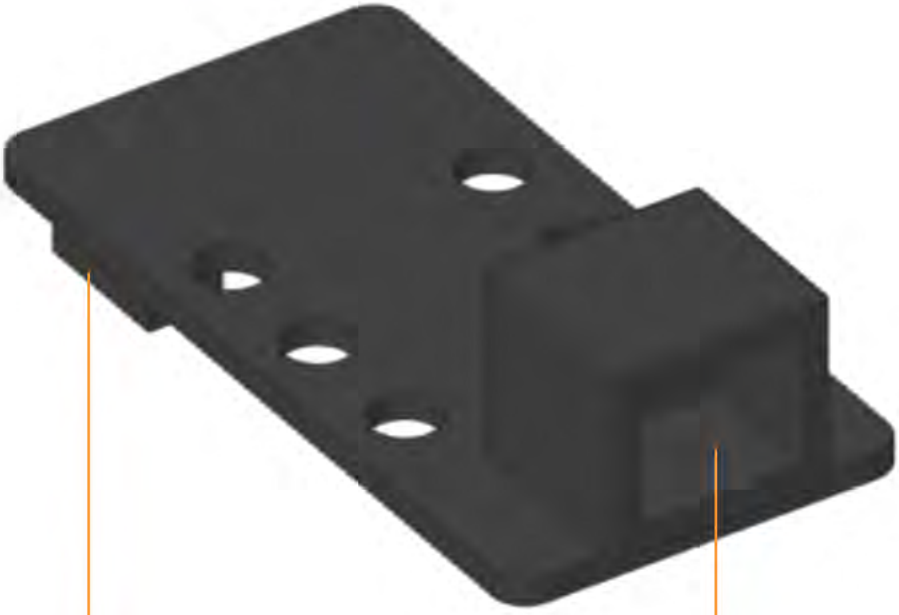
Patrol guards are indispensable in wars as they safeguards the troops when they rest. Now let's turn the magical Q-scout into a patrol guard who can patrol automatically and tirelessly!

Stories in life

On the battlefield, patrol guards will patrol the camps. In our daily life, we can see more use of ubiquitous surveillance cameras to monitor important places. The videos captured by the cameras are transmitted via cables or over the network to the terminals connected to the cameras and displayed on the screens.

With the continuous development of surveillance cameras, they have become a non-negligible presence in social infrastructure, and moreover, they are everywhere in major cities. The era with surveillance cameras is totally transparent, which is a nightmare for criminals.

Learn about the electronic parts



A line tracking sensor recognizes the black lines on the ground and transmits information to the motherboard to make the robot travel along the black lines. Line tracking sensor is also widely used in daily life, such as elevator's sensor door and sensor faucet. With the aids of sensors, we can make life more convenient and safer.

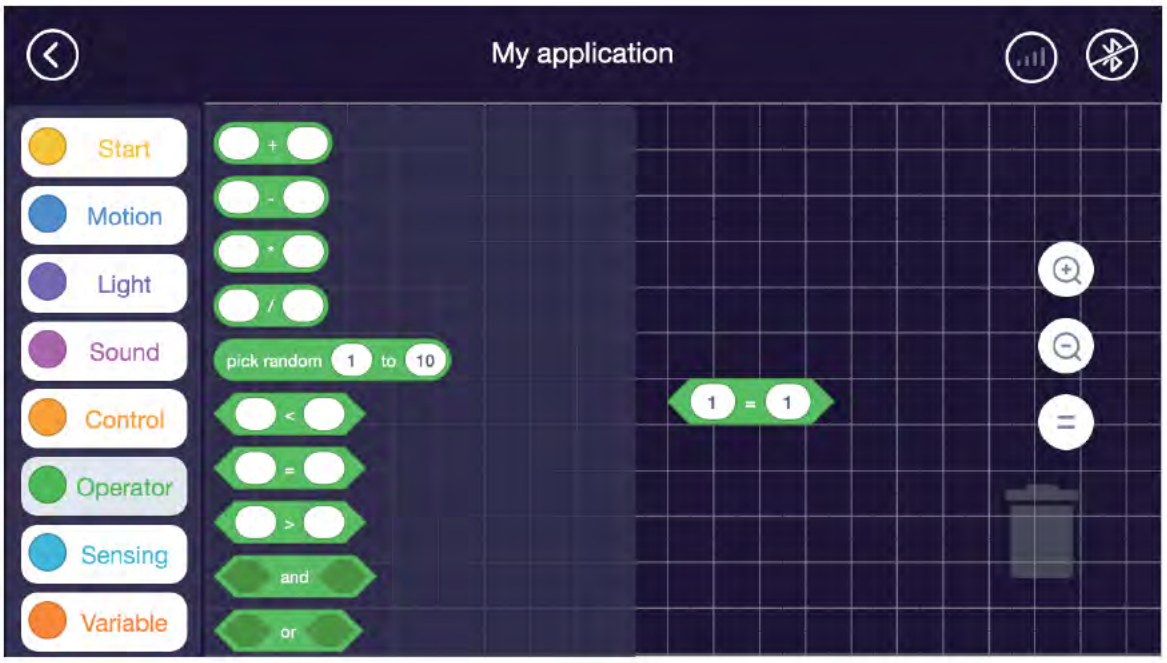
It works by emitting light through the infrared emission tube. If the obstacle is black, it absorbs the light, so the infrared receiver tube will not get conducted; if the obstacle is white, it reflects the light, and the infrared receiver tube will get conducted.

Learn about the programs

"Control" module

- Function: It contains addition, subtraction, multiplication and division formulas and logical operation formulas.

- How: Drag and drop the calculation formula icon to the programming panel, and enter the values into the calculation formula to obtain the calculation result. Drag and drop the logical operation icon to the programming panel, drag and drop the calculation formula icon that obtains the calculation result to the logical operation icon, and put the logical operation result into the conditional statement as needed.

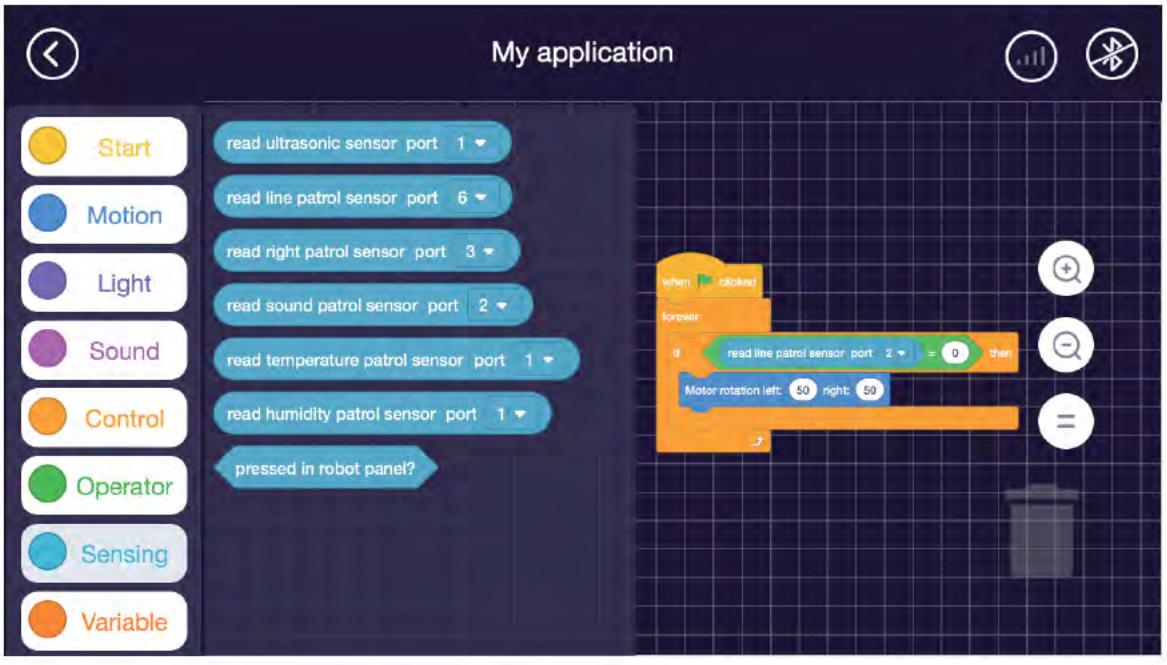


Learn about the programs

"Sensor" module

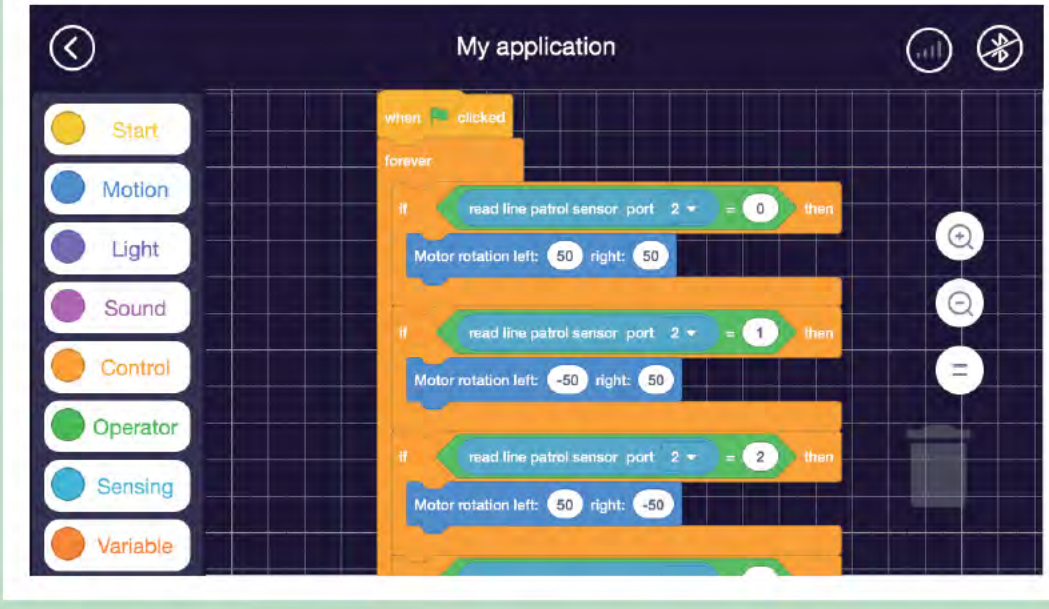
- Function: It contains line tracking sensor value, ultrasonic sensor values and motherboard button module.

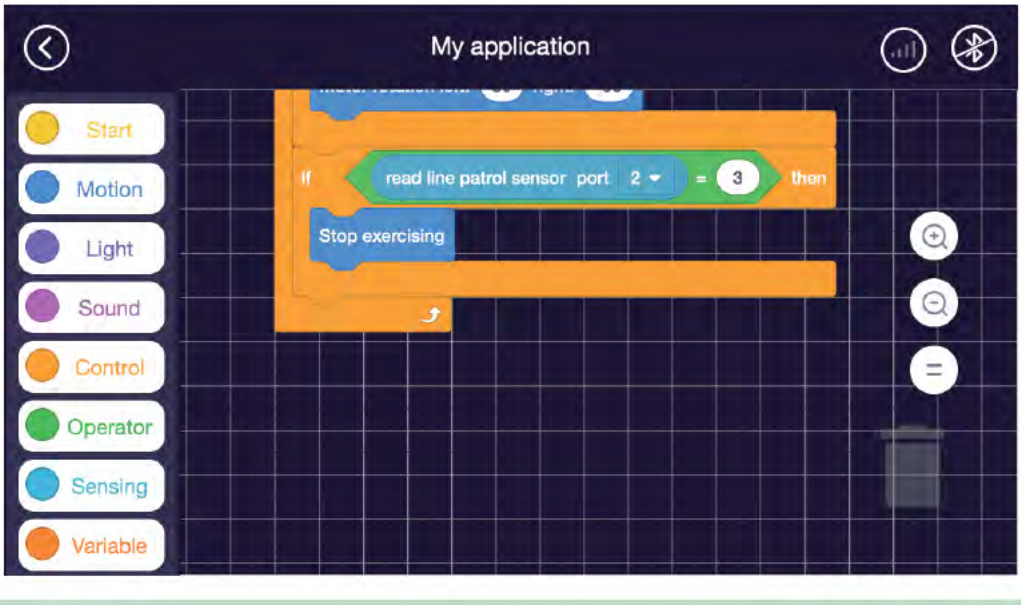
- How: If line tracking sensor value = 0, it means that neither the left nor right infrared sensors receives light; if line tracking sensor value = 1, it means that the left infrared sensor receives light but the right infrared sensor doesn't receive light; if line tracking sensor value = 2, it means that the left infrared sensor doesn't receive light but the right infrared sensor receives light; if line tracking sensor value = 3, it means that both the left and right infrared sensors receive light. Drag the sensor value module into the calculation formula or logic formula, and then arrange them as needed.



Try it yourself

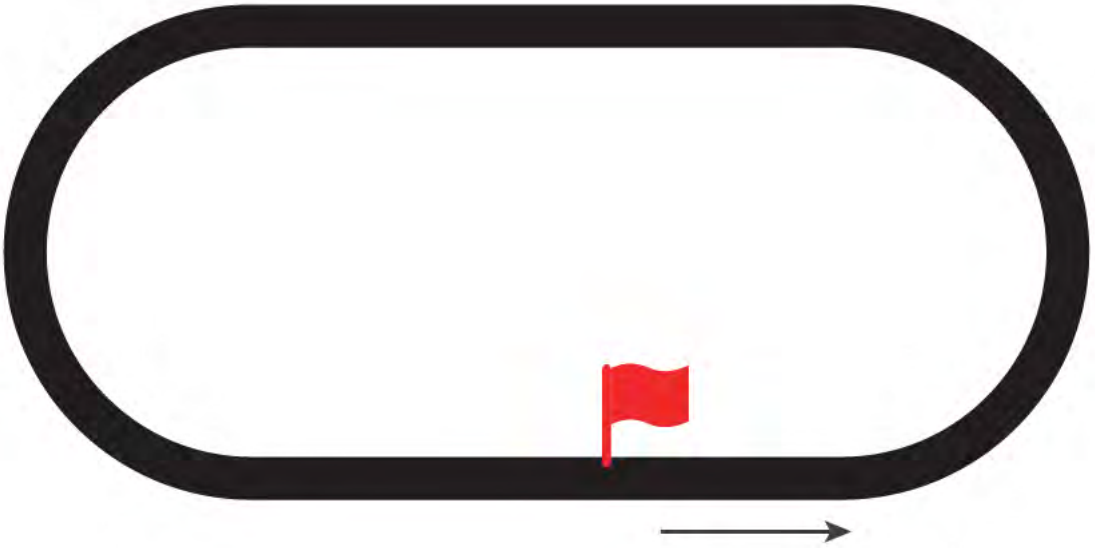
Try setting it up and see what happens to your Q-scout!





What did you learn?

Can you turn your Q-scout into a patrol guard?
Try to make it go along this line!



Complete the evaluation

Ultrasonic Warrior

We need brave soldiers to defend our homeland, and we never lack courageous soldiers on the battlefield. However, a great soldier needs not only to move forward bravely, but also to evade early in face of unconquerable enemies to reduce the losses.

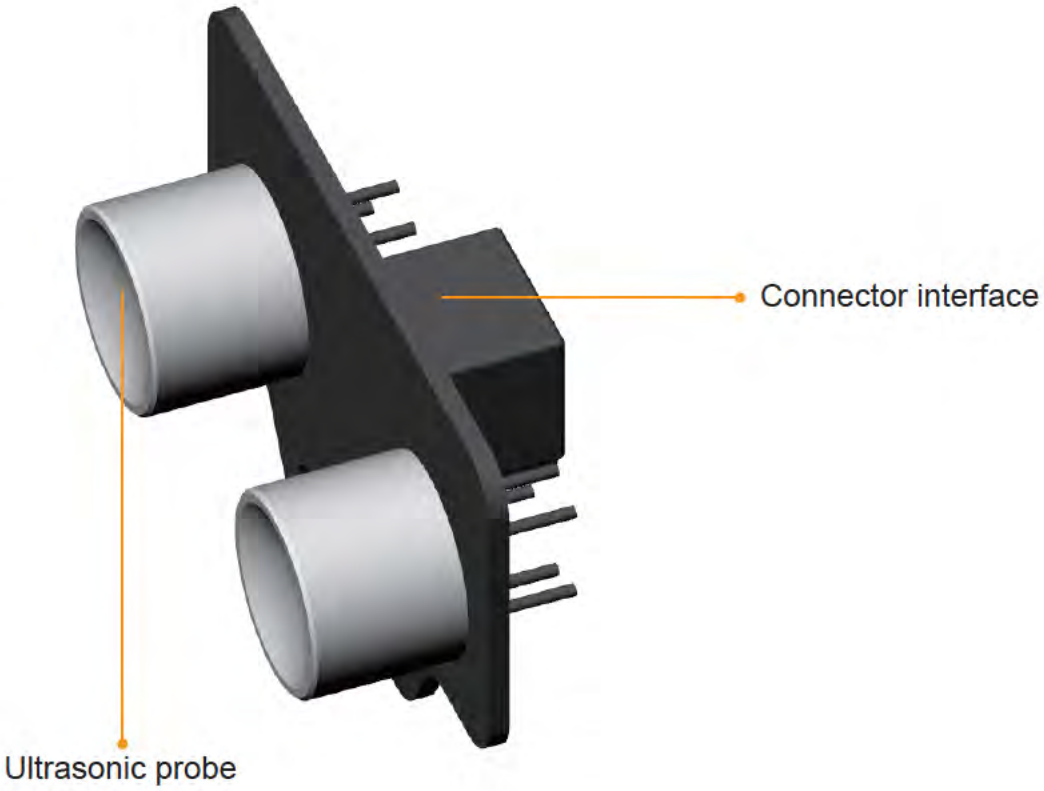
Stories in life

Those who fight on the battlefield are called soldiers, and the objects the warriors use on the battlefield are called weapons. With the development of science and technology, the weapons of soldiers on the battlefield are constantly changing. From swords and sticks to guns and cannons, their power is increasing, and their range is getting further and further.

Tank is one of the most effective weapons on modern land battlefield. It is a tracked armored combat vehicle that can shoot directly and go off-road. It is mainly composed of weapon systems, targeting systems, power systems, communication systems and armored body.

The great destructive power of the tank not only brings victory in the war, but also brings destruction to the world. The Earth is now crumbling, and many many people lost their homes to wars. It is hoped that powerful weapons are used to protect homes but not to destroy them.

Learn about the electronic parts



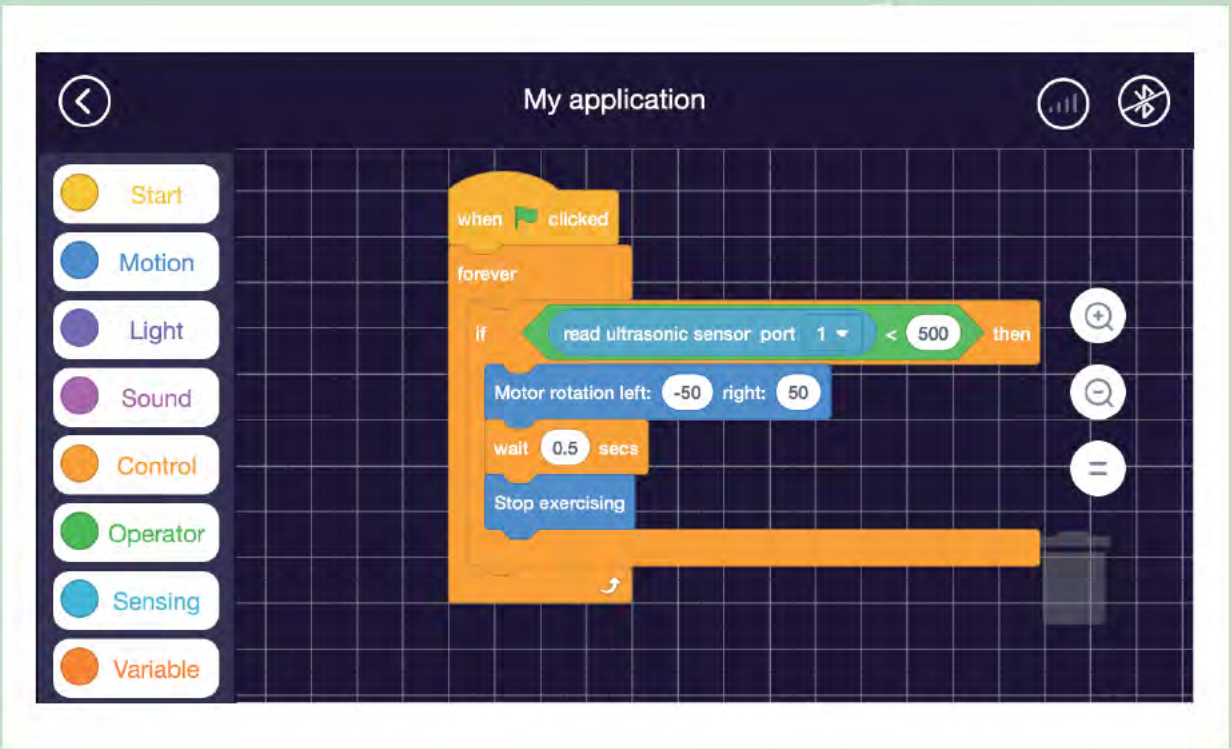
An ultrasonic sensor detects the obstacle in front and then feeds back the detected information to the motherboard, so that the motherboard can send other operational commands. Ultrasonic sensors are widely used in our life, such as liquid level detection, robot collision avoidance and burglar alarms. They make our work and life more convenient and faster.

An ultrasonic sensor works in the following way: Its ultrasonic probe first transmits the ultrasonic wave, the ultrasonic wave gets reflected when it reaches an obstacle, and then the probe receives the reflection information and feeds back the information to the motherboard.

Learn about the programs

Set avoiding obstacles

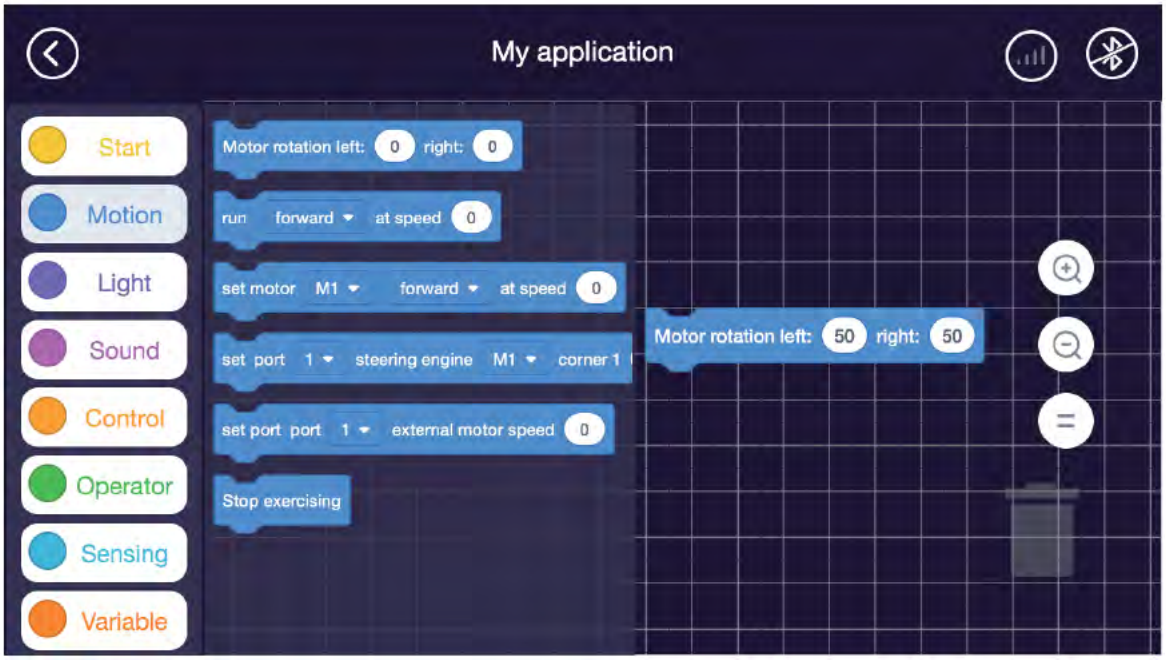
- Function: Avoid obstacles.
- How: Put the "ultrasonic sensor value" into the logic calculation module and set the value. Then put the entire statement block into the conditional statement block. (Valid range for ultrasonic sensor value: 50-1500)



Learn about the programs

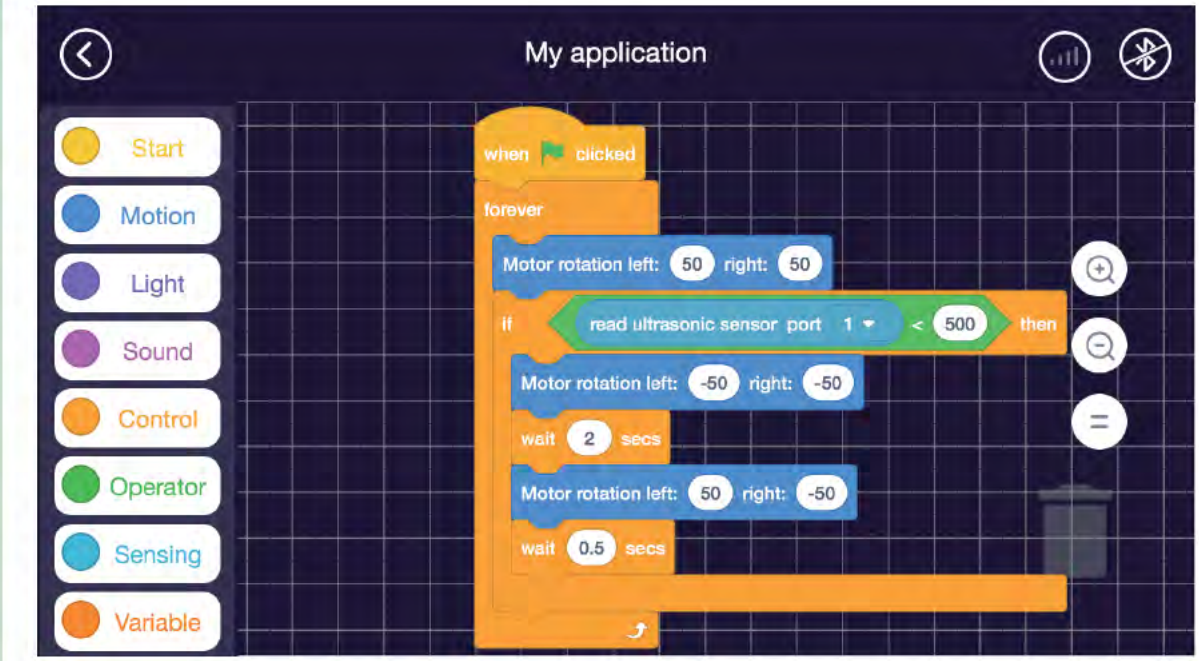
Set moving forward

- Function: Make the ultrasonic warrior move forward.
- How: Set the left and right motor speed to the same value between 50 and 100.



Try it yourself

Try setting it up and see what happens to your Q-scout!



What did you learn?

Can you turn your Q-scout into an ultrasonic warrior?
Have you thought of other ways to use the ultrasonic sensor?

Complete the evaluation

Great Doorman

In our life, we usually see "stay clear" signs that warn people who are near dangerous areas. At home, we often hear watchdogs yell when strangers are approaching. Actually, in addition to being our good friend, Q-scout is also a great guard. Today, let's see how Q-scout can become a guard.

Stories in life

Dogs have become our closet companions in our daily life. In many people's minds, dogs are their very important partners. One of the reasons is that dogs are very loyal. Whether it's a pet dog, a hound or a Chinese rural dog, it always faithfully obeys the master's orders and never leave them.

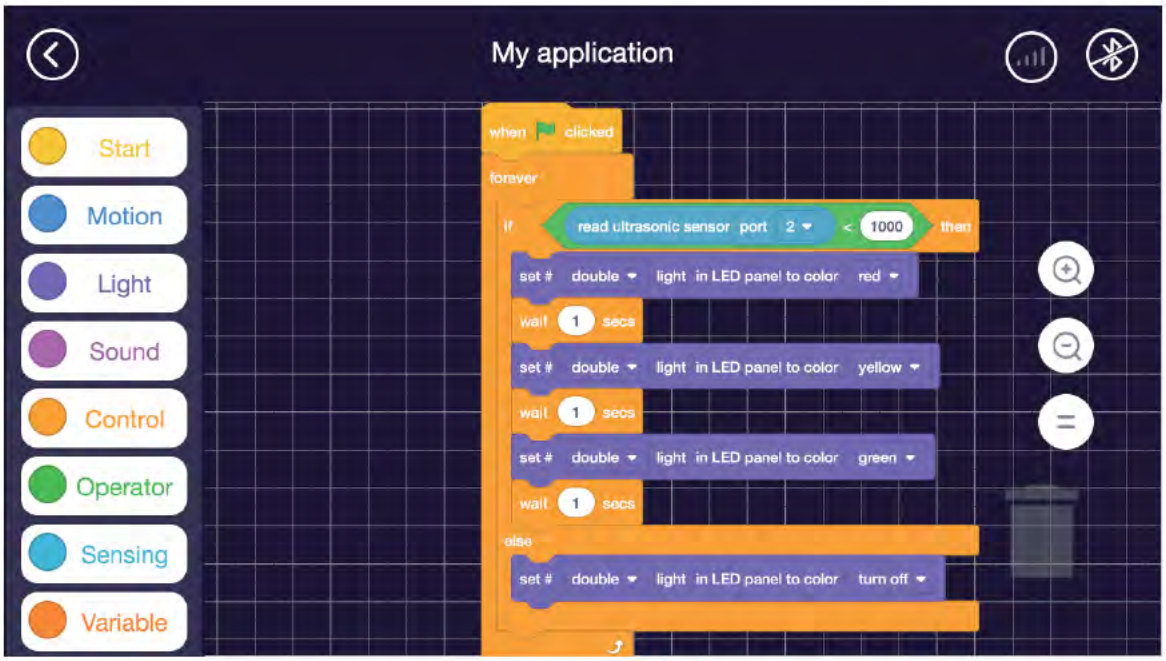
Once there was an American pit bull named Chief that dared to fight against a cobra inside the house to protect its master. Although it eventually succeeded in killing the snake, it died of the snake bite. In its last minutes, it still remembered to shake its tail to its master.

Not only dogs, but many other animals in the world are kind, and we hope that they are tenderly treated.

Learn about the programs

Set lighting up when something gets close

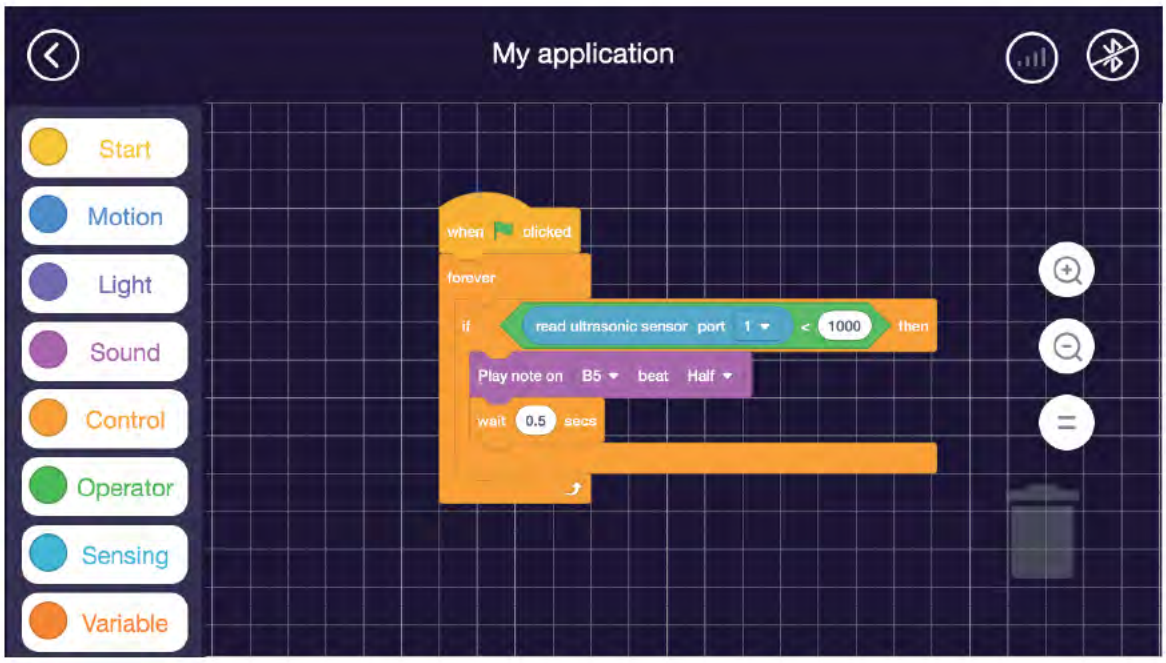
- Function: Set the value of the ultrasonic sensor as a condition when Q-scout lights up when something gets close to it.
- How: Set the value of the ultrasonic sensor to less than 1000, so the indicator will be turned on if the ultrasonic sensor detects that something is getting close to it within 1 m.



Learn about the programs

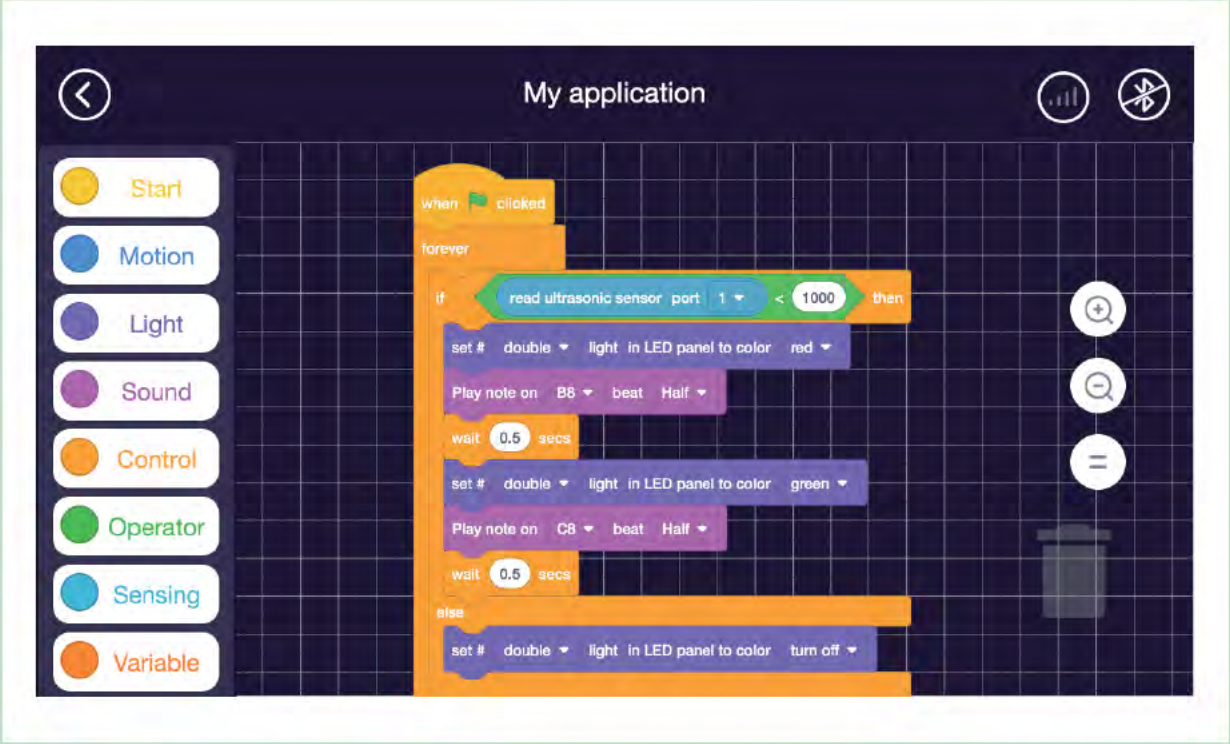
Set sounding when something gets close

- Function: Set the value of the ultrasonic sensor as a condition when Q-scout makes a sound when something gets close to it.
- How: Set the value of the ultrasonic sensor to less than 1000, so a sound will be made if the ultrasonic sensor detects that something is getting close to it within 1 m.



Learn about the programs

Now let's try to transform Q-scout into a master scout!



What did you learn?

Do you understand how an ultrasonic sensor works?
Think about what else it can do!

Complete the evaluation

Treasure Hunt

It's believed that everyone has a crazy idea to hunt mysterious treasure that no one ever knows. Most people have also played treasure hunt games. In fact, our Q-scout is also a "master treasure hunter"! Let's use Q-scout to play treasure hunt games today!

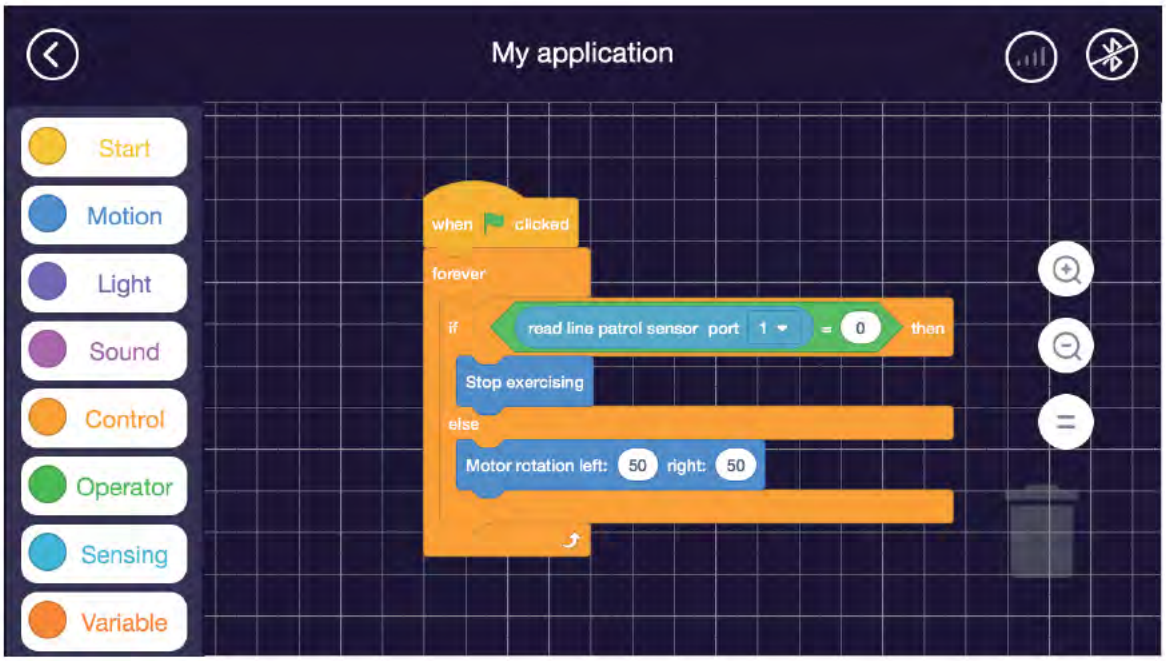
Stories in life

When speaking of treasure, people tend to think of those pirates who look for treasures in the sea and their pirate ships with skull marks. With the development of science and technology, our ships are now made of steel instead of wood. Steel is much heavier than water, and there are so many goods on board. How can the ship float in the water? An important physical law is applied here: "The buoyancy of an object in the water is equal to the gravity of water displaced by the object". This law of object floating or sinking changed the history of mankind's use of wood to build ships.

Learn about the programs

Set up a stop-for-treasure program

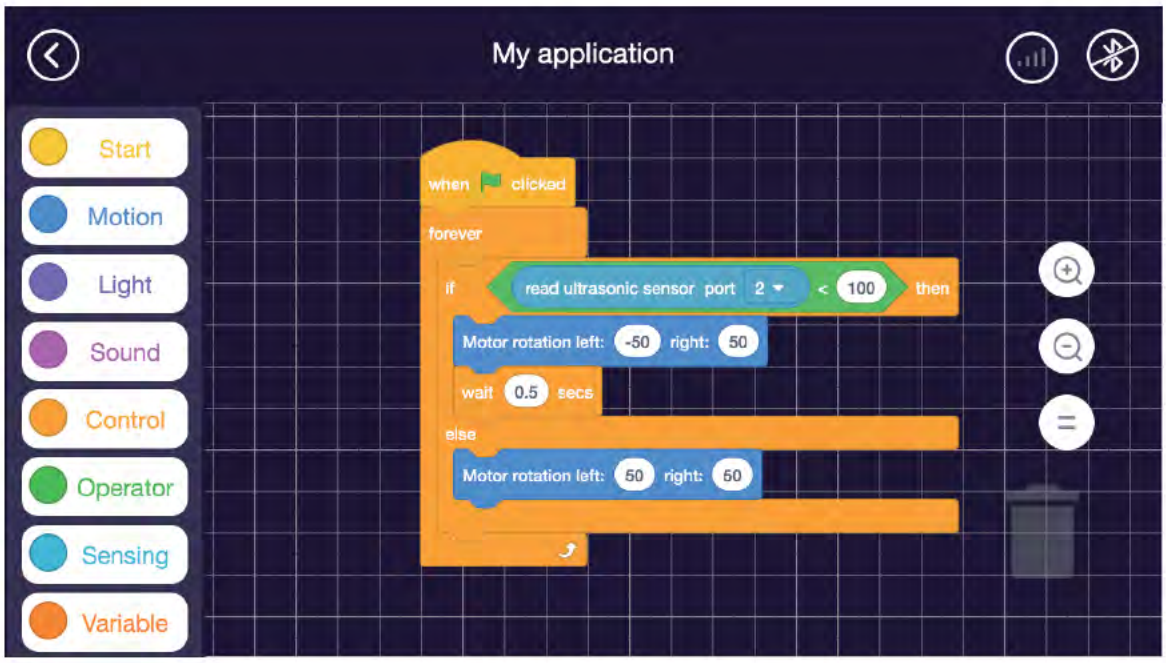
- Function: Set the value of the line tracking sensor as a condition when Q-scout finds treasure and stop.
- How: Set the value of the line tracking sensor to, and set the motor speed for both the left and right wheels to 0 when a black object is detected below the sensor.



Learn about the programs

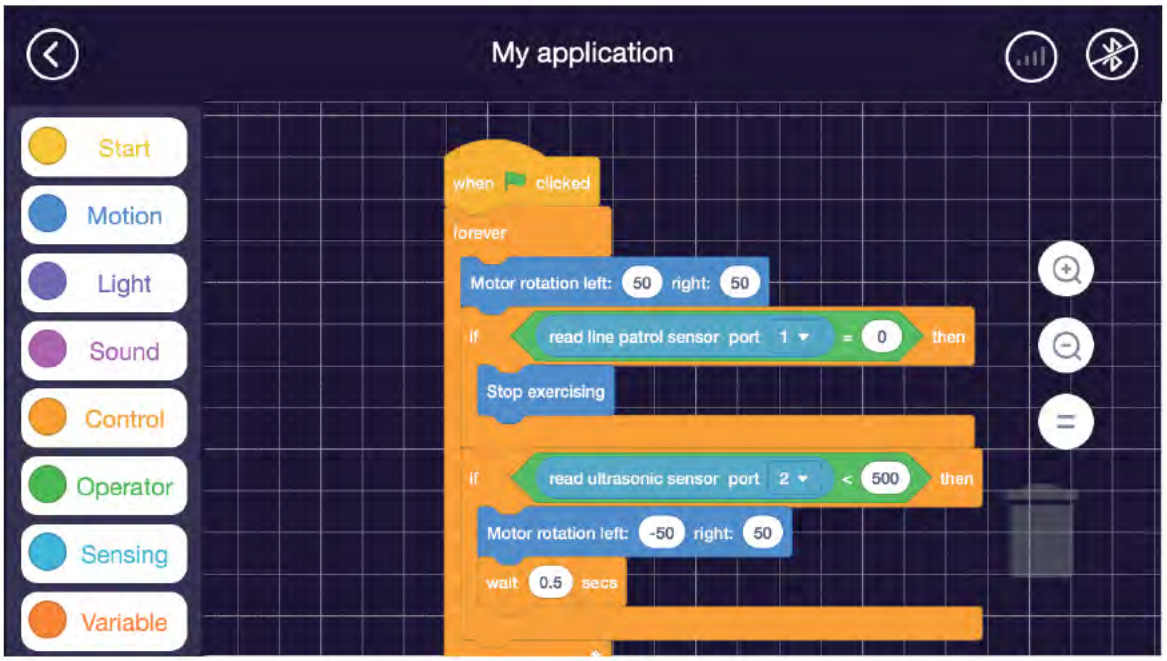
Set up a treasure hunting program

- Function: Set the motor speed to have Q-scout go on treasure hunting and avoid any obstacle in its way.
- How: Set the value of the ultrasonic sensor to 50, and set the motor speed to make a turn to avoid the obstacle when the ultrasonic sensor detects an obstacle. Plus, set the motor speed to have Q-scout travel to hunt treasure.



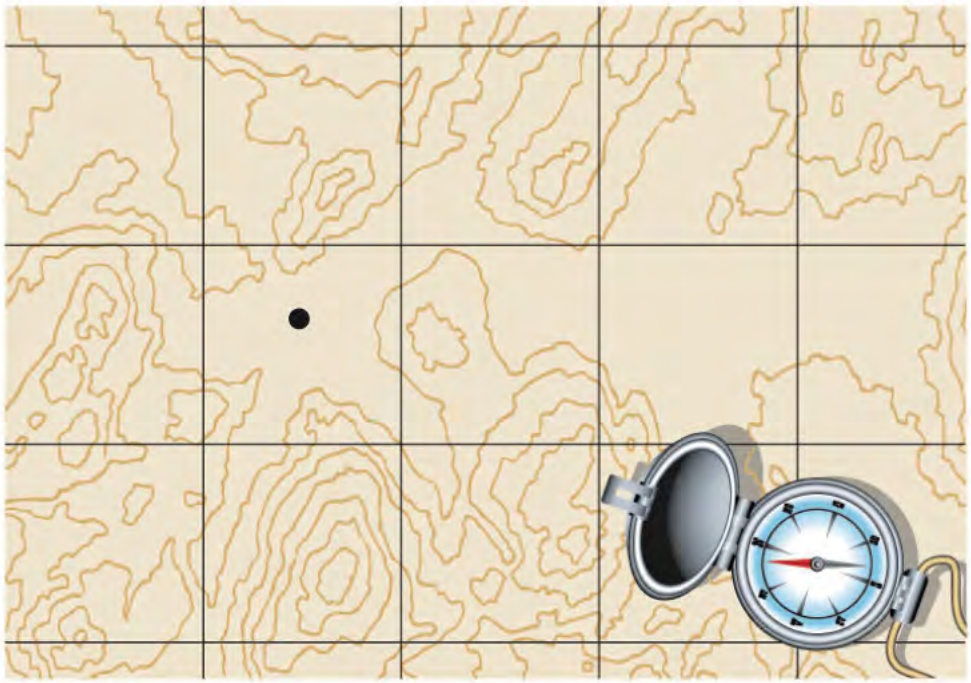
Try it yourself

Now let's try to transform Q-scout into a master treasure hunter!



Let's go on treasure hunt

Come to see who is first to find the treasure!



<Map for reference only>

What did you learn?

Do you know how to use the ultrasonic sensor together with the line tracking sensor? Try it yourself to see if you have any different ideas!