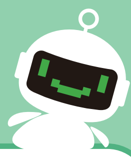
Fostering DIY Ability and Programming Thinking

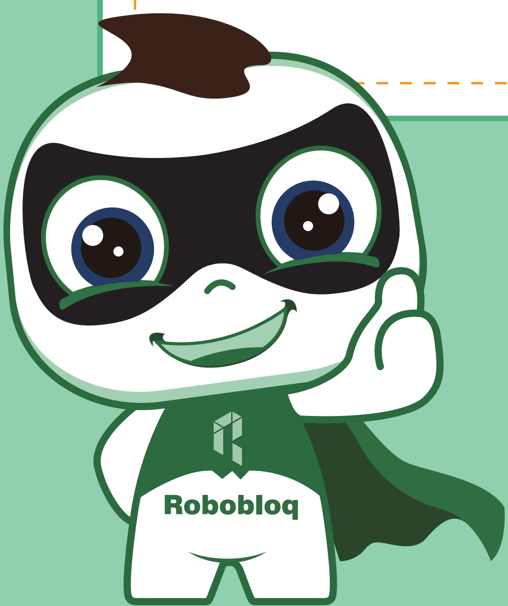
Creative Robot Engineering Workshop

Preface



Locke's World

Locke is a robot from the future, he has a brain with the same consciousness as a human being. His love for research, study and his abilities make him a famous inventor of the future.
One day, he started working on a time shuttle in his lab. Unfortunately this was a hard challenge and he failed and failed again many times. He gave up the project and as he was preparing to disassemble the time shuttle he accidentally activated something leading him the return to present days.
In modern days, he has no friends and no way to make his way home. The lonely Locke decided to invent some robots to be friends with him.



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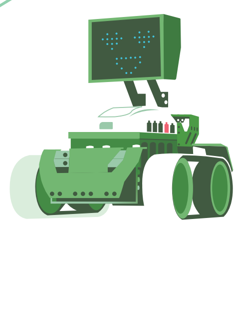
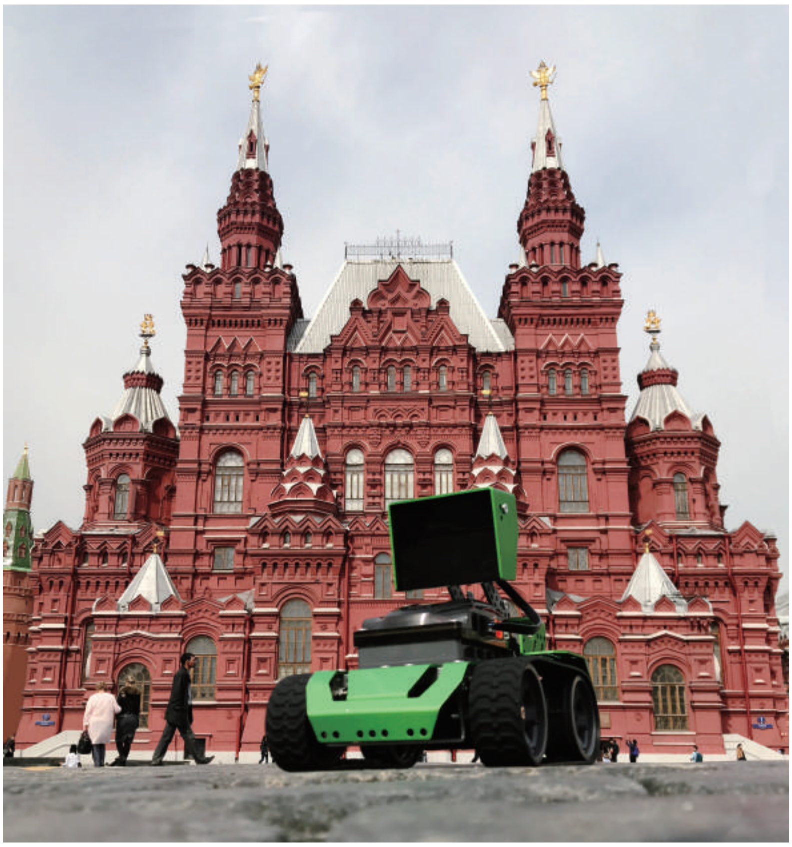


Chapter 1 The Robot's Brain

Locke's Story

Looney Locke has no friends in present days, so he can only silently collect parts that can be used to make robots.

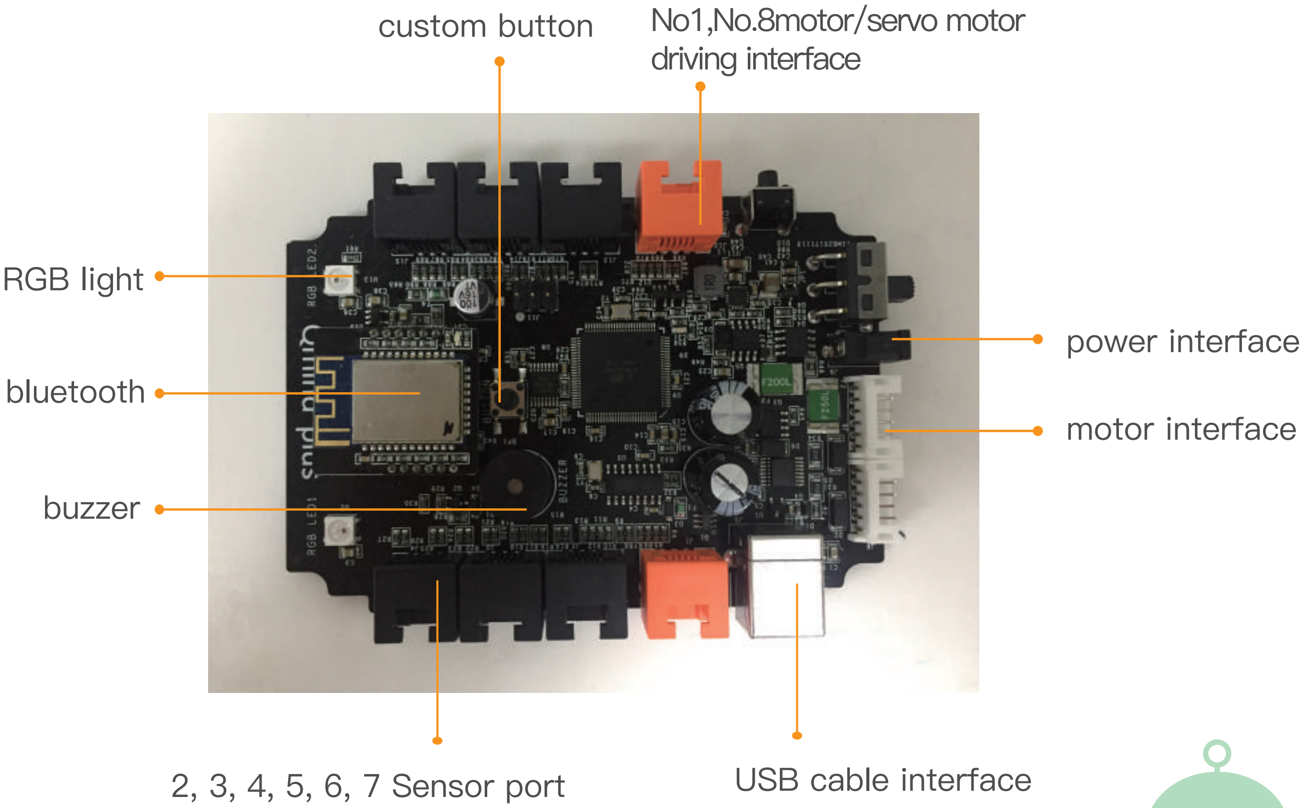
To make a robot, the most important thing is to make a robot's brain first. After a period of parts collection, Locke finally used the collected parts to create the robot's brain.



Functions and Principles

The effect of the mainboard on the robot is equivalent to that of the brain for humans. As shown in the below figure, it is composed of a CPU, other electronic components, a port for connecting sensors and drivers, a jack for inputting power, and the likes.

- Bluetooth: Bluetooth can connect the mainboard and mobile phone wirelessly to transmit data.
- RGB lights: There is an RGB light on each of the left and right sides of the mainboard, which can be changed by the editing program.
- Buzzer: There is a buzzer on the main board that can make a sound and can change the sound produced by editing the program command.
- Sensor port: Ports 2, 3, 4, 5, 6, and 7 are sensor ports. The sensor can be connected to the main–board through a cable to transmit the data obtained by the sensor to the mainboard.
- Steering gear/motor drive port: Ports 1 and 8 are servo/motor drive ports. The servo/motor drive can be connected to the mainboard through the cable to transmit the commands issued on the main board to the drive.
- USB cable interface: The USB cable interface can connect the mainboard to the computer through the USB cable provided by the Q Corps. It can transfer the data on the to the computer or transfer the data on the computer to the mainboard.
- Motor interface: M1/M2 interface is the motor interface. Connect one end of the motor wire to the motor interface and the other end to the motor. You can connect the motor to the mainboard and transfer the commands from the main board to the motor.
- Power connector: The interface that supplies power to the mainboard, and the cable for the battery pack needs to be connected to it.



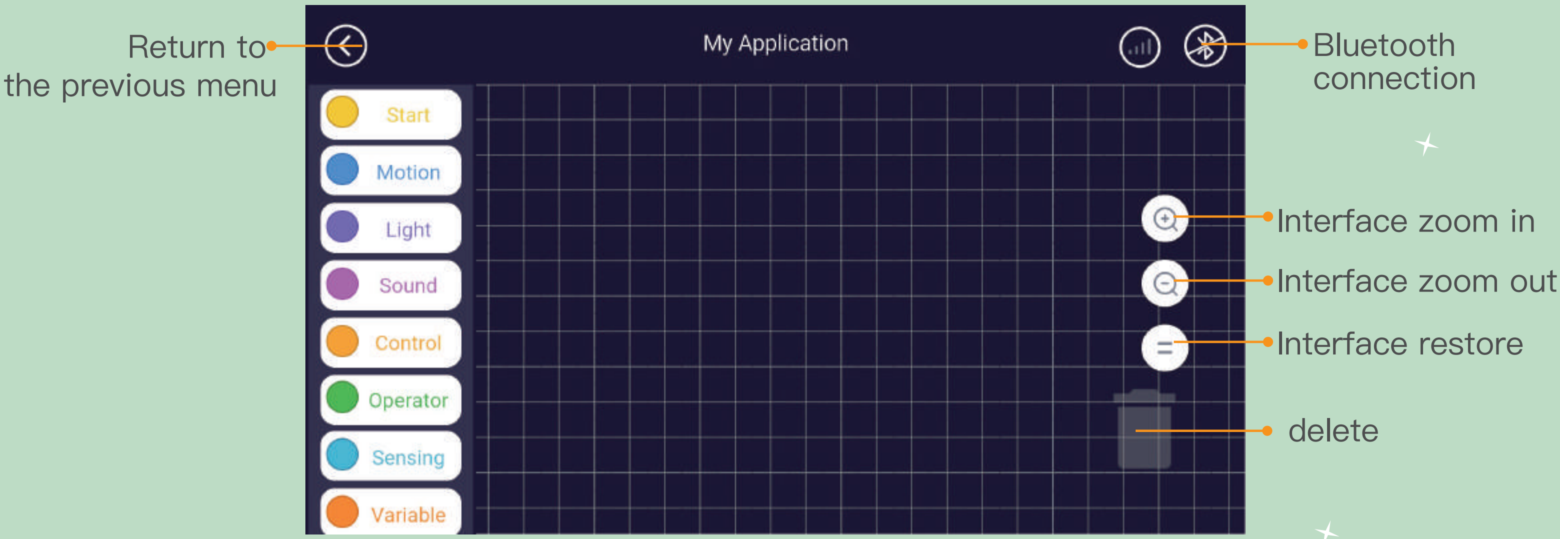
Program Learning

After making the robot's brain, Locke could not wait to use the robot's brain function. Let's take a look at how this robot's brain is used.

Understanding the programming interface

- Function: You can drag the module editing program on the grid interface and send the program to the control panel via Bluetooth connection.

- How to use: As shown in the figure below, drag the module on the left to edit the program in the grid interface on the right; the first icon in the upper right corner is the Bluetooth connection icon. You can connect the mobile phone and the motherboard to send the edited program instructions. On the main board; the three white circular icons on the right side of the interface are the interface zoom in, zoom out, and restore; you can drag and drop the unused statement blocks and delete them; the arrow icon in the upper left corner returns to the previous menu.

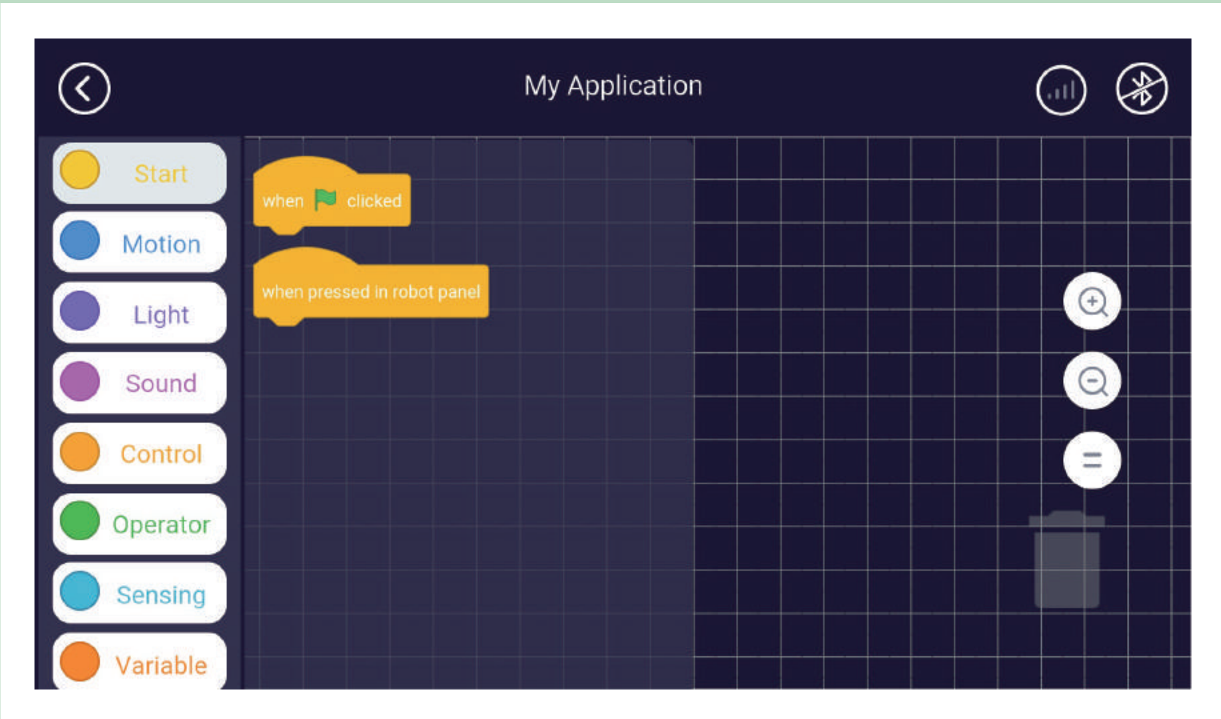


Program Learning

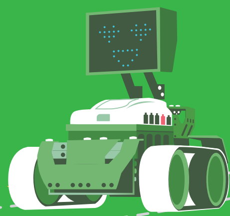
"Start" module

- Function: the Start statement block contains two programs, which must be added to it.

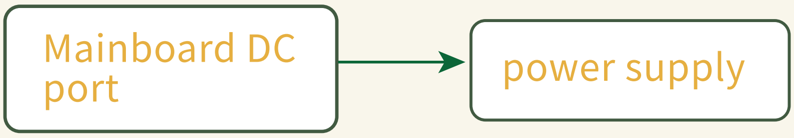
- How to use: It can only be placed in the head of the program. “When clicked” module starts the program by clicking on the module with the phone; “When the button on the top of the motherboard is pressed”the module starts the program by pressing the custom button on the motherboard. Drag the module to the program interface as required.



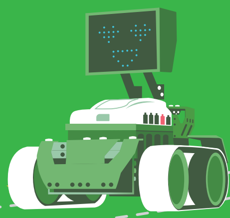
Competition



Let's connect the power supply and mainboard together and see if our robot brain can start.



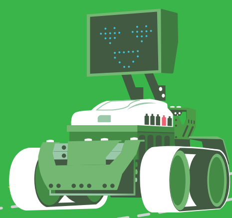
What have you learned?



Please match the following content using line

Motor interface	Starting statement block
Start	M1/M2
Power interface	DC（6.5~9V）

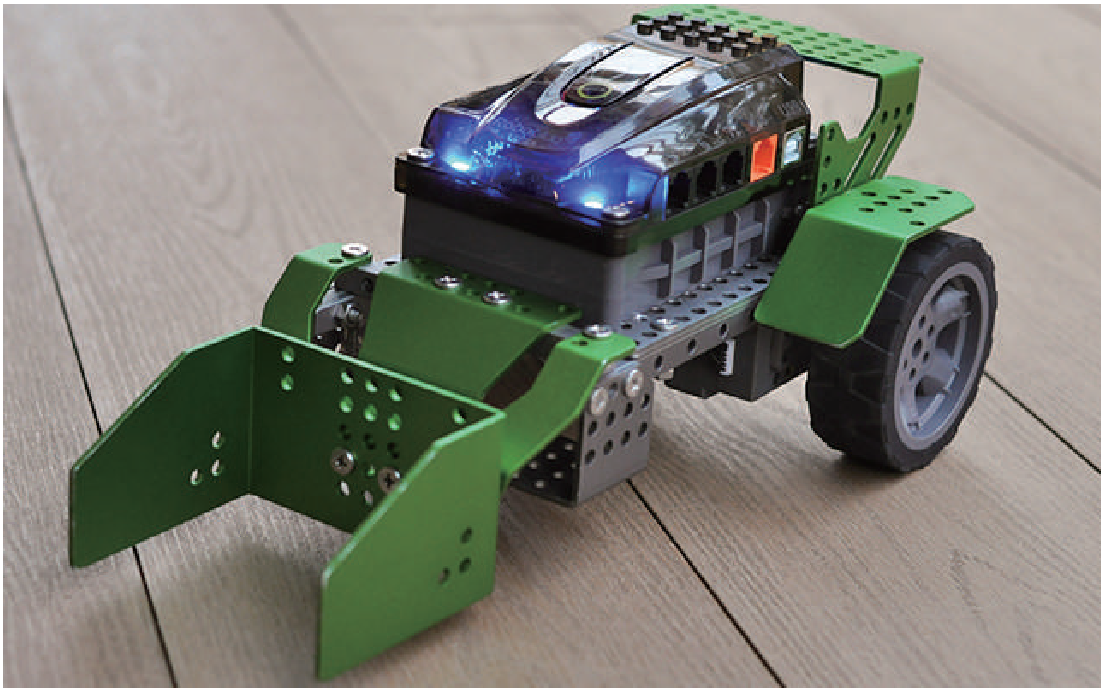
Complete Evaluation



Chapter 2 The Birth of Dozers

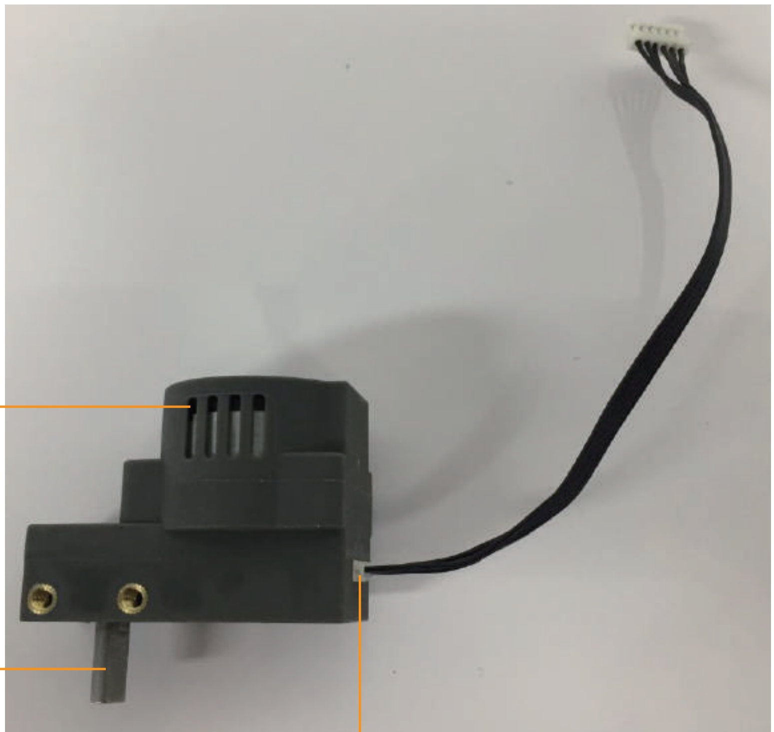
Locke's Story

After Locke succeeded in making the robot's brain, he couldn't wait to make a complete robot through the robot's brain. But what kind of robots to do? After seeing what kind of robot he was thinking about, Locke saw his own workbench with various parts scattered around. He decided to do a robot that could help him organize the workbench first.
After many experiments, Locke finally succeeded in making the robot, and Locke gave a very cool name to the first robot he made here, called "The Dozer"



Functions and Principles

A motor is a device that powers a robot. It is a device that can turn a wheel or cause a robot to perform an action. In physics, the principle of a motor is described as a device that converts electrical energy into kinetic energy.
There are many types of motors, and the motor we use today is a DC motor that can be directly connected to a battery. In addition, there are AC motors, stepper motors and more.
Our motor is not directly connected to the battery. It needs to be connected to the M1/M2 port of the mainboard through the motor cable. We need to supply power to the motor and transmit signals through the motherboard.



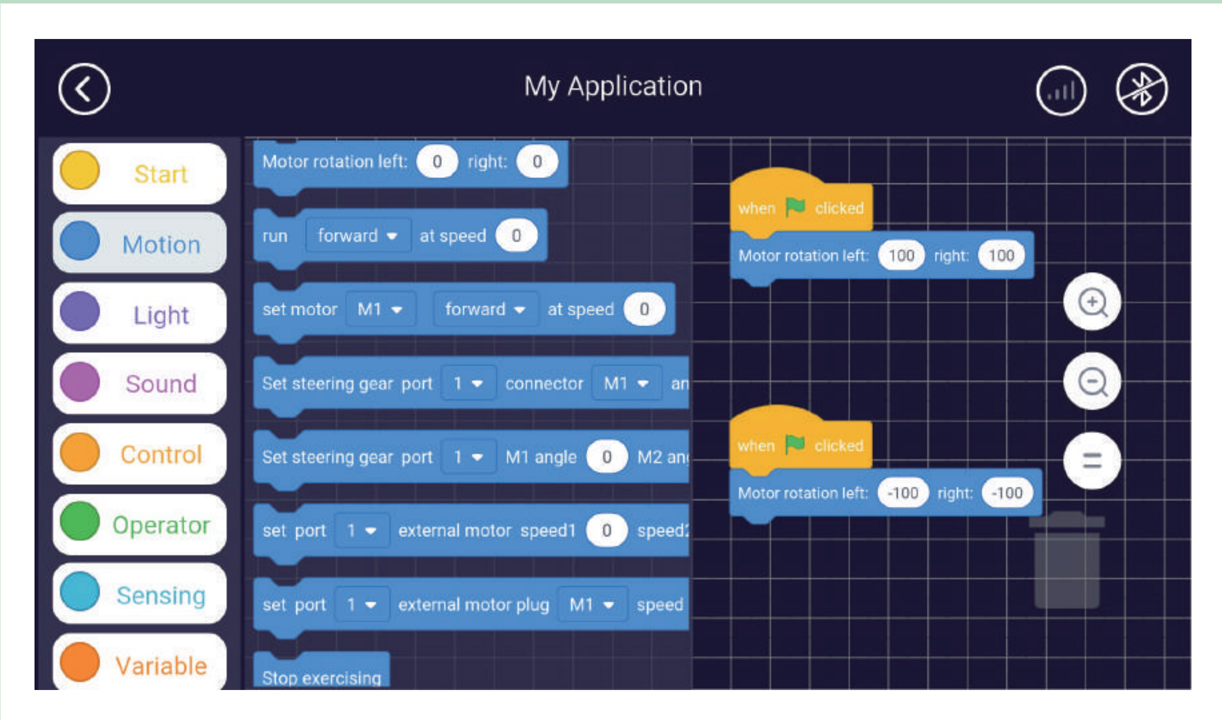
Program Learning

After assembling the cool Dozer, let's see how it can be controlled!

Forward/backward

- Function: You can control the robot to move either forward or backward.

- How to use: As shown in the figure below, in the "Start" module, drag the "When 🏳 clicked" to the program editing interface, then in the "Motion" module, "Set the motor speed revolver: () Right wheel: ()" Drag and drop to "When 🏳 clicked" and set the same positive/negative numbers in both white boxes to move forward or backward.

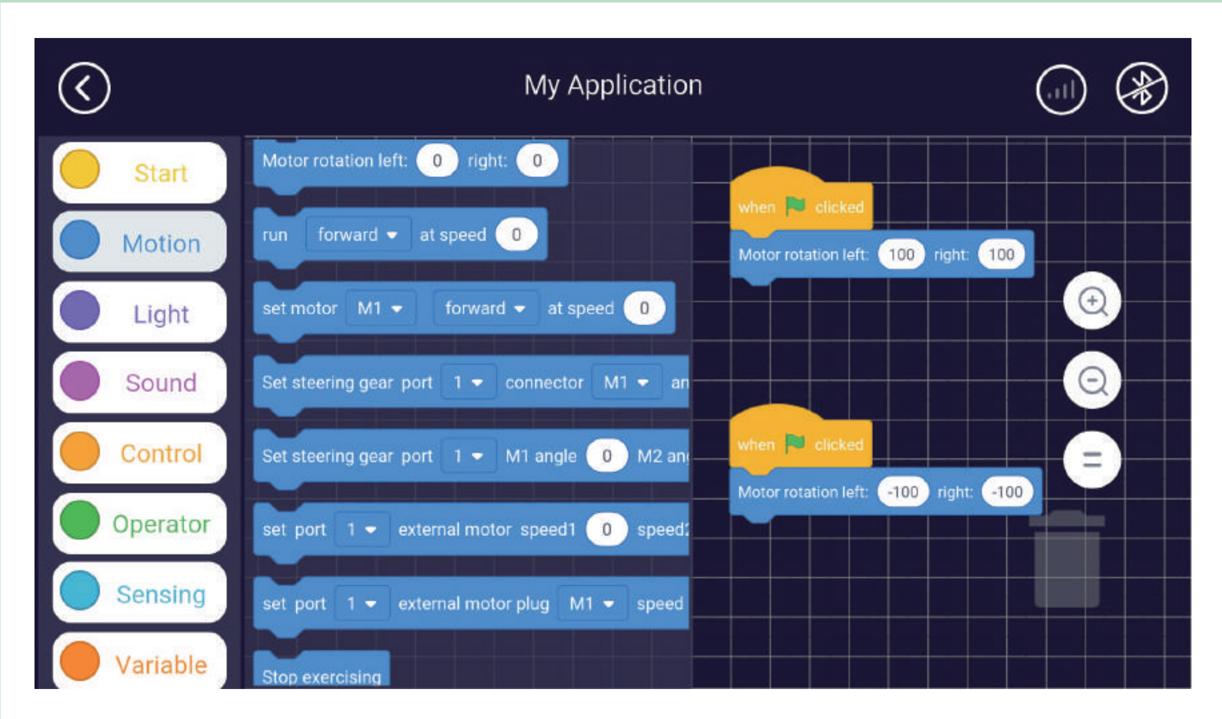


Program Learning

Turn left/right

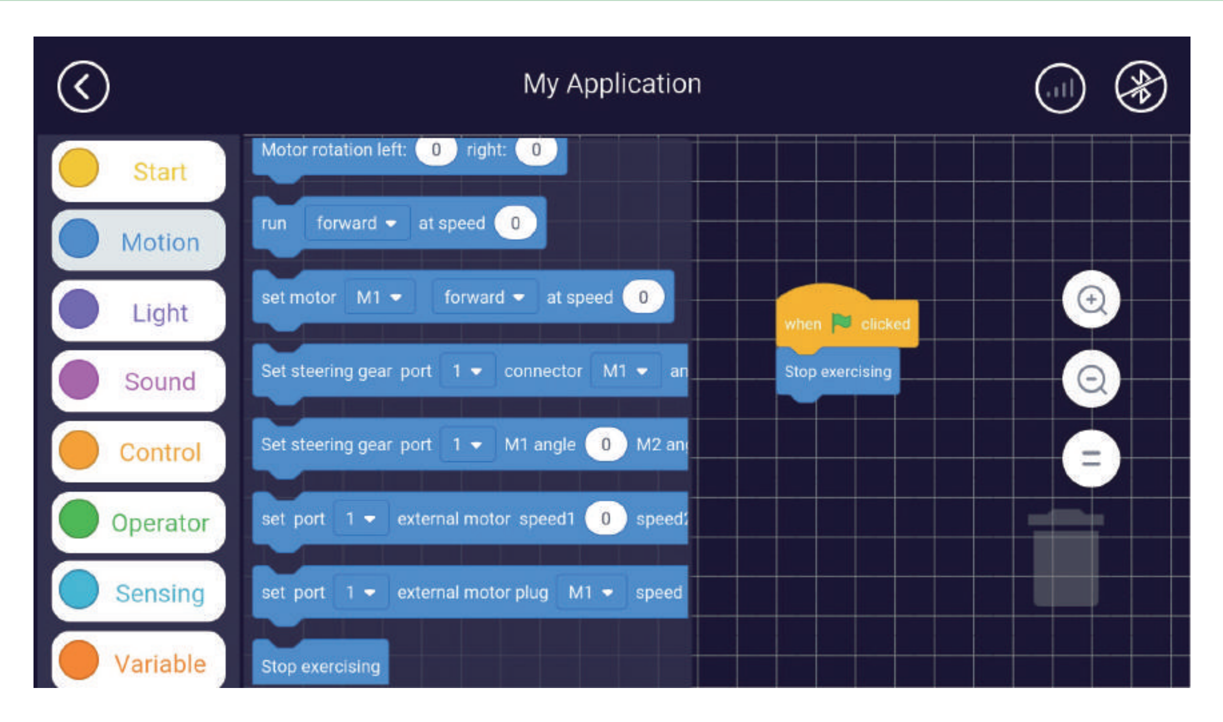
- Function: You can control the robot to move left or right.

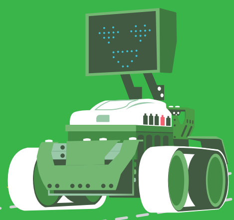
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, then in the "Motion" module, "Set the motor speed revolver: () Right wheel: ()" Drag and drop to "When clicked" below, and set a positive number and a negative number in the two white boxes to make a turn, and turn left and right to make a right turn, and right and left to make a left turn.



Stop the exercise

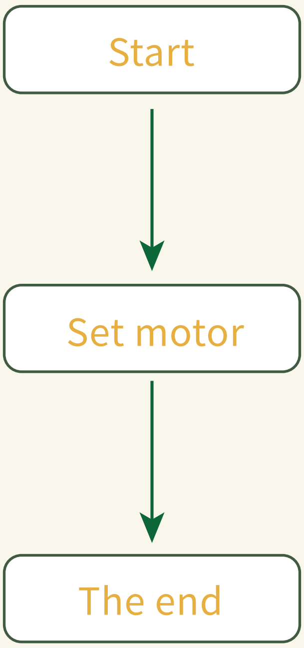
- Function: It can control the robot to stop moving during the movement.
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Motion" module, drag "Stop Motion" to "When clicked" can.





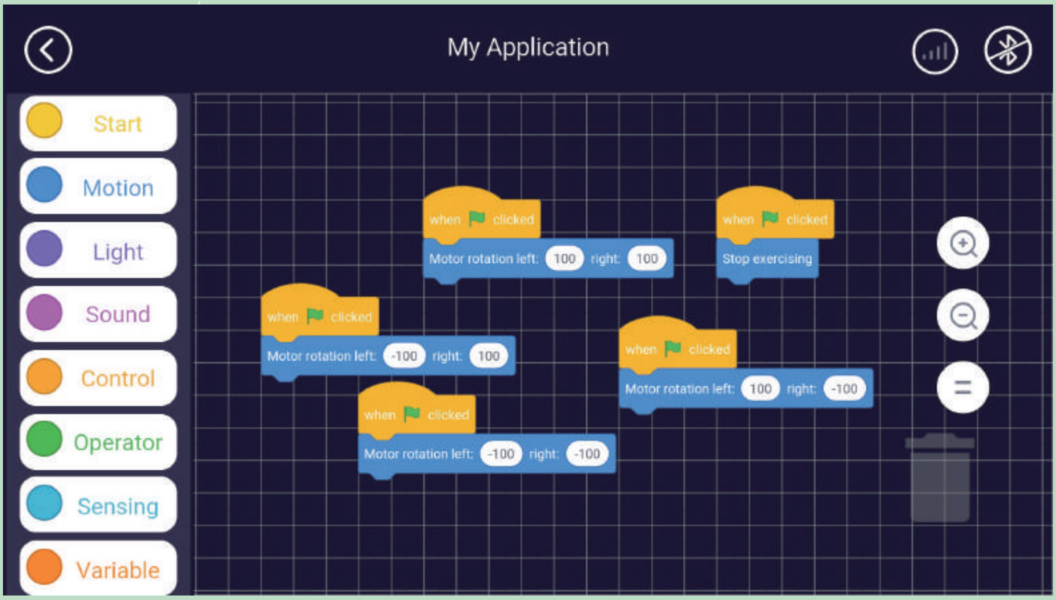
Program flow

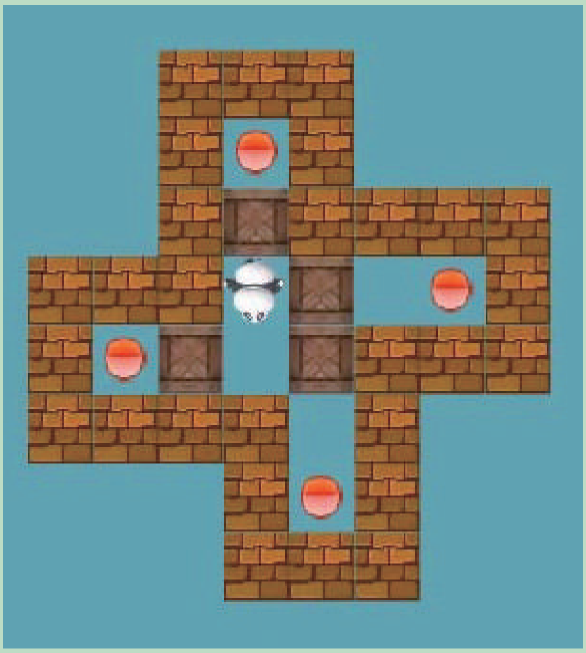
Let's connect the motor to the mainboard, power supply and mainboard together!



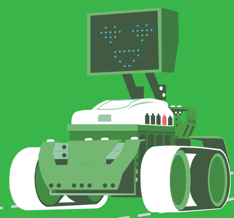
Crazy Games

Learn how to control the movements of the Dozer, then let's play a game! Try using some graphical blocks to control the robot's direction of movement and then push things/ small objects to the specified location. See who can do it in the shortest possible time.





What have you learned?



Please match the following content using line

Motor	Lefet wheel （100） Right wheel （100）
Turn lefet	Lefet wheel （-100） Right wheel （100）
Forward	M1/M2

Complete Evaluation

Chapter 3 Birth of Alloy Captain

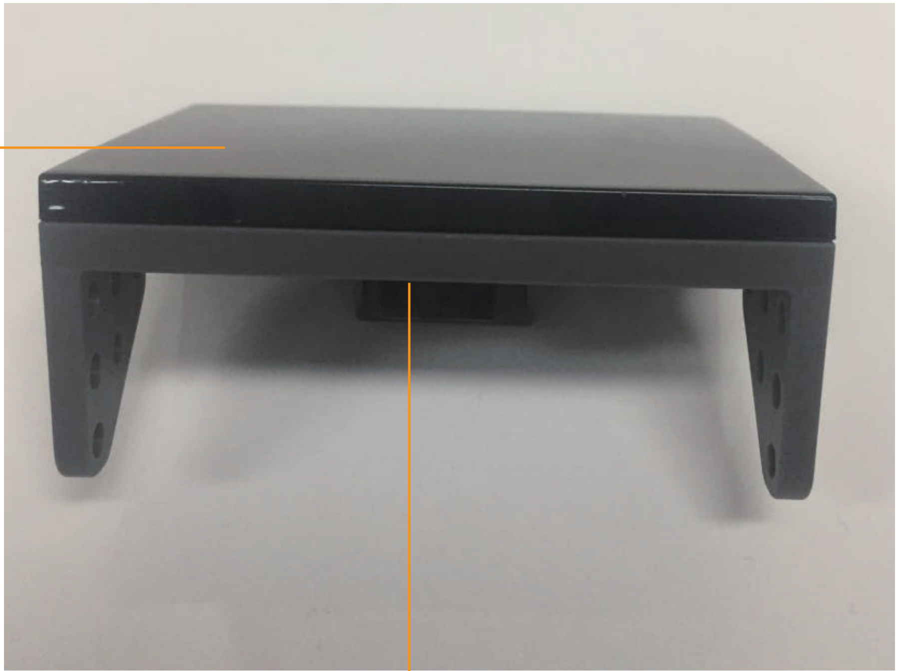
Locke's Story

Locke felt very correct about his decision to build a robot after seeing Dozer helping him to clean up the workbench. But Dozer only helps him clean up the workbench every day. He couldn't be happy only with him and laugh together. So Locke decided to create an expressive robot.
Locke began to work. With this time a successful experience, making him more skillful.
Soon, another robot was successfully produced. Locke gave it a name "Captain Alloy." The Captain Alloy had a face that could change his expression at any time. He could laugh with Locke.

Functions and Principles

The LED matrix screen is composed of 140 LED lights. When the mainboard and the LED matrix screen port are connected by a connection cable, the main board will supply power to the matrix screen and transmit signals.
When there is a signal access, the 140 LED lights on the matrix screen will light or not shine according to the signal, and according to the instruction, the desired pat–tern can be generated.

LED matrix screen



Connection port

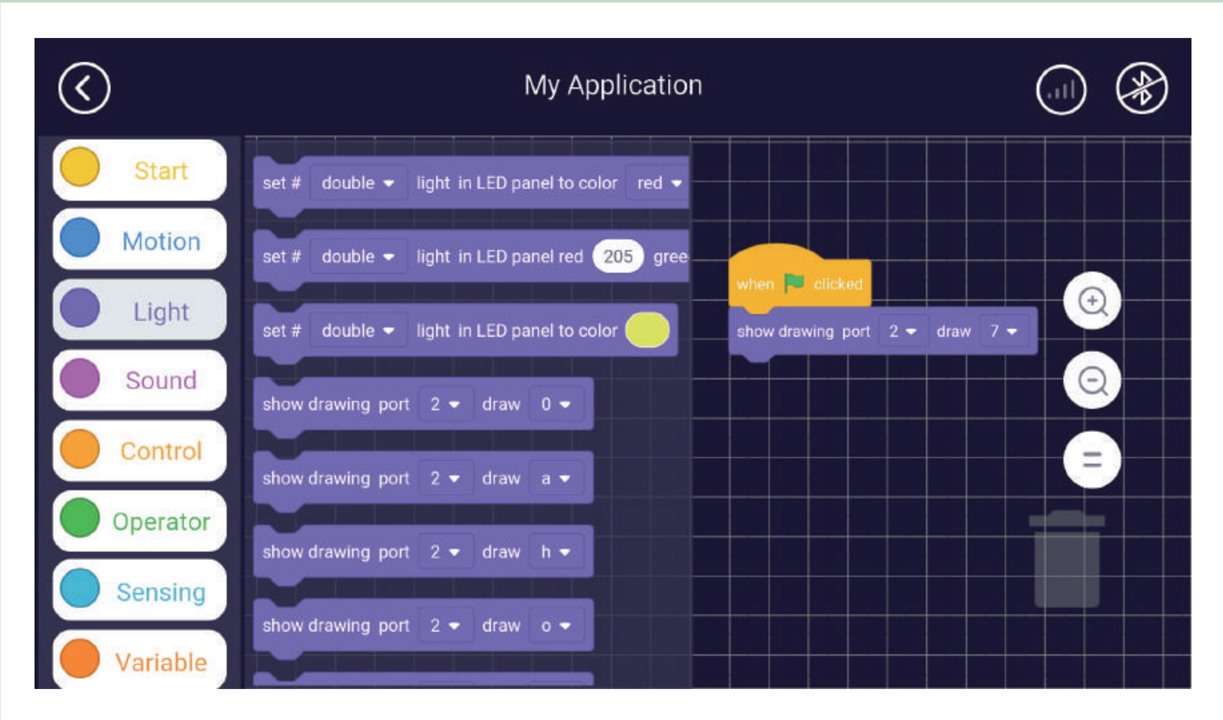
Program Learning

After learning the electronic knowledge of the matrix screen, now we have a look at how to control the 140 small lights on the LED matrix screen to generate the pattern we want!

Matrix screen pattern setting

- Function: Set the pattern of the LED matrix screen.

- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, then in the "Lights" module will "Port (2) LED matrix display number / text / drawing ( )" Drag and drop to "When clicked" below and select it at port (7).

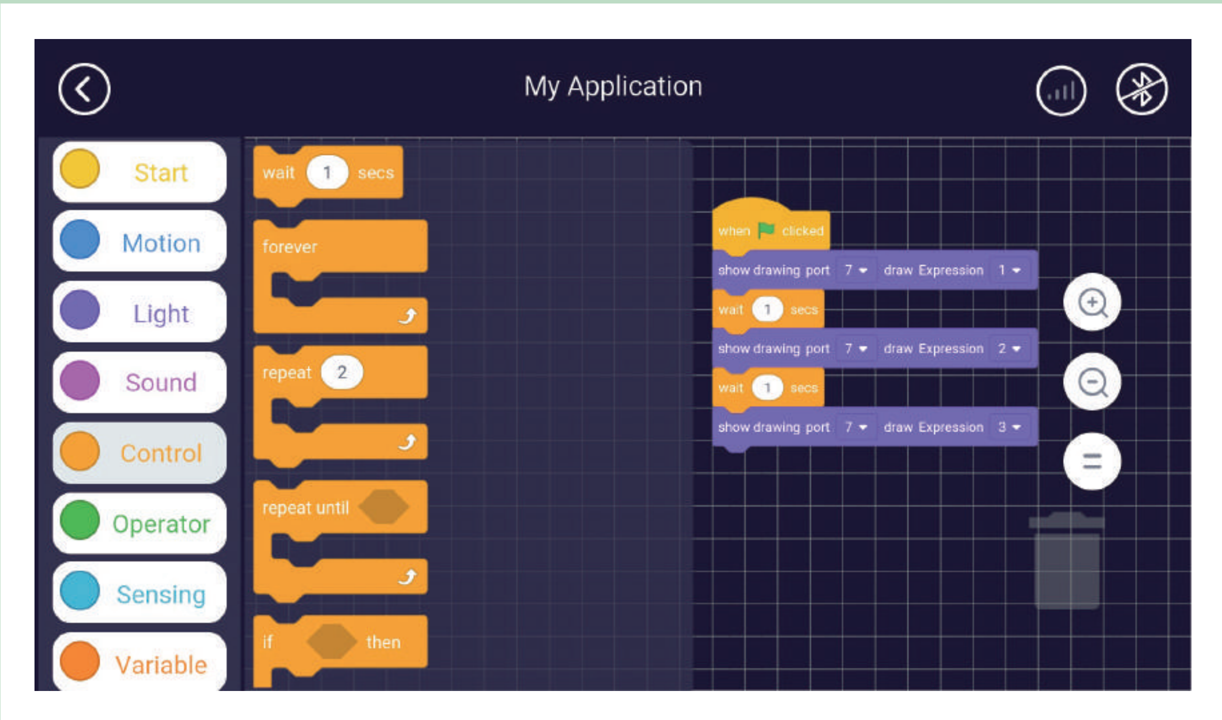


Program Learning

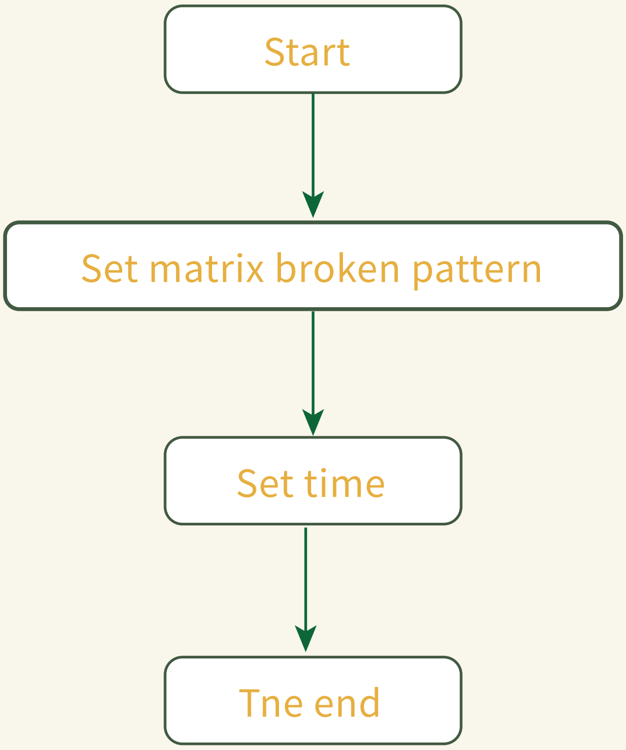
Automatically change the expression

- Function: Replace the matrix screen display pattern after setting the time.

- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, then in the "Lights" module will "Port (2) LED matrix display number / text / drawing ( )"Drag down to "When clicked", then drag "Waiting () seconds" to "Port (2) LED matrix display number/text/drawing ()" in the "Control" module, then In the "Lights" module, drag "Port (2) LED matrix display number/text/drawing ()" below "Wait () seconds". This will automatically change the pattern and select all ports on the matrix screen (7) .



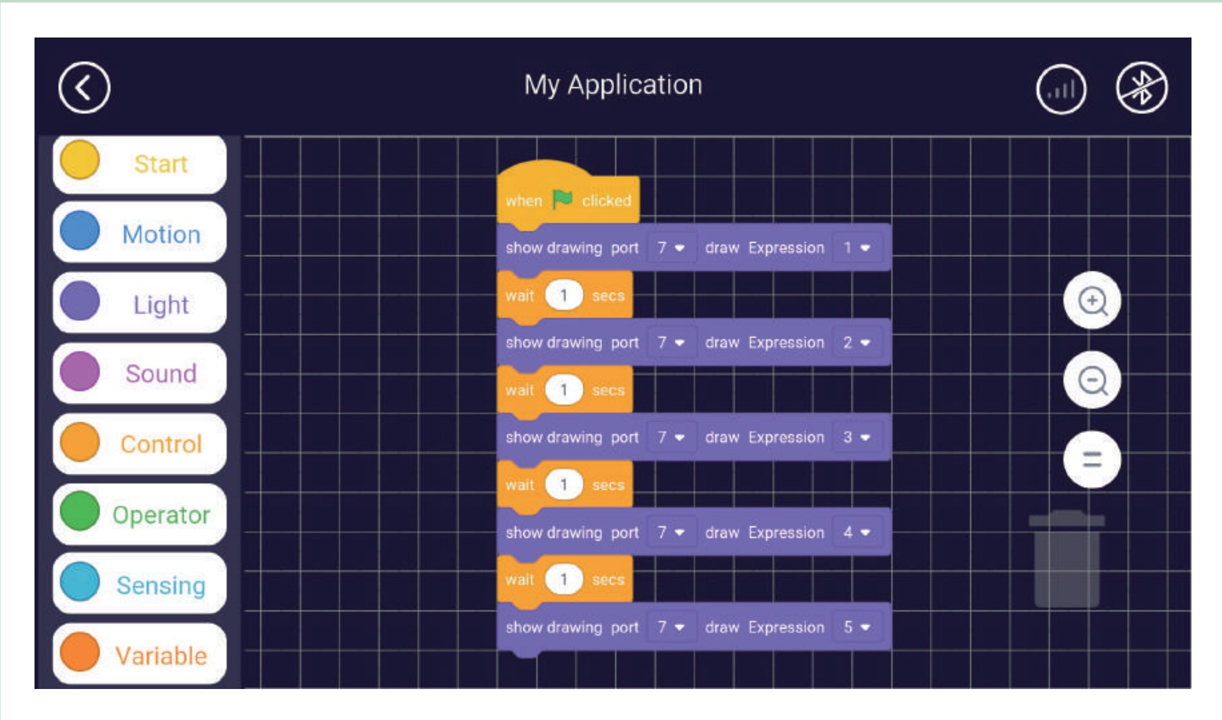
Program flow



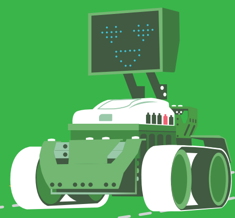
Crazy Games

Crazy game

Learn how to control our matrix screen. Let's play a face-changing game now! Take a look at the child's fastest reaction and the most like face expression!

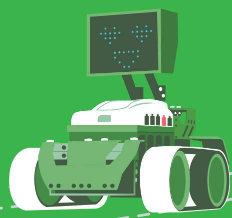


What have you learned?



Do you remember how many LED small lights were on our LED matrix screen? How are they arranged?

Complete Evaluation



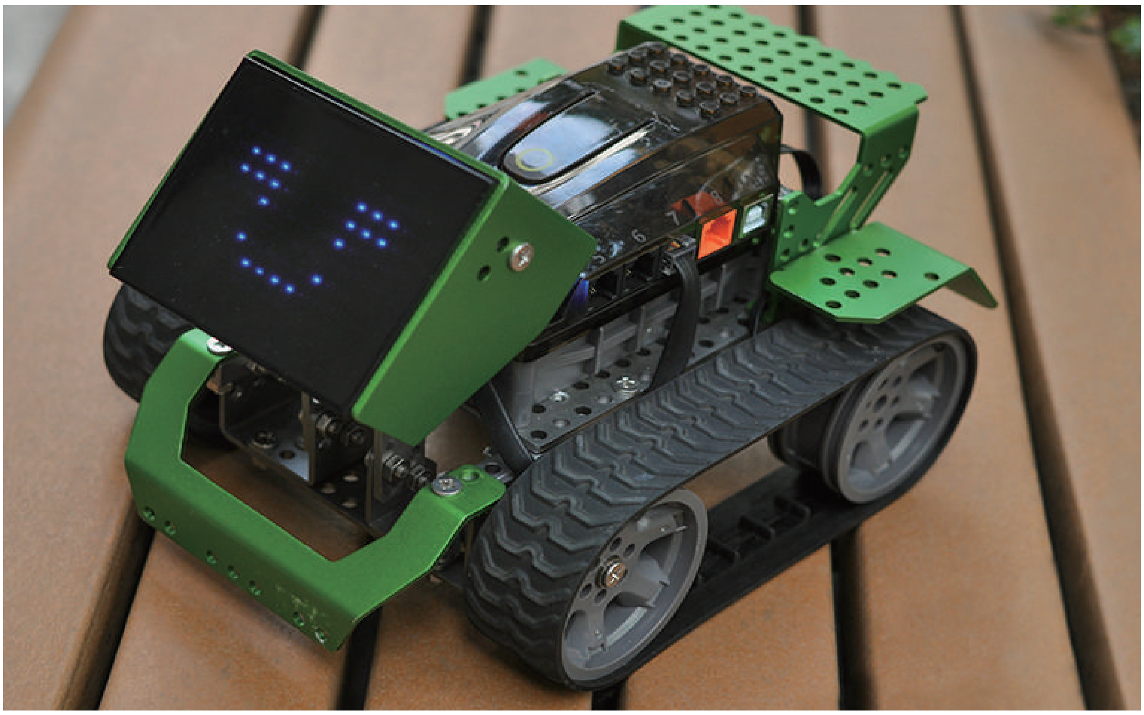
Chapter 4 The Birth of Li'l Guardian

Locke's Story

After completing the Captain Alloy, Locke already has two small partners. With the Dozer who could help him clean up the workbench and the Captain Alloy who could change his face to make him laugh, Locke wanted to have more robotic partners to play with him. For this reason Locke continued to work on making robots.

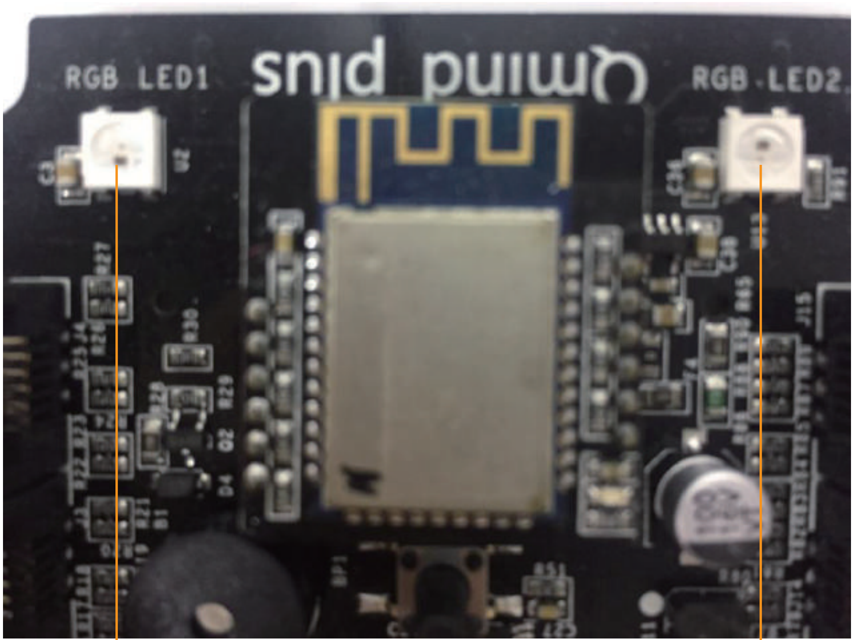
More and more skilled technology makes Locke work faster and faster. Soon, another robot was created. Locke named the newly-manufactured robot "Li' l Guardian". His new creation has the same facial expression as the Captain Alloy. He was assigned a task that would be to turn on the lights to illuminate the house at night.

Let's take a look at how Li' l Guardian turns on the light of the body, and what its mysterious light will play!



Functions and Principles

LED is short for Lighting Emitting Diode. The semiconductor can emit light when it is powered on. LED is a kind of semiconductor produced by using this phenomenon. There are white LEDs in the LED and there are RGB LEDs. The difference between the two is that the white LED is directly represented by white light, and the RGB LED is formed by mixing three colors of red, green, and blue. Through the three primary colors (red, green, and blue) of the colored light to collectively integrate the images, a clear and vivid color light can be presented. The LED on our motherboard is an RGB LED. When a signal is connected, the RGB LED light board will send out the desired color light according to the instructions.



Onboard RGB LED1

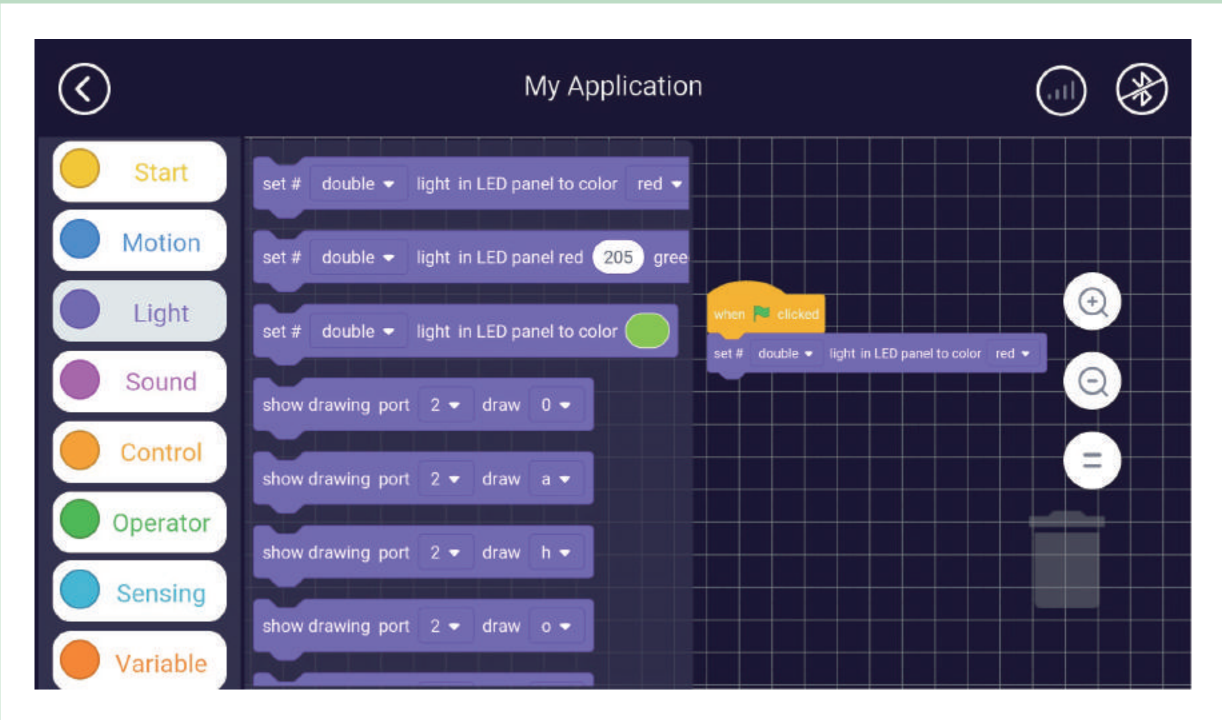
Onboard RGB LED2

Program Learning

After learning about the electronic knowledge of RGB LED lights, let's con-trol the RGB lights together and modulate the beautiful lights!

Set monochromatic light

- Function: You can directly set the red, yellow, and green lights or turn off the lights.
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Lights" module will "set the onboard (dual/left/right) The color of the light is (red/yellow/green) "Drag down to "When clicked", and select the lights and colors to control.

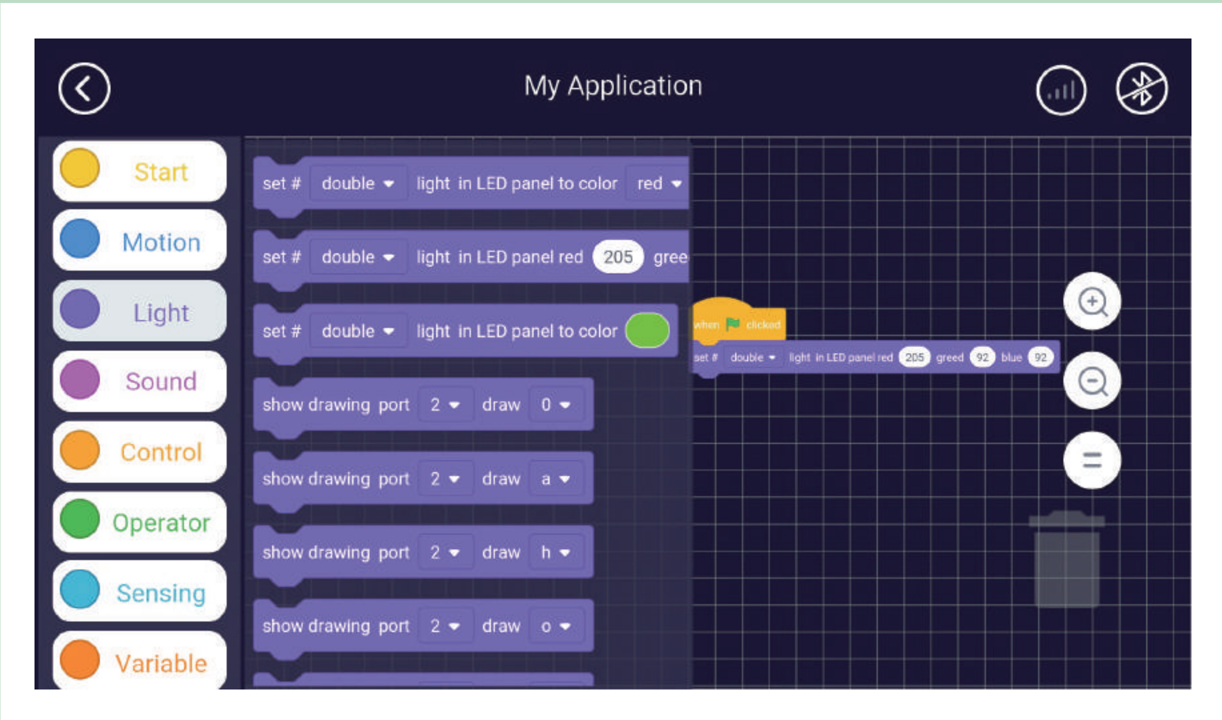


Program Learning

Set the red, green and blue colors mixed lights

- Function: Mixing light can be created by setting the concentrations of red, green, and blue.

- How to use: As shown in the figure below, in the "Start" module, drag the "When 🏴 clicked" to the program editing interface, and then in the "Lights" module will "set the onboard (dual/left/right) Red () green () blue ()" drag down to "when 🏴 clicked" below, and select the lamp to be controlled and fill in the color concentration in the white box.

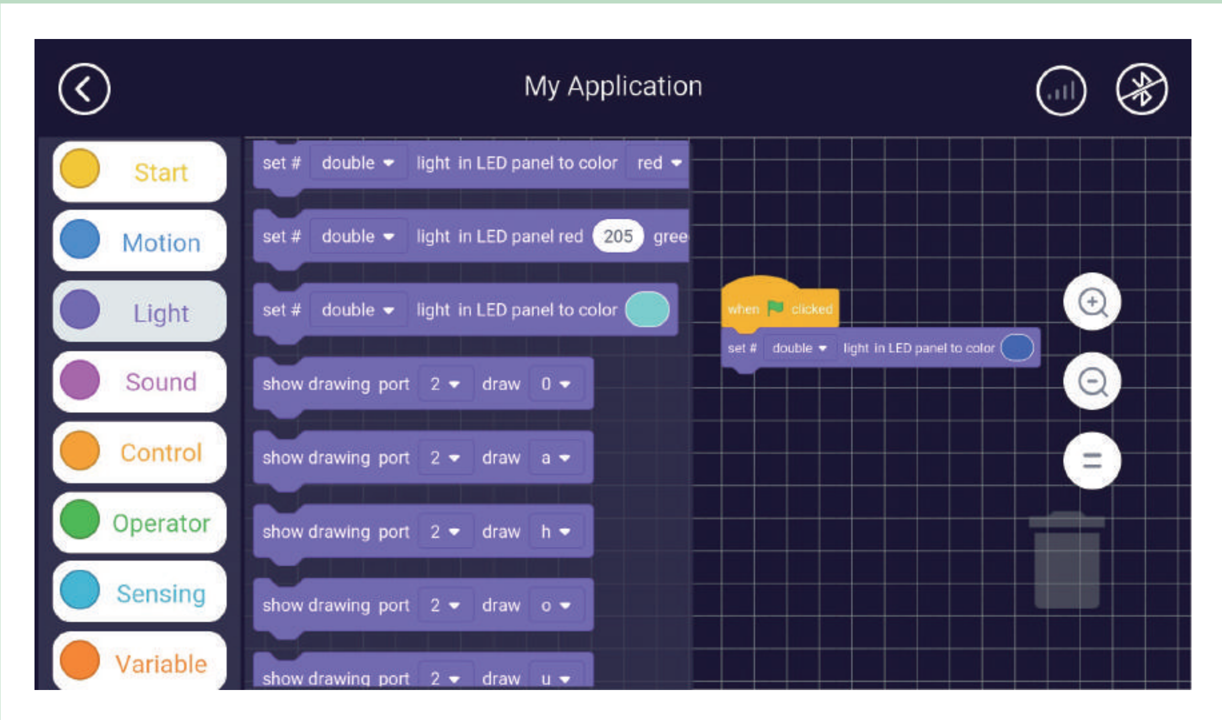


Program Learning

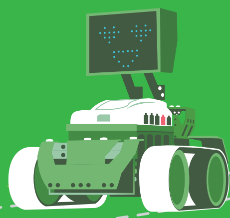
Set the light's color, brightness and saturation

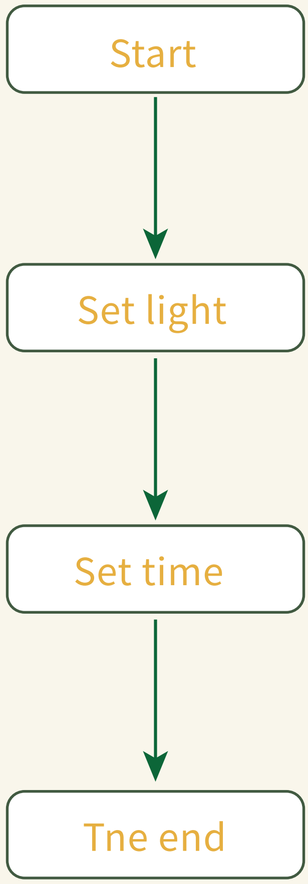
- Function: The color, brightness and saturation of onboard RGB lamps can be set.

- How to use: As shown in the figure below, in the "Start" module, drag the "When 🏳 clicked" to the program editing interface, and then in the "Lights" module will "set the onboard (dual/left/right) The color is ()" dragged to "when 🏳 clicked" below, and select the light color, bright–ness, saturation.

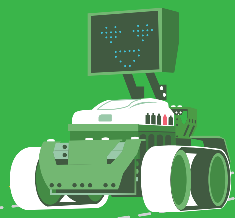


Program flow

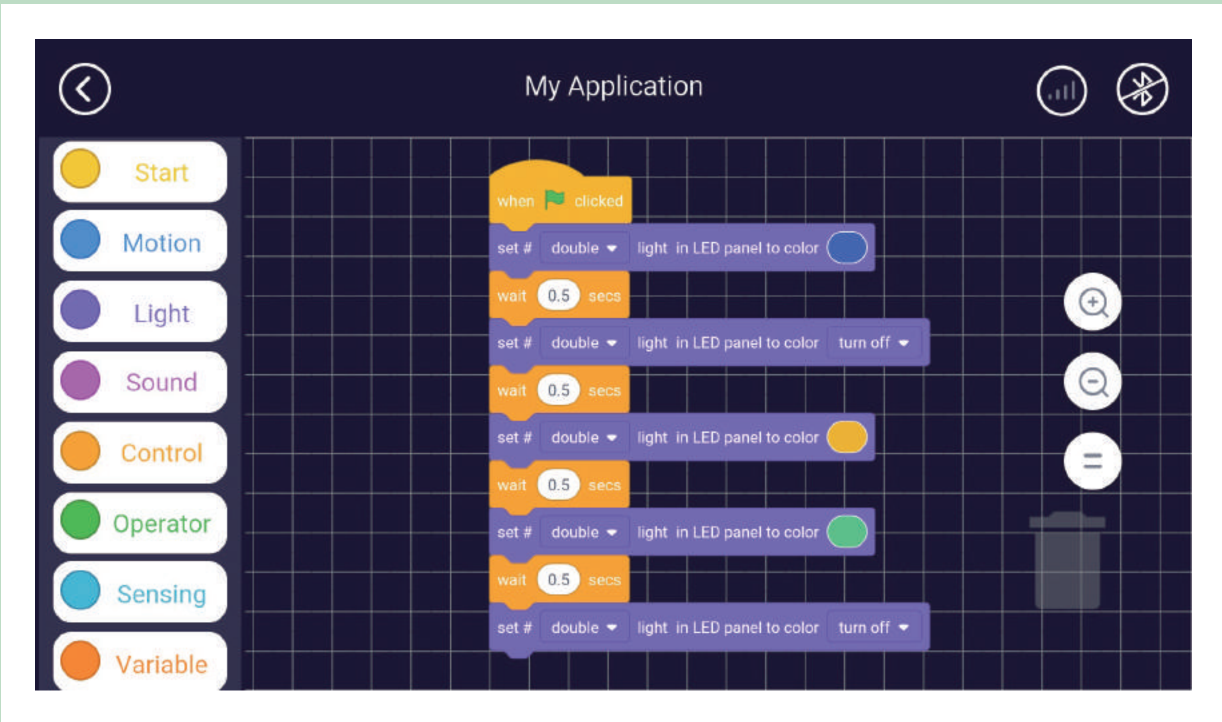




Crazy Games



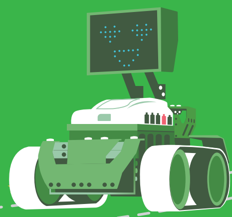
Learn how to control our onboard RGB lights. Now let's make a beautiful flashing light together, just like the stars in the sky. Take a look at who is the most beautiful of the "little stars".



What have you learned?

The three primary colors of pigments are red, yellow and blue. What are the 3 primary colors of light?

Complete Evaluation

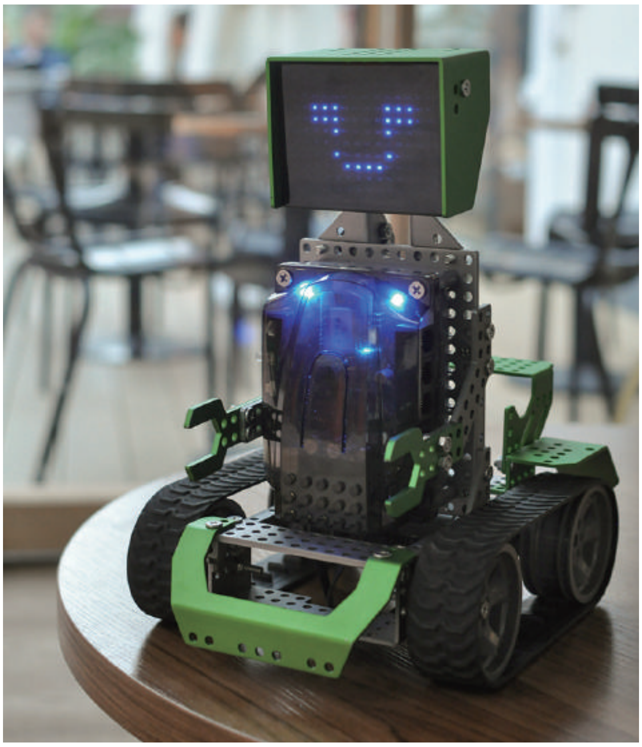


Chapter 5 The Birth of a Cavalier

Locke's Story

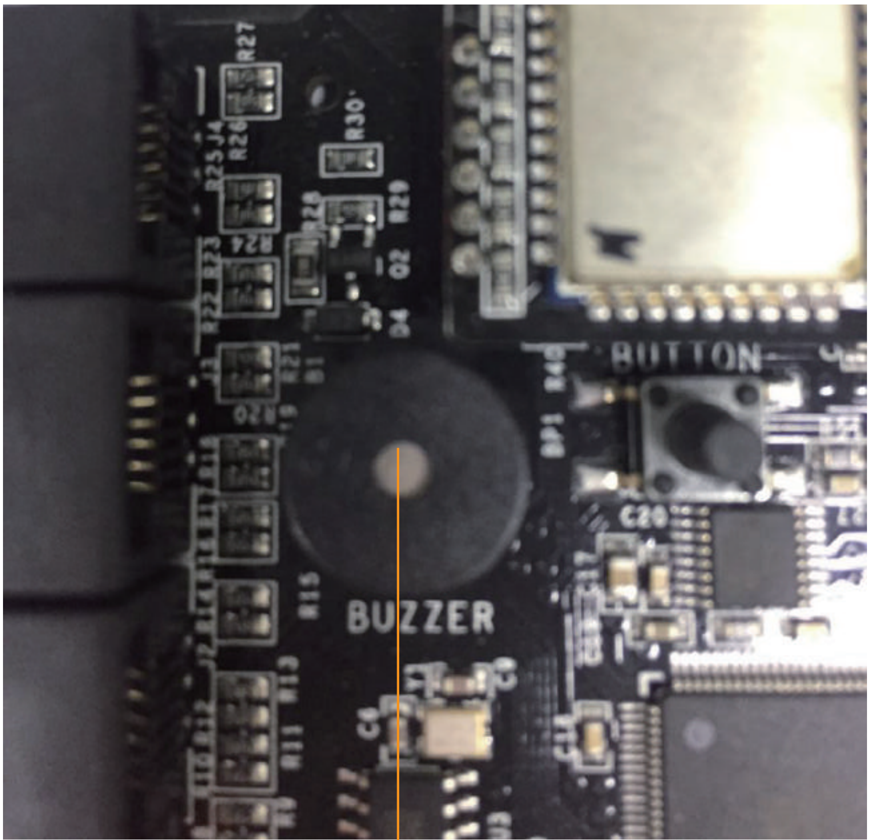
With Li' l Guardian, Locke' s house is bright, day or night with a brilliant light show from his new companion. With beautiful lights, Locke suddenly wanted to have a wonderful party. But the wonderful party is only light, how can it be done without music? So Locke decided to make a robot responsible for playing music at the party.

For Locke, who has successfully completed three robots, the whole process is now becoming more and more familiar. Soon, the fourth robot was created. Locke named the new robot "The Cavalier" because he decided that the party needed a romantic knight.



Functions and Principles

The buzzer is an integrated structure electronic sounder that uses a DC power supply. Divided into two types: piezoelectric buzzer and electromagnetic buzzer. What we are now using is a piezoelectric buzzer. When the power is turned on, and when there is a signal, it will output 1.5~1.5KHZ audio signal according to the signal, so that the piezoelectric buzzer will make different sounds.



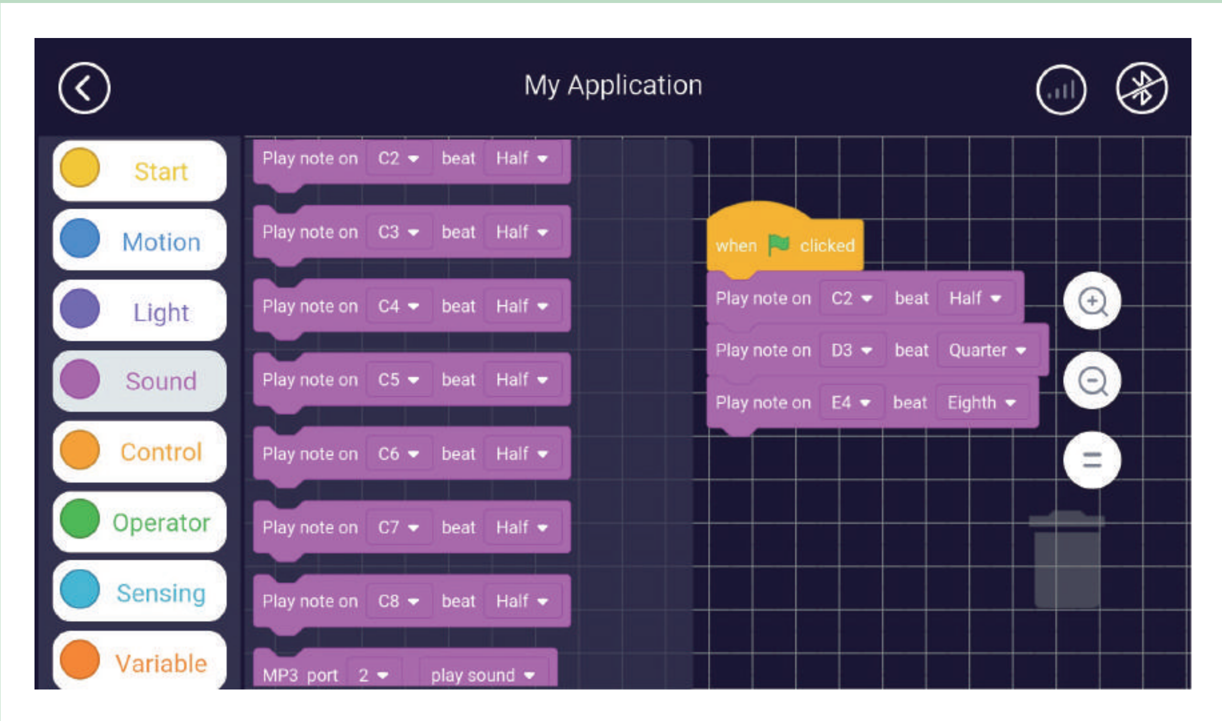
Onboard buzzer

Program Learning

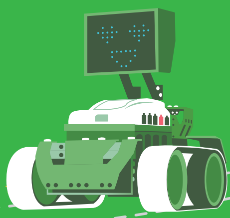
After learning the electronic knowledge of the buzzer, let's control the buzzer together and play good music!

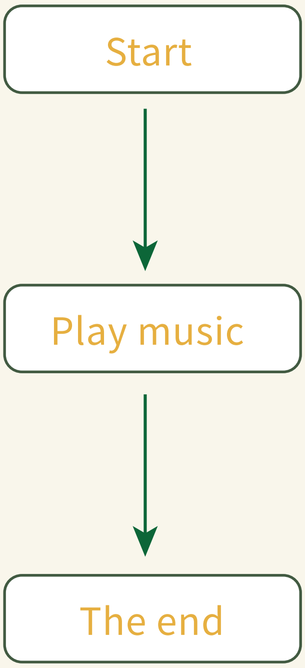
Buzzer tone setting

- Function: You can set the tone and beat of the buzzer.
- How to use: As shown in the figure below, in the "Start" module, drag the "When 🏴 clicked" to the program editing interface, and then in the "Sound" module, drag "play tone () beat ()" drag and drop to Under "When 🏴 clicked", select the pitch and beat in turn.

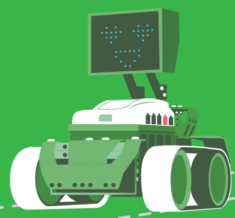


Program flow

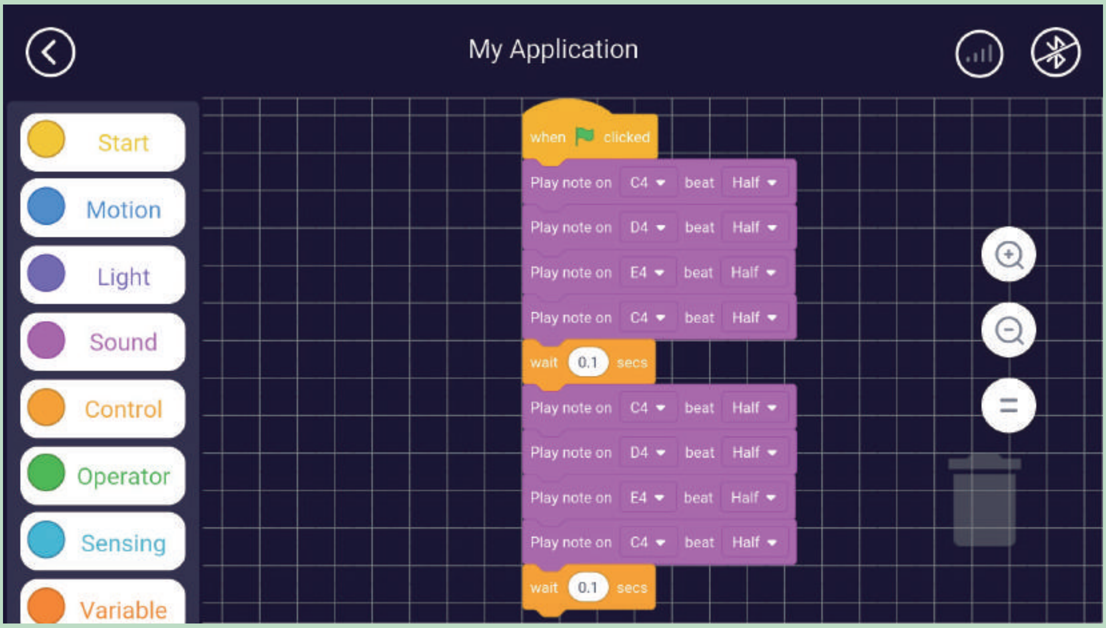


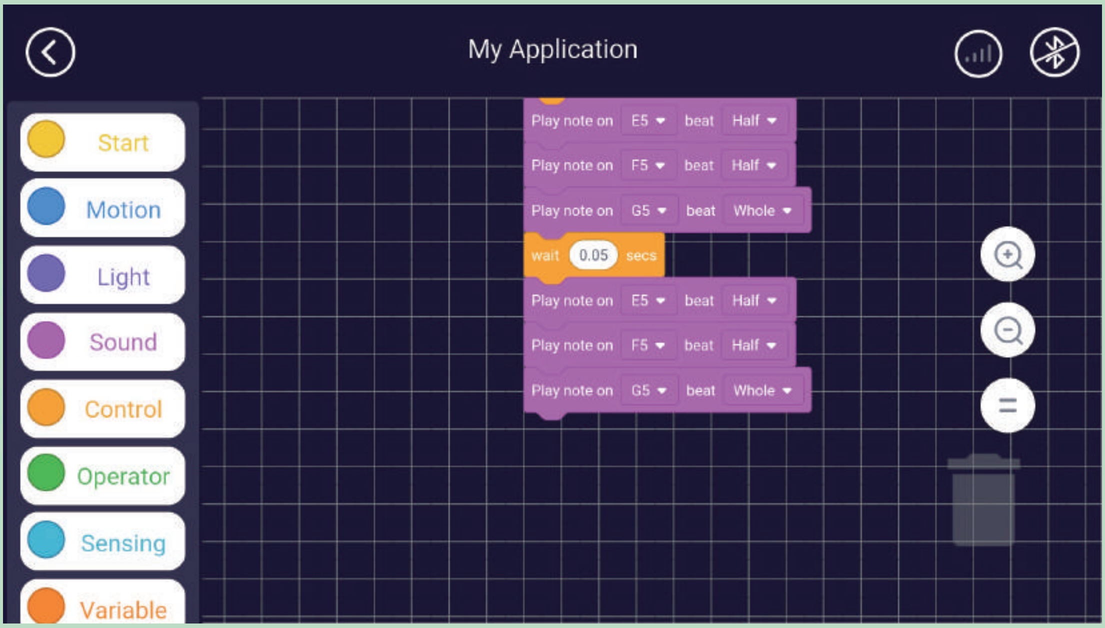


Crazy Games

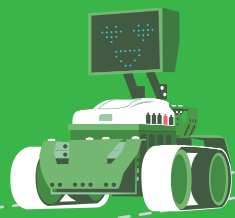


Learn how to control our buzzer to make a sound. Now let's set a song for the party!

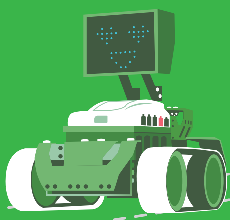




What have you learned?



How many beats can we set for our buzzer?

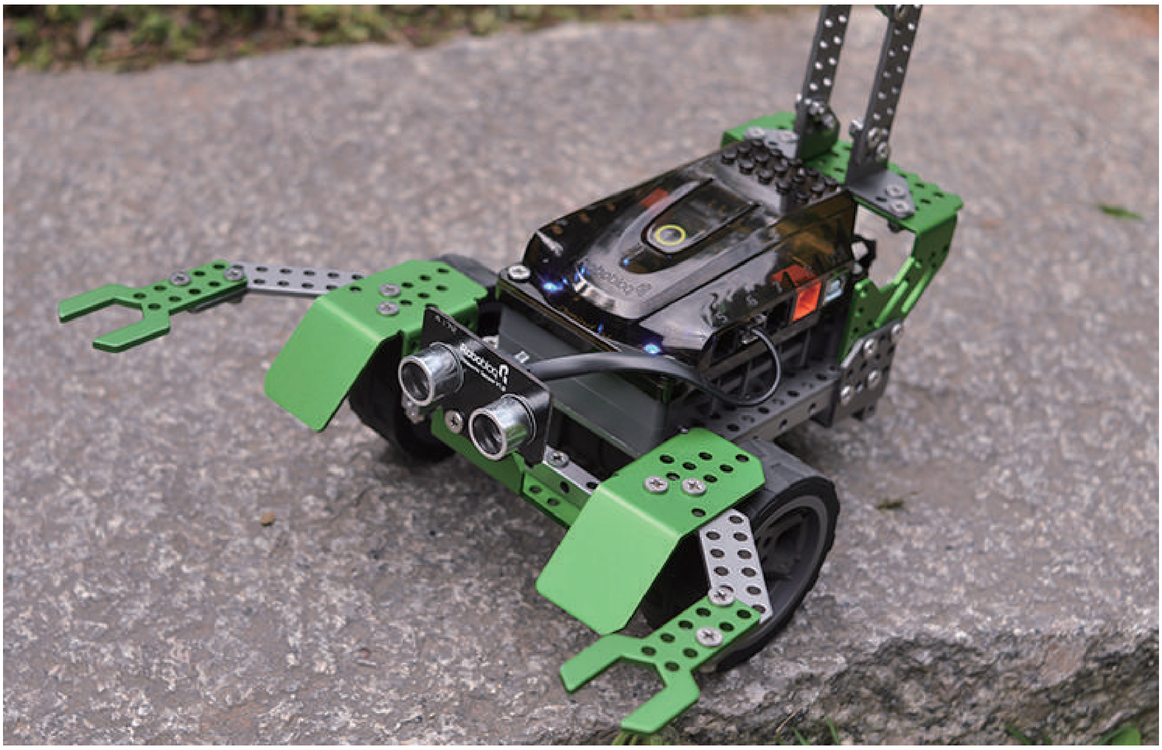


Complete Evaluation

Chapter 6 The Birth of The Scorpoid

Locke's Story

With brilliant lights and wonderful music, Locke had an unforgettable party. It was the happiest night for him to come since he had arrived. But after the fun ended, the house became somewhat deserted. Locke was in bed and remem–bered the pets that had been with him every night.
One night Locke was missing his pet and he couldn't sleep. The next morning, Locke decided to develop a robot pet to replace his previous one so he could have some company. After the decision was made, Locke could not wait to start doing it.
Soon after, Locke came out with an idea and created what he called "The Scor–poid"

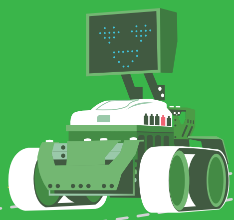


Functions and Principles

The custom button is a touch sensor that outputs a signal when the custom button is pressed and does not output a signal when it is not pressed.
The contact sensor is a kind of pressure sensor, which is mainly used to sense whether the outside is pressed. The pressure sensor is classified into a me–chanical pressure sensor, an electronic pressure sensor, a semiconductor pressure sensor, and the likes according to the pressure sensing method.

Custom button

Program Learning

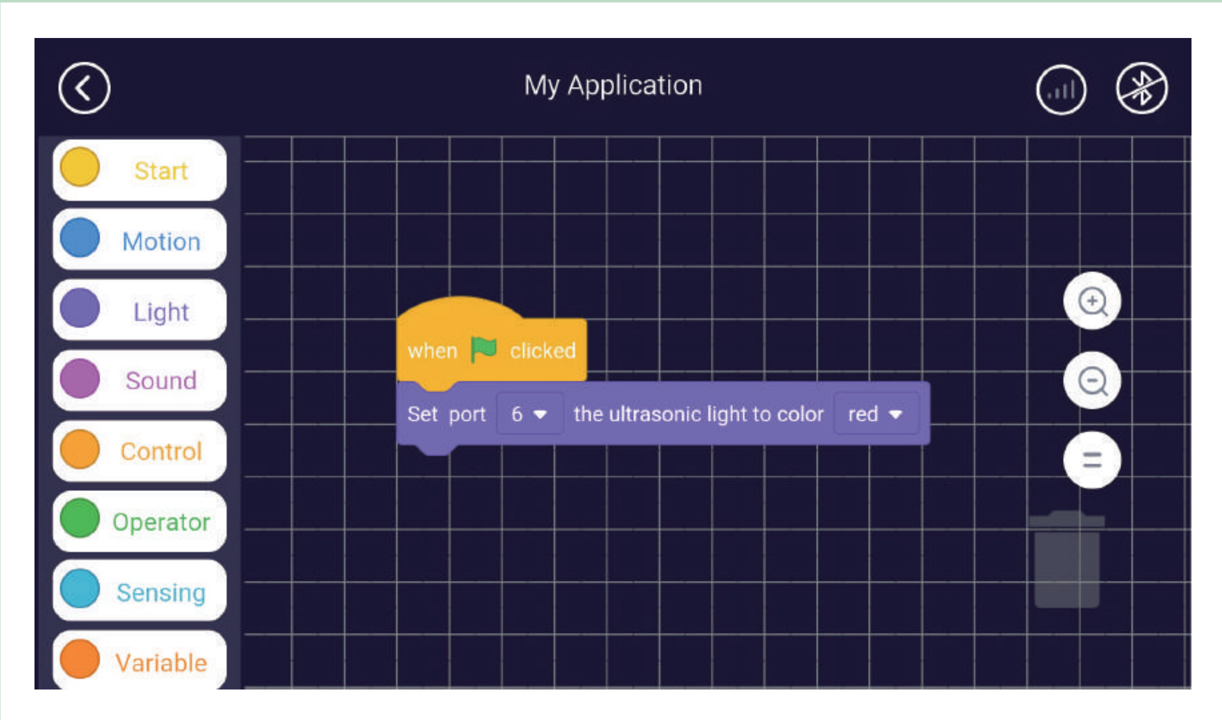


The Scorpoid is a very cranky pet, and if you press the custom button on its back, it will run back and scream. Now let's make a patrol soldier together!

Setting the ultrasonic sensor light

- Function: You can make the ultrasonic sensor light different color shades.

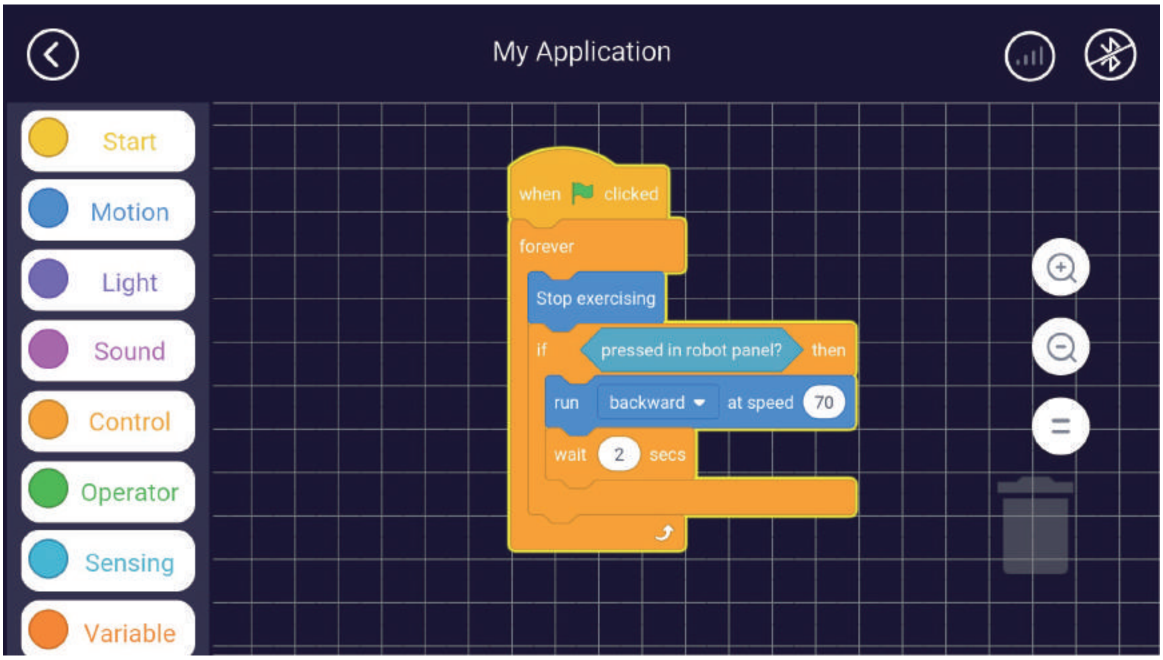
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Lights" module, "Set the port () ultrasonic color to ()" drag and drop Go to "When clicked" and select the port and color in order.



Set the push custom button to go back

- Function: It can detect whether the custom button is pressed, and it will go back if pressed.

- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Control" module, drag "Persistently execute..." to "When Clicked "on the bottom, then drag the "Stop Motion" in the "Motion" module to the small groove in the "Continuous Looping" and drag the "If () to..." in the "Control" module to Under "Stop Motion", then drag the "Board Top button is pressed" in the "Sensor" module to the "If () Just..." box, and drag "Setting () Motion The speed is ()", "wait () seconds", and change to backward movement, the speed is 70, wait 2 seconds.

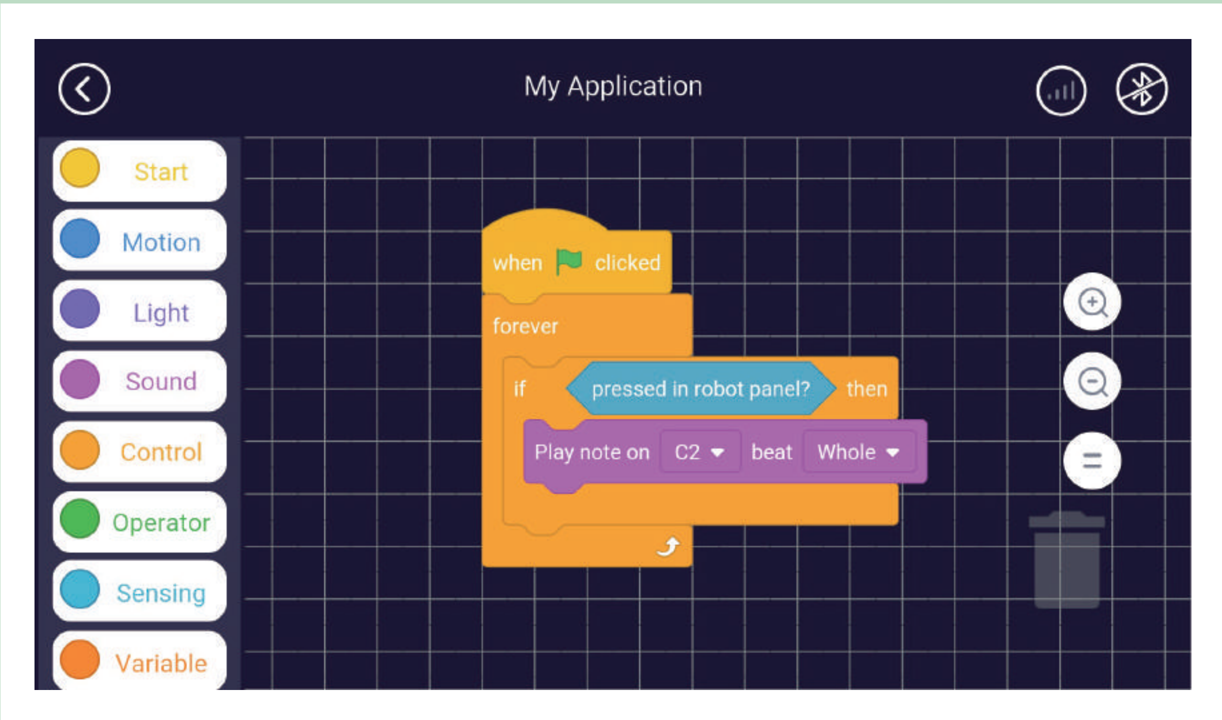


Program Learning

set to press the custom button then scream

- Function: It can detect whether the custom button is pressed, and scream if pressed.

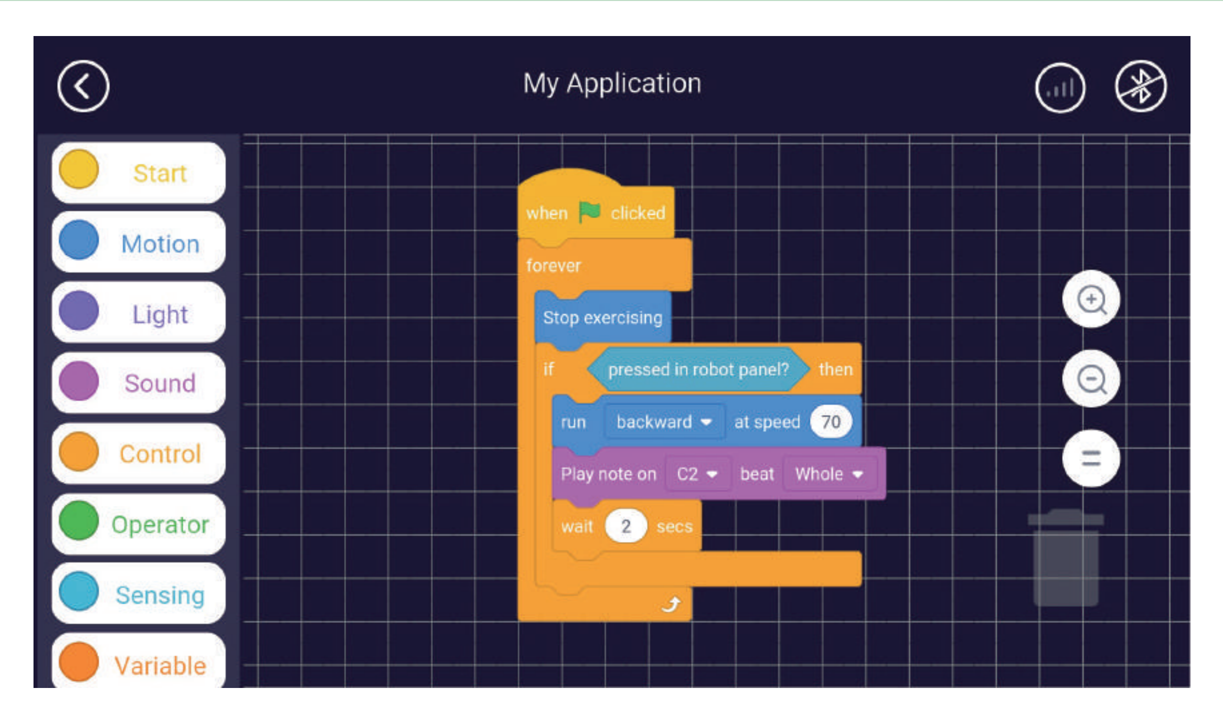
- How to use: As shown in the figure below, in the "Start" module, drag the "When 🏳 clicked" to the program editing interface, and then in the "Control" module, drag "Persistently execute..." to "When 🏳 Clicked" on the next, then drag "If () just..." in the "Control" module to the "Con–tinuously execute..." box, and then" press the button on the top of the motherboard "in the "Sensor" module. Drop to the "if () to ..." space, and in the box dragged into the "sound" module, "play tone () beats ()", and set up according to demand.



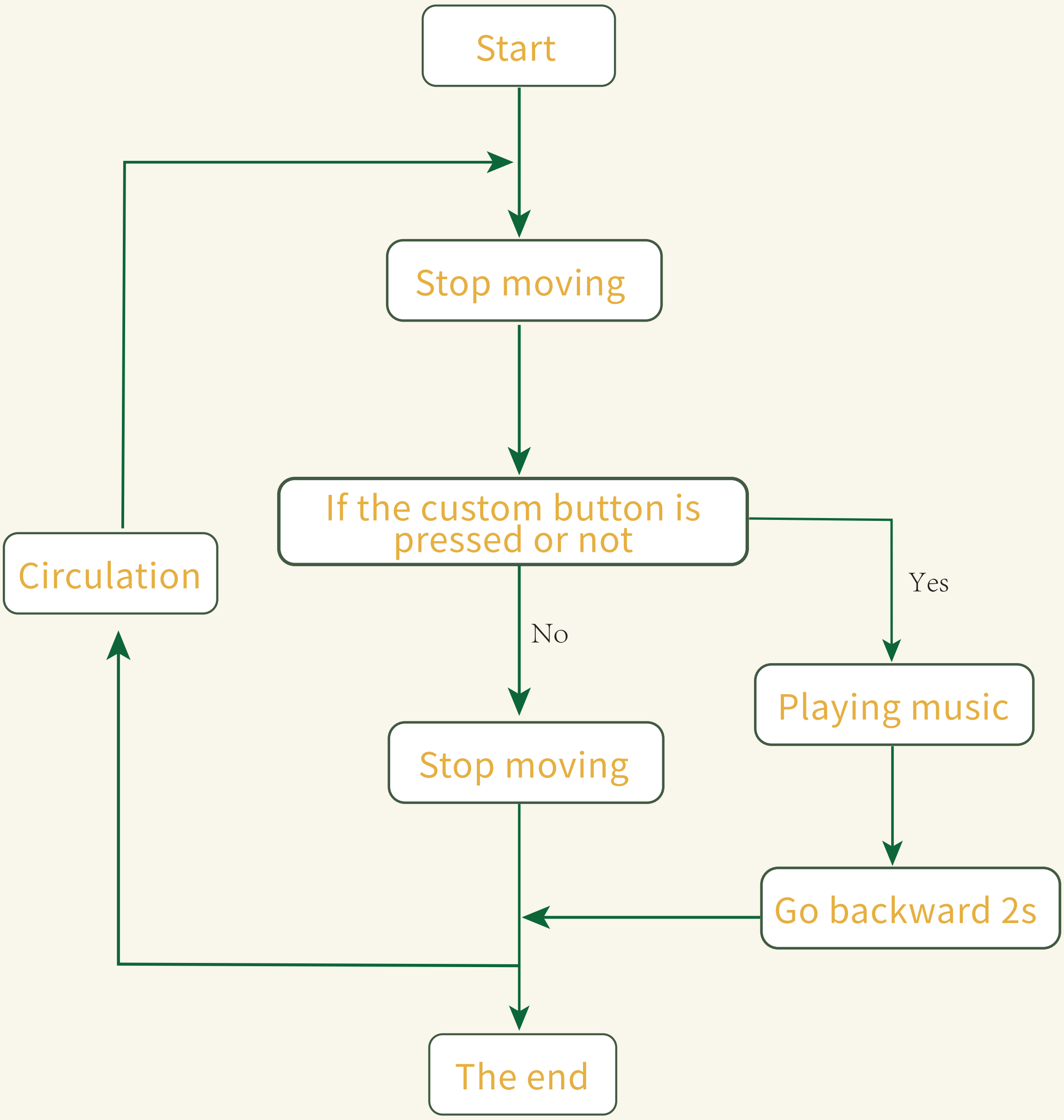
Program Learning

Set to press the custom button to recede and scream

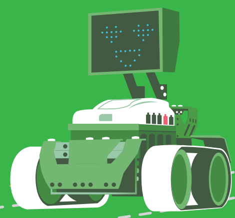
- Function: It can detect whether the custom button is pressed, and if it is pressed, it will recede and scream.
- How to use:As shown in the figure below, merge the first two programs.



Program flow



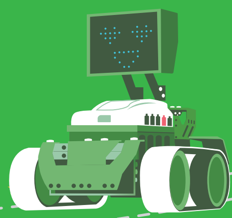
What have you learned?



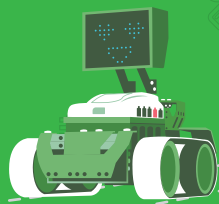
1.What modules do we need to use if we want to execute the program repeatedly?

2. What modules need to be used when we need the pro–gram to meet a certain condition to execute?

Complete Evaluation

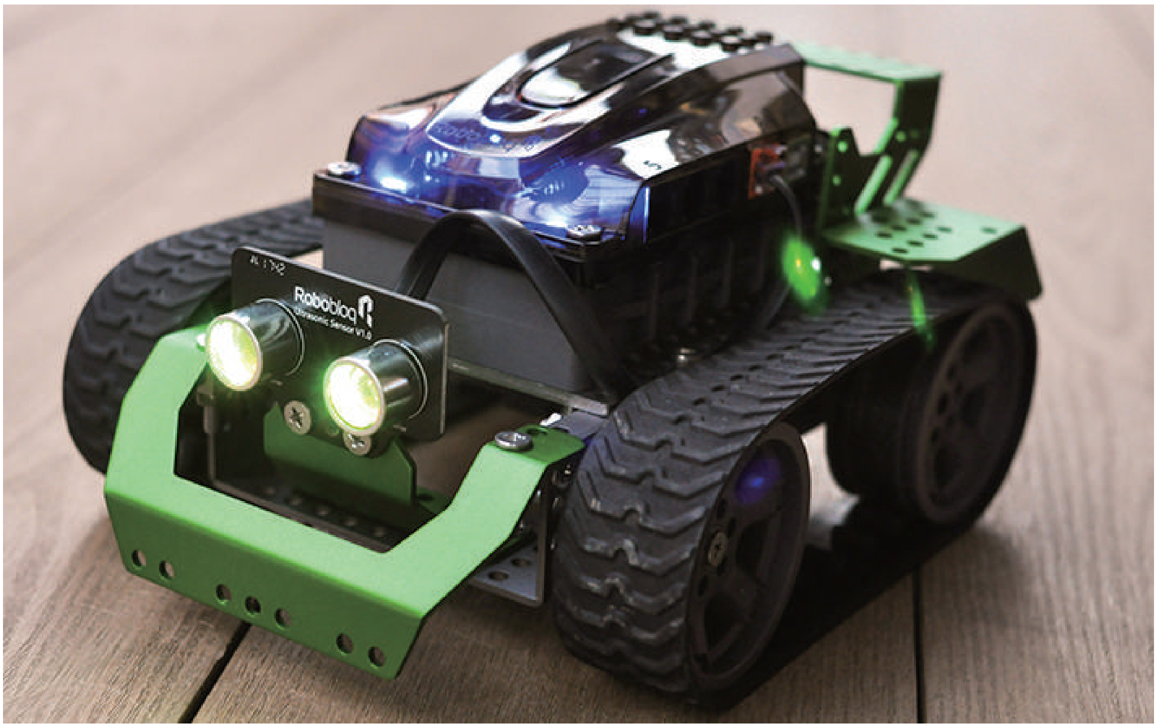


Chapter 7 The Birth of the Voyager



Locke's Story

Locke has been patrolling with crouching soldiers every day since he had The Scorpoid. In one play, he accidentally injured one of his eyes, making his life difficult temporarily.
With only one eye, even his daily tasks and routine were extremely hard to complete. For this reason he decided to make a robot to guide him.
After the decision was made, Locke returned to his own lab to start production. Despite the difficulties with his sight, Locke finally completed the production of the robot. He gave a name to the new robot, called the "Voyager".



Functions and Principles

The ultrasonic sensor is mainly composed of an ultrasonic probe and a port for transmitting signals, and an RGB light is also installed in the ultrasonic probe. Two ultrasonic probes are responsible for transmitting ultrasonic waves, and one is responsible for receiving reflected waves. The ultrasonic wave is emitted forward and a reflected wave is formed after the obstacle is touched. After the probe is received, the ultrasonic signal is converted into an electric signal. The signal is fed back to the motherboard for processing through the connection port.

Ultrasonic search unit

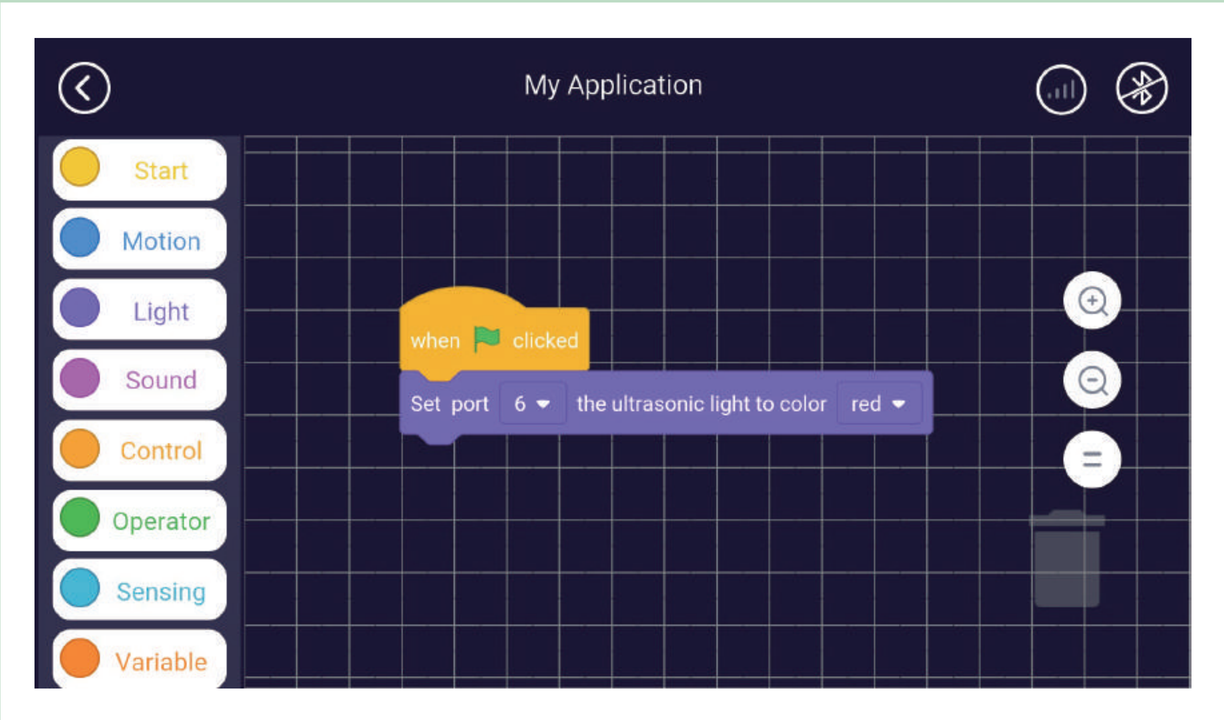
Connection port

Program Learning

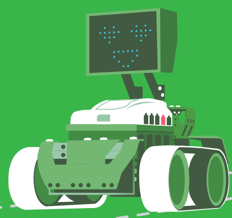
After learning about the electronic knowledge of ultrasonic sensors, let's take a look at how to use it!

Set the monochromatic light of the ultrasonic probe

- Function: You can directly set the red, yellow, and green lights or turn off the lights.
- How to use: As shown in the figure below, in the "Start" module will be "when clicked" drag and drop to the program editing interface, and then in the "light" module will "set the port () ultrasonic color ()" drag and drop to "When clicked" and select the port and color.



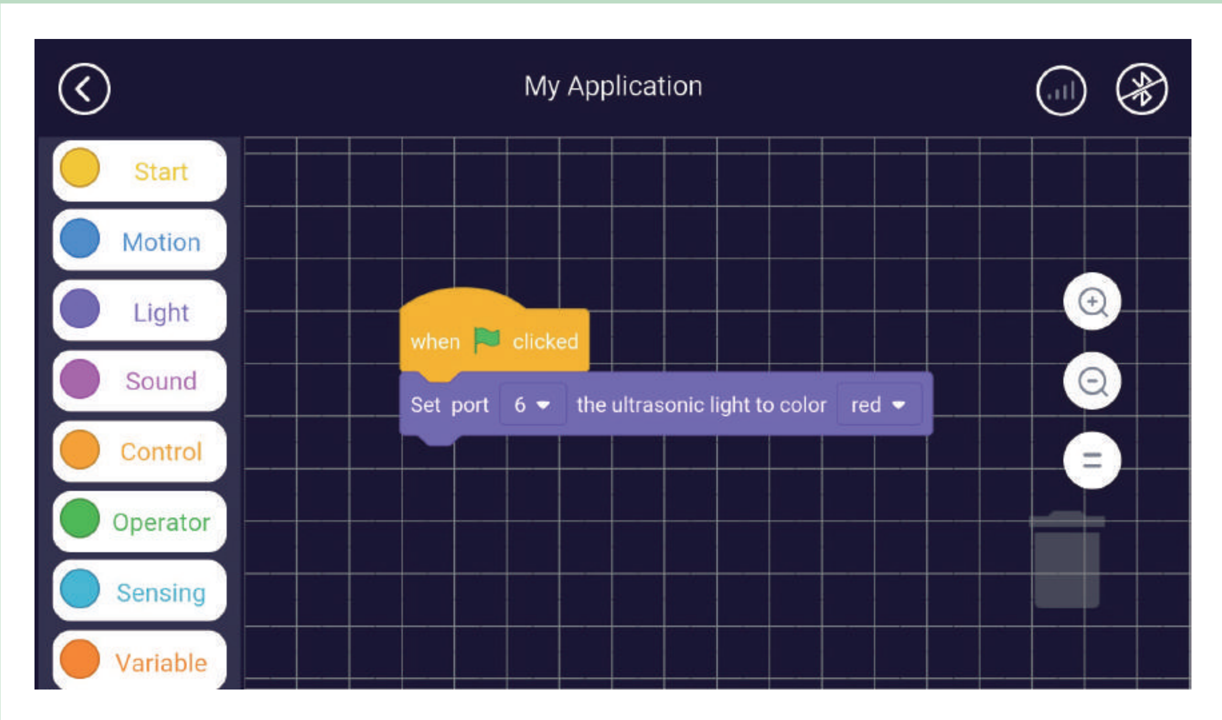
Program Learning



After learning about the electronic knowledge of ultrasonic sensors, let's take a look at how to use it!

Set the monochromatic light of the ultrasonic probe

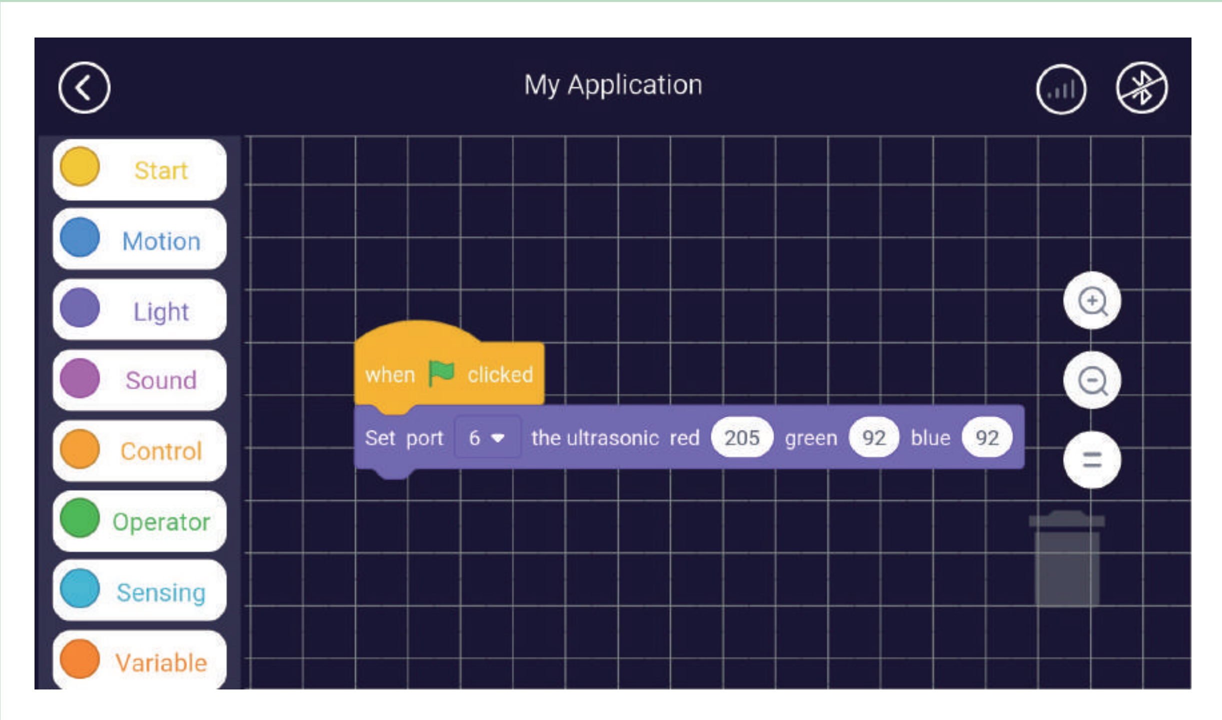
- Function: You can directly set the red, yellow, and green lights or turn off the lights.
- How to use: As shown in the figure below, in the "Start" module will be "when clicked" drag and drop to the program editing interface, and then in the "light" module will "set the port () ultrasonic color ()" drag and drop to "When clicked" and select the port and color.



Program Learning

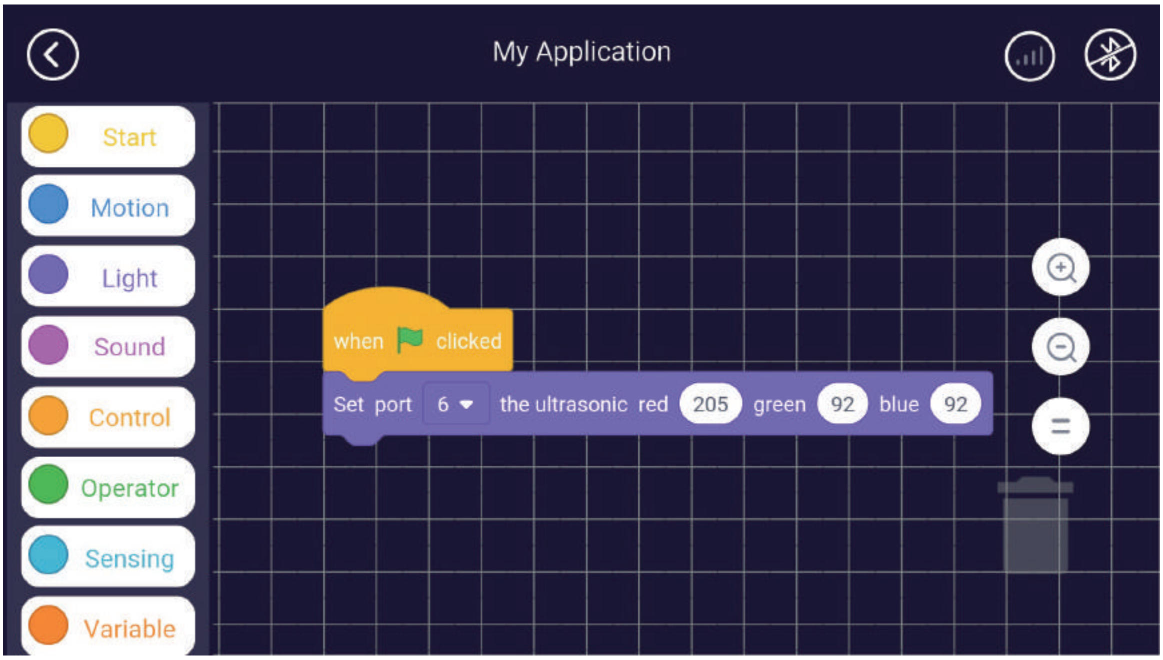
Set the ultrasonic probe red, green and blue mixed light

- Function: Mixing light can be created by setting the concentrations of red, green, and blue.
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Lights" module will "set the port () ultrasonic red () green () blue ( )" Drag and drop to "When clicked" below and select the port and fill in the color concentration in the white box.



Set the light color, brightness, saturation

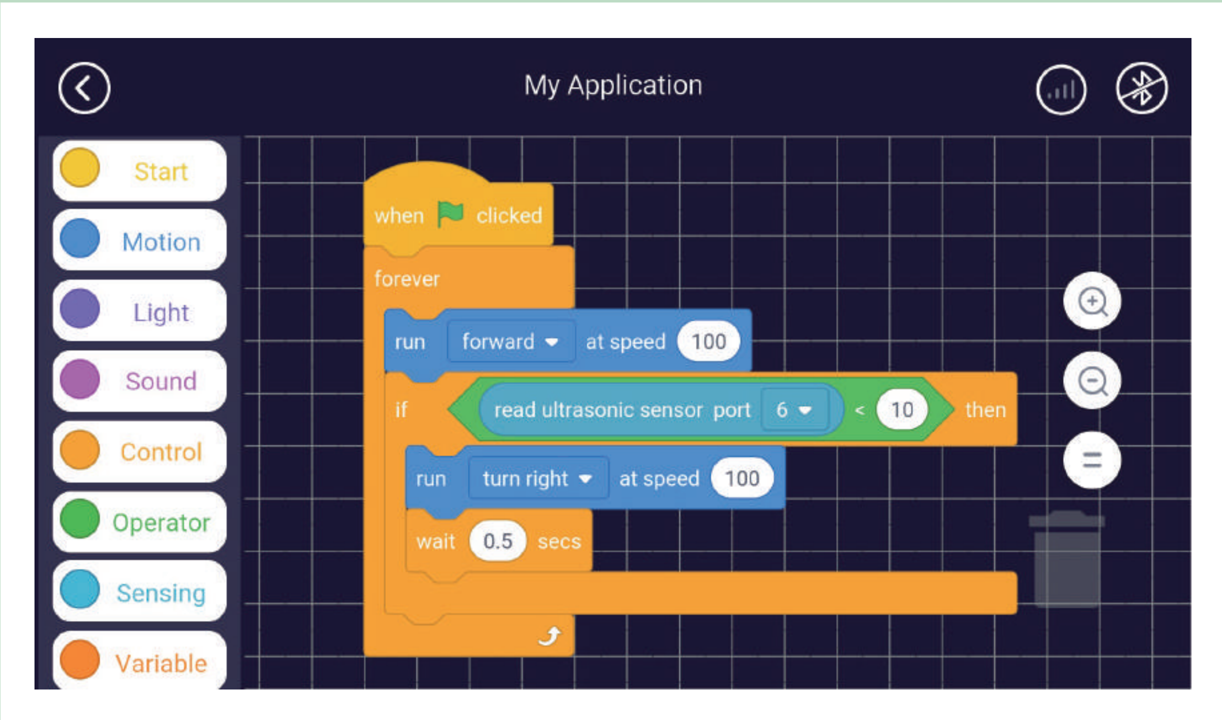
- Function: The color, brightness and saturation of onboard RGB lamps can be set.
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Lights" module will "set the on board (dual/left/right) The color is ()" dragged to"When clicked" below, and select the light color, bright–ness, saturation.



Program Learning

Ultrasonic sensor automatic obstacle avoidance

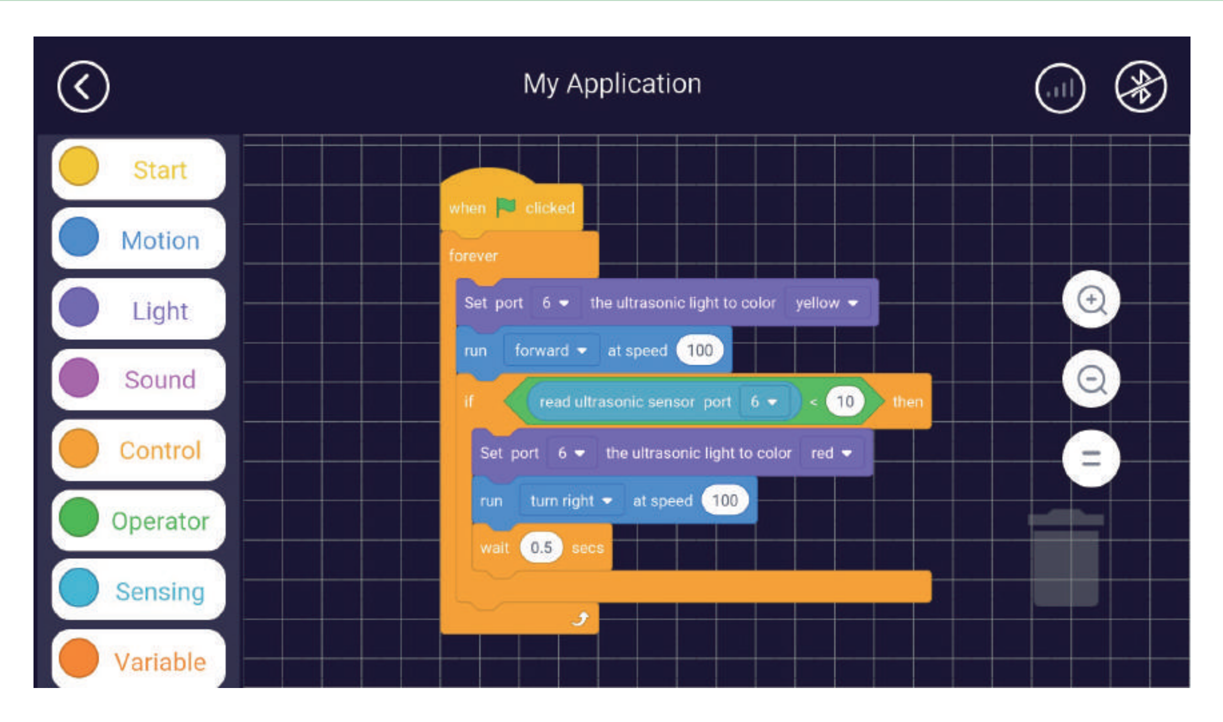
- Function: Automatically avoid obstacles through ultrasonic sensors.
- How to use: As shown in the figure below, in the "Start" module, drag the "When clicked" to the program editing interface, and then in the "Con–trol" module, drag "Persistent Loop Execution" to "When clicked" , and then drag the "set () motion, speed ()" in the "movement" to the "continu–ous loop execution" box, and then drag "if () just ..." in the "control" module Go to the "Settings () motion, and the speed is ()" below, and drag the "Settings () motion, speed ()" in the "Motion" module to the "if () just..." box, and In the "Set () motion, the speed is ()" is placed under the "wait () seconds" in the "control" module, and set it.



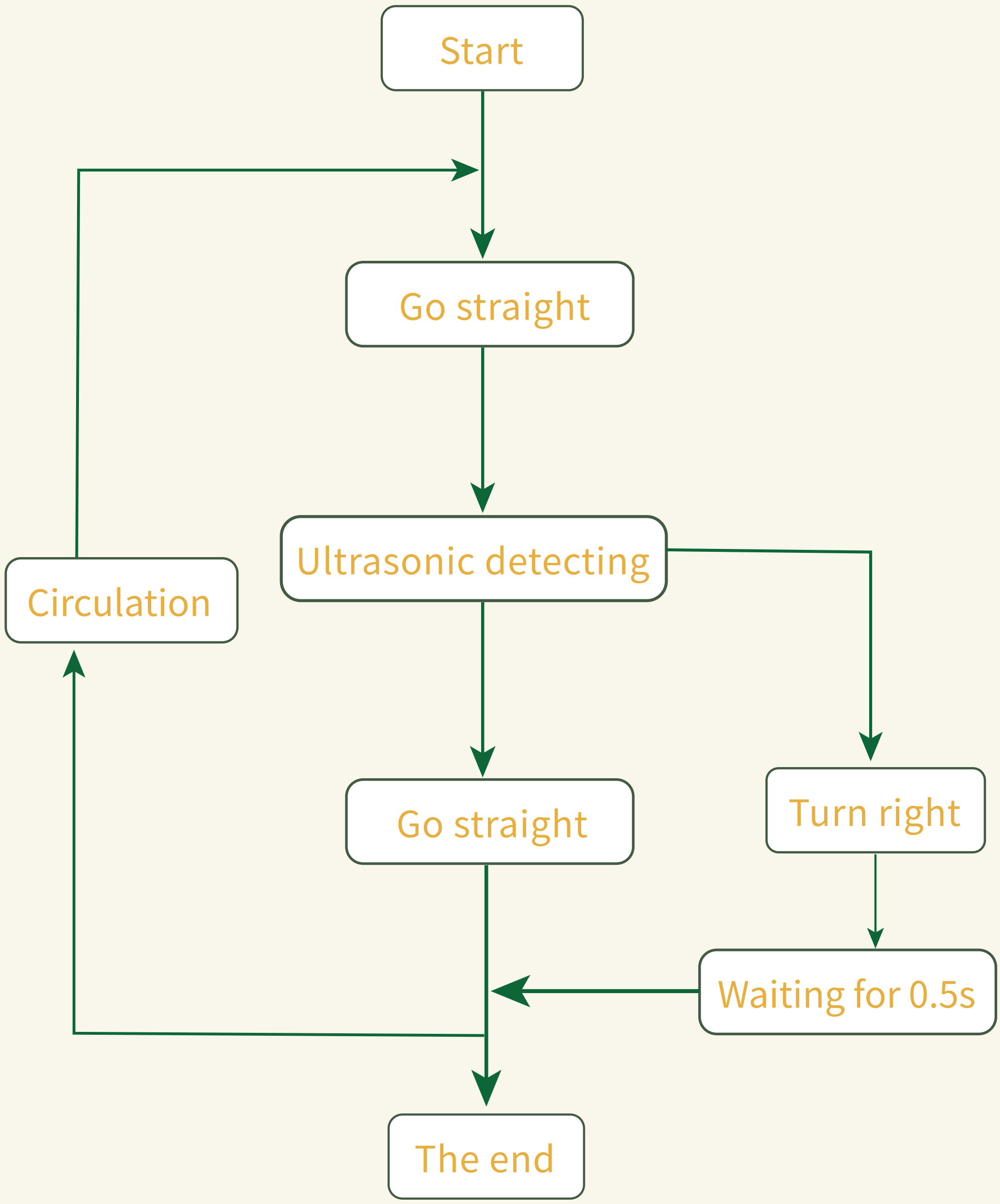
Program Learning

Ultrasonic automatic obstacle avoidance and lighting

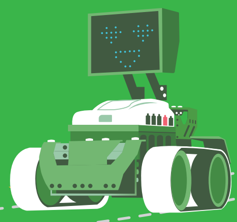
- Function: Automatically avoid obstacles and turn on the ultrasound probe lights.
- How to use: As shown in the figure below, combine the first program and the fifth program.



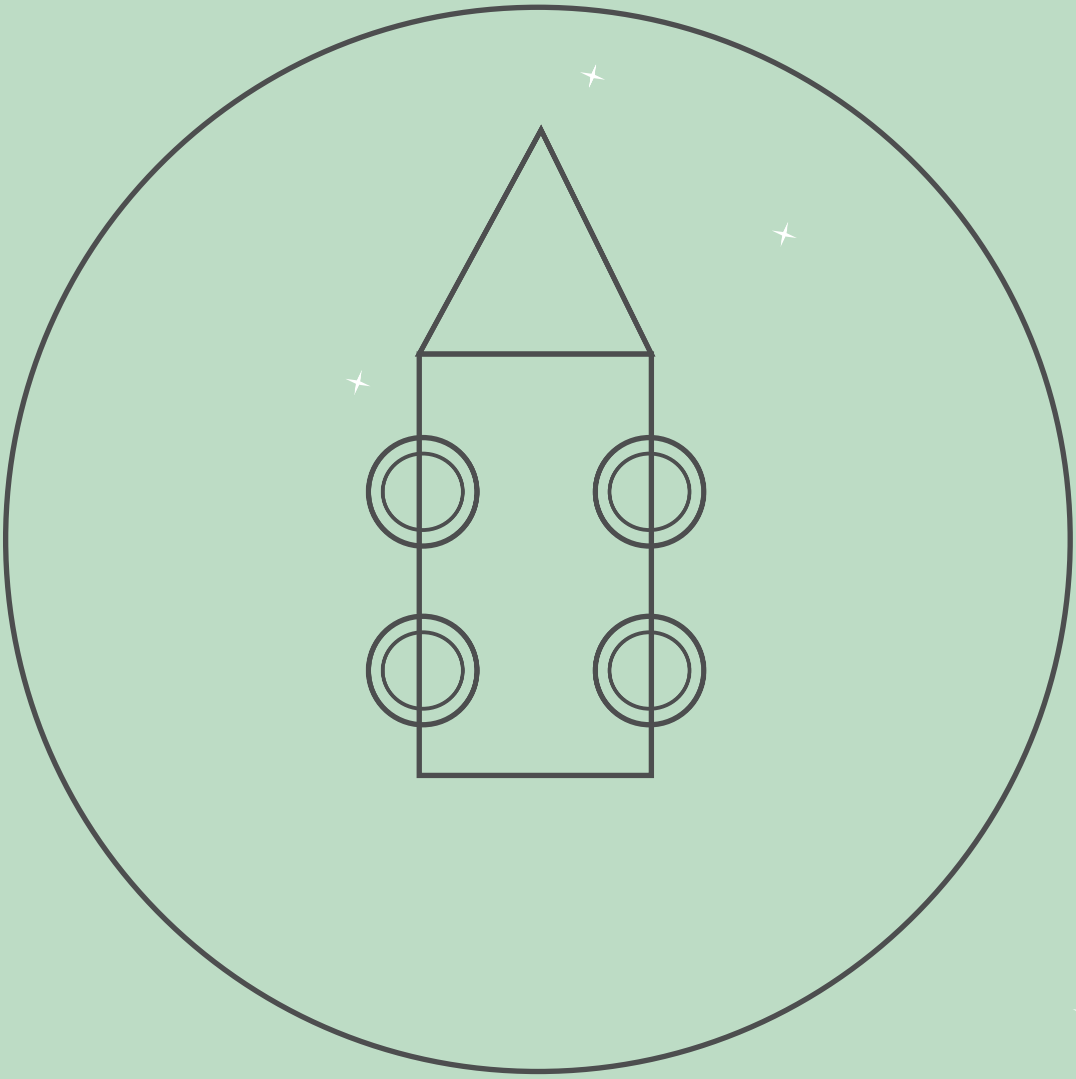
Program flow



Crazy Games



Learned to avoid obstacles automatically. Now we use automatic obstacle avoidance to play games! Join hands in a circle with your friends, move constantly to block the Voyager, do not let it break through the circle, and see if you can insist on 5 minutes!



Complete Evaluation