

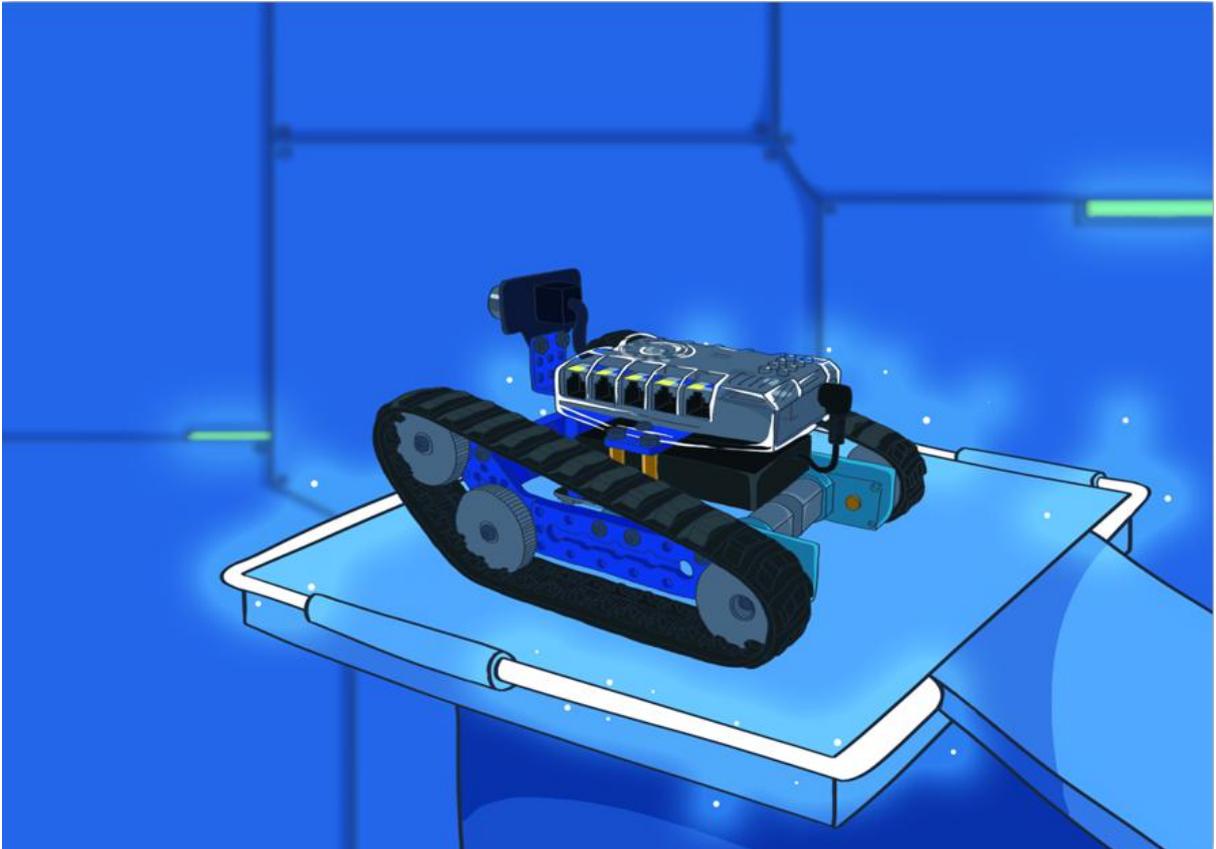
## Gift

How to select an empty bridge among three? The smart Peter takes out the infrared detector, it is found that only one empty bridge leaves significant traces...

"Haha, that's it!" "Peter says excitedly, quickly goes to the other end of the bridge, carefully looks at the structure of entrance and thinks about how to open the door. . .

Mark commands Rex to turn on the headlights to see what clues can be found, and when the lights turn on, the familiar D5 scales are heard...

"The keys to the doors are the same, how to prevent thieves?" Said Dr. Chiu jokingly. Rex enters the colored light's combined data that peter is used to open the entrance of ground, and turns on full-color light that is composed of three-color RGB so as to project the fixed spectrum on the door...



E5, C5, C4, G4, when playing the last scale, the lights in the entire suddenly turn on brilliantly, ring lights parked on the Ranger Tank platform constantly flash and shine out with colorful brilliancy just like performance. They are especially bright to people who are adapted to the darkness.

At this point, the door is slowly opened. There are no Martians standing in the doorway to welcome, instead only Curiosity is located in the bright channels. It is said that it is similar to the Curiosity...

"Please do not be afraid, nobody has stationed here except me in the entire spacecraft.

Other people have completed the task and returned to the distant hometown! Please come with me. "

## Learning Objectives

12 three-color RGB LED lights are located on the Ranger's mainboard Me Auriga, which are arranged in a circular. As for these LED lights, they should be properly applied. This chapter describes how to use 12 LED lights on the Me Auriga, coordinate variables and mathematical calculations to create a different lighting effect.

## Scientific Knowledge



### Persistence of vision

Extend your hand to make V-shaped gestures with index finger and middle finger, and then quickly wave your hand, how many fingers do you see? Do you see three or four fingers?

When the object moves rapidly, the eye will retain the image of observed object due to the delay of transmission of optic nerve. This delay will last about 0.1-0.4 seconds, which is known as persistence of vision.

The most common phenomenon of visual persistence is phenomenon that is created via quickly circling the flashlight. Our eyes will see a circle of light rather than a point light. As the principle of visual retention is applied in the film and television, the original static picture can be turned into a fast-moving film.

## Assembly Preparation

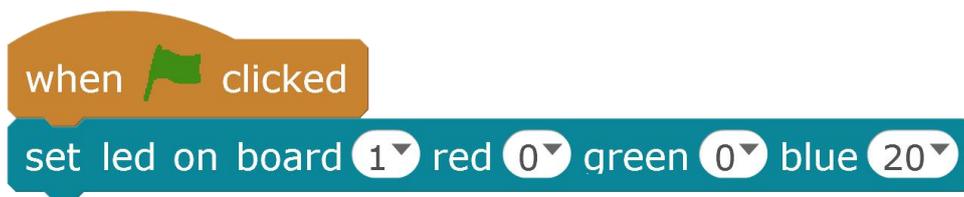
We use the tracked vehicle for the task.



## Learning tasks

### Learning Task 1 - Turn on a light

Ranger has 12 three-color LED lights, we can choose to light up any LED light.



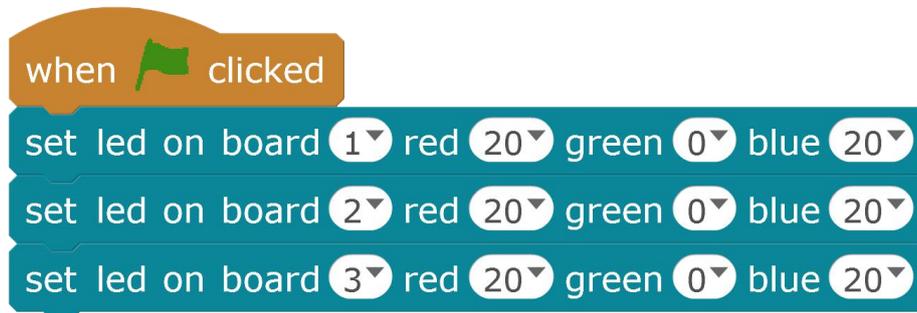
Click on the inverted triangle next to "All" and a drop-down list will appear, allowing you to select LEDs in different positions.



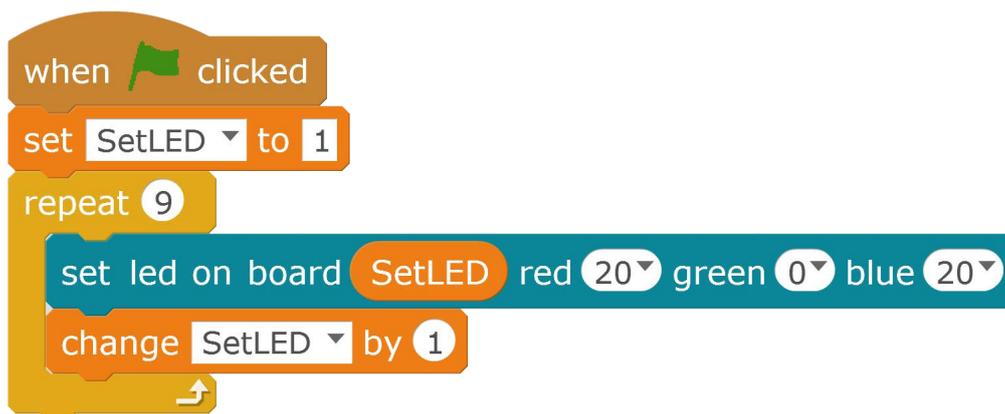
LED lights are arranged in a clockwise manner as follows: No.1 LED light is located near the middle of No. 7 and. 8 port on the left side of Me Auriga mainboard, followed by 2 to 12 LED lights. "All" means that all LEDs (12) are lit or turned off together.

## Learning Task 2 - Turn on more lights

One light may be a little boring, turn on more LED lights as shown below. We can use copy command to make several instructions and turn on three LED lights one time.



We also can use the characteristics of the variable, apply variable to specify the location number of LED lights to turn on more than one LED lights. The program is shown as follows: Create a variable called SetLED, repeat several times, and set LED light represented by SetLED position when repeating, and change the variable to 1 (increase 1), so 9 LED lights will be turned on in order.



Please try it, can you light up 12 LED lights?

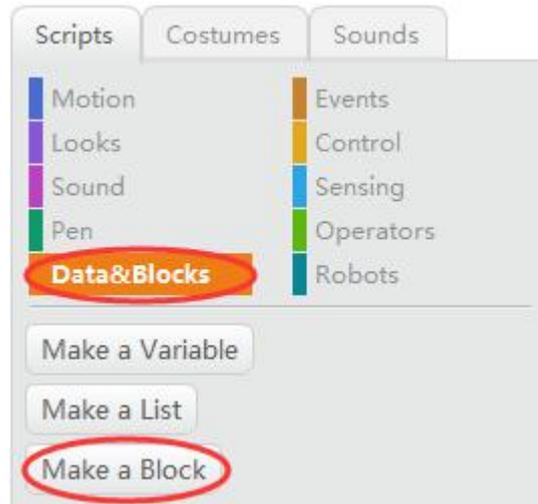
## Target Task

### Target Task 1 - Intensity indicator

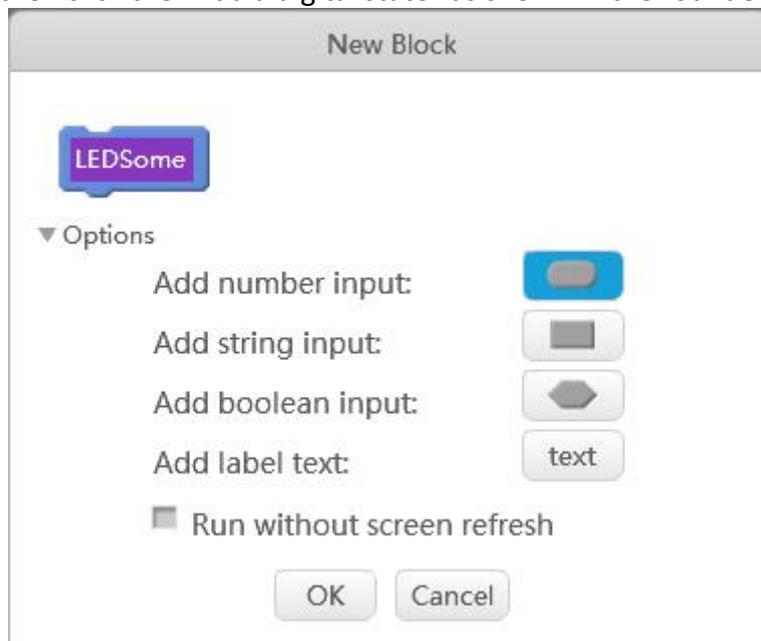
After learning how to turn on the LED lights sequentially, then you can create intensity indicator via the program for turning on lights sequentially.

Intensity LED is intended to indicate the current state via LED lights. For example, according to the distance of the ultrasonic sensor, display the state via a plurality of LED lights. The further of the distance, the more LED lights will be turned on; the closer, the fewer LED lights will be turned on.

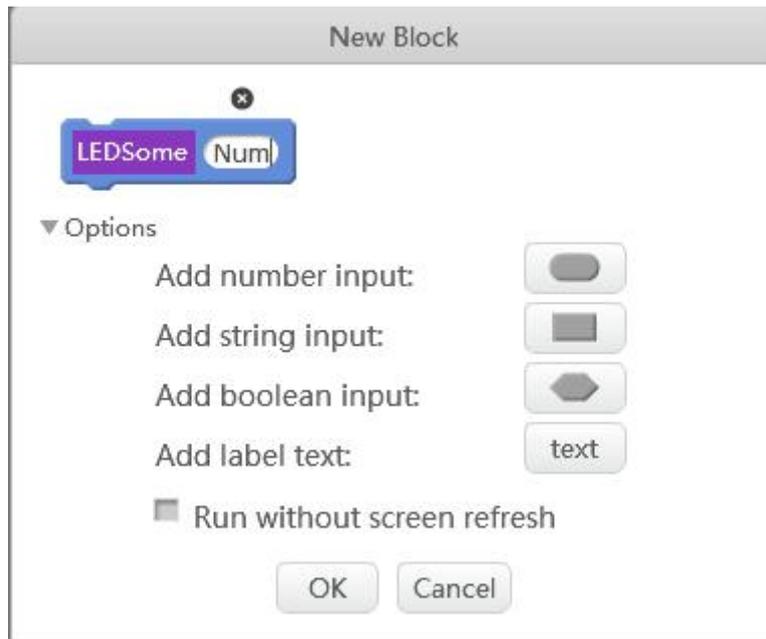
First of all, create a new command block, named LEDSome,



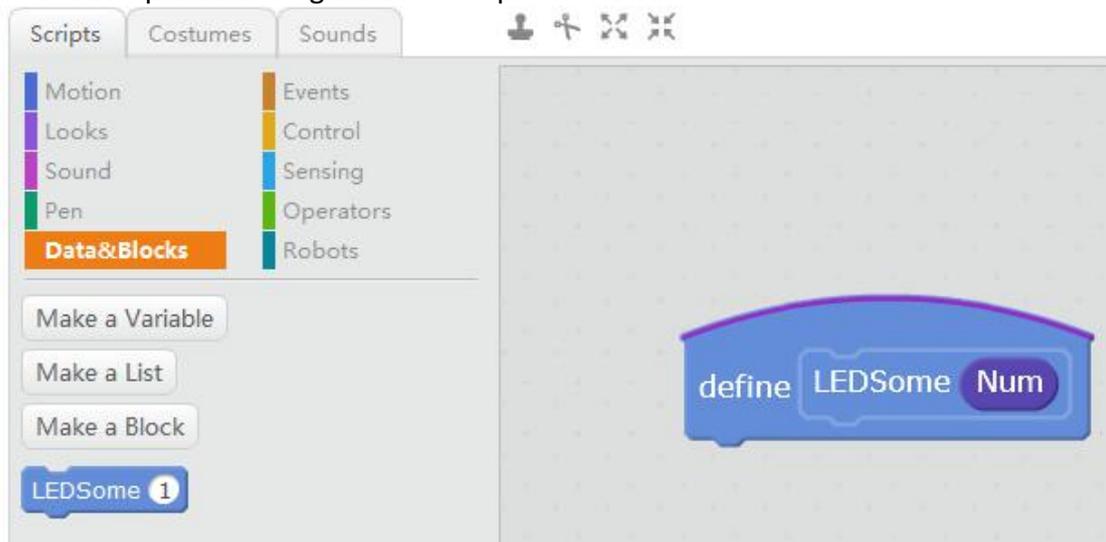
This instruction should have one digital parameter. After adding the name of the LEDSome, click "Options", then click the "Add a digital state" as shown in the rounded edge icon.



Change number1 to Num, press "OK"



You have completed adding a block with parameters.



Next, write LEDSome program and its purpose is simple: turn on the lights that need to light up, and close the lights that need to turn off.

Create a variable SetLED, set to begin from 1, and follow the method described in the learning task 2, repeat the times specified in Num, and turn on the LED lights; If you want to turn on all 12 LED lights, the remaining number of lights is 12-Num, and the remaining lights should be turned off. The program is shown as follows:

```

define LEDSome Num
  forever
    set SetLED to 1
    repeat Num
      set led on board SetLED red 20 green 0 blue 20
      change SetLED by 1
    repeat 12 - Num
      set led on board SetLED red 0 green 0 blue 0
      change SetLED by -1
  
```

According to the above program, assuming that the variable Num is set to 3, and the No.1-3 LED lights will be set to lavender, and No.4-12 LED lights are set to off.

Create a new variable US, and set US value to "ultrasonic sensor distance divided by 10", and match with LEDSome (Num)'s function, the program is as follows:

```

when green flag clicked
  forever
    set US to ultrasonic sensor Port10 distance / 10
    LEDSome US
  
```

After clicking on the green flag to execute the program, move the hand in front of the ultrasonic sensor, and the Ranger will turn on different number of LED lights depending on the ultrasonic distance.

The overall program is shown as below:

```

when clicked
  forever
    set US to ultrasonic sensor Port10 distance / 10
    LEDSome US

```

```

define LEDSome Num
  forever
    set SetLED to 1
    repeat Num
      set led on board SetLED red 20 green 0 blue 20
      change SetLED by 1
    repeat 12 - Num
      set led on board SetLED red 0 green 0 blue 0
      change SetLED by -1

```

Please adjust the setting value of US, such as "ultrasonic distance divided by 5", to observe the effects presented in different distances.

## Target Task 2—Horse race lamp

Use variable to control and light up LED lights in different positions, and create horse race lamp visual via the persistence of vision.

Also use the variable SetLED in the task target 1 as the value of the LED light's position, set the brightness of LED light to red 20 and blue 20, this will appear purple.

In order to show the moving light effect of horse race lamp, turn on the LED lights, delay 0.1 seconds, and immediately turn off the LED lights, and then delay 0.1 seconds, then turn on/off the LED lights in that order. The light will show moving forward when repeating 12 times.

```

when clicked
  forever
    set SetLED to 1
    repeat 12
      set led on board SetLED red 20 green 0 blue 20
      wait 0.1 secs
      set led on board SetLED red 0 green 0 blue 0
      wait 0.1 secs
      change SetLED by 1

```

Repeat above-mentioned program, create "moving forward" state of light, if you want the lights to turn back, how to make the light "turn back"?

Yes, the original variable SetLED is incremented (changed 1). "Turning back" will be realized as long as the program fragment of "Repeat 12 times" is copied and set to decrement (change -1).

The program is shown as follows:

```

when clicked
  forever
    set SetLED to 1
    repeat 12
      set led on board SetLED red 20 green 0 blue 20
      wait 0.1 secs
      set led on board SetLED red 0 green 0 blue 0
      wait 0.1 secs
      change SetLED by 1
    repeat 12
      set led on board SetLED red 20 green 0 blue 20
      wait 0.1 secs
      set led on board SetLED red 0 green 0 blue 0
      wait 0.1 secs
      change SetLED by -1

```

Similarly, effect of horse race lamp change can be enhanced via delaying the waiting time, adjusting bright color and mixing colors. Please try.

## The Challenge

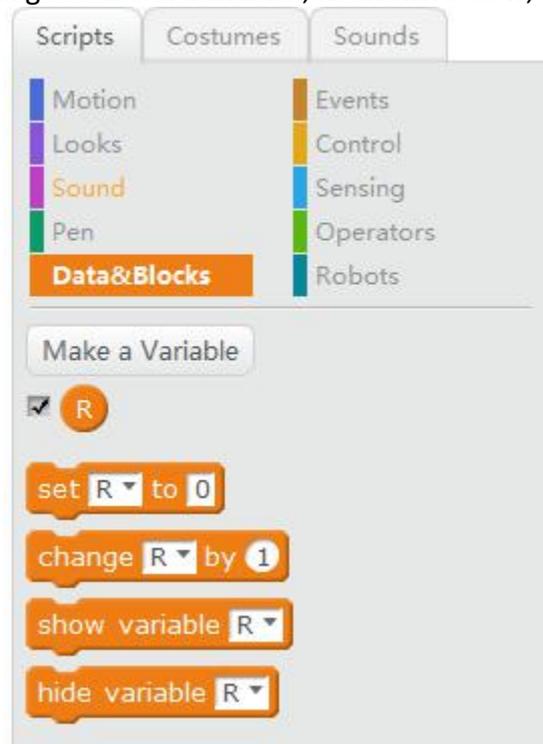
After learning how to use variables in the LED light position, let us challenge another LED light changes—breathing lights.

### Challenge Task 1 - Breathing light

When we use command block on "Set Onboard LED", LED lights show fixed brightness. For example, use the following command, and set LED red to 10 and blue to 10, the light will show purple.



In fact, you can also make good use of variables, as shown below, create a variable R,



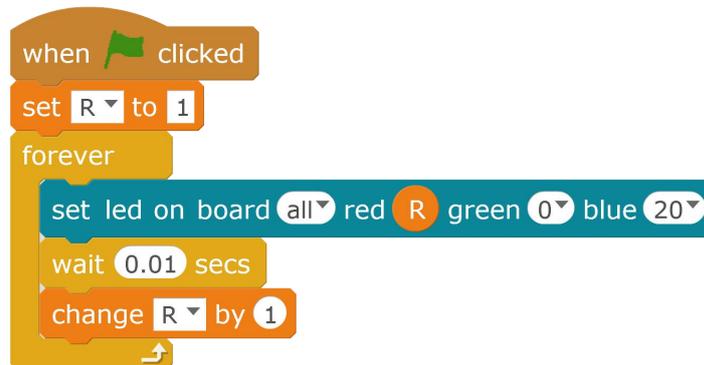
Drag the command block of variable R to the red value of "Set Onboard LED" command, as shown below:



As a result, when the variable R changes the value, the above command will turn on the red light of the LED with the value of the variable R.

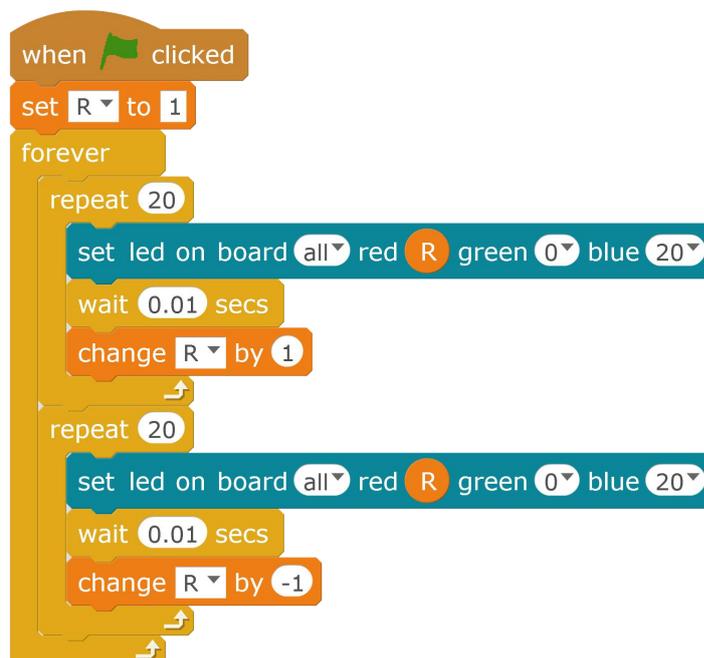
Please refer to the following procedure, repeat 20 times, add 1 for the value of variable R each time. The variable R will increment from 1, the red brightness of LED lights will

increase accordingly, wait for 0.01 seconds in the middle to prevent from failing to observe the changes due to the procedures are executed quickly.



Copy "repeat 20 times" command, modify "Change the value of the variable R to 1" to "change the value of the variable R to -1", that is, the effect of decreasing. The LED light will gradually darken to turn off.

With repeated commands, you will observe that the red light is gradually lighting up, and then gradually darkening, just like breathing. The program is shown as follows:



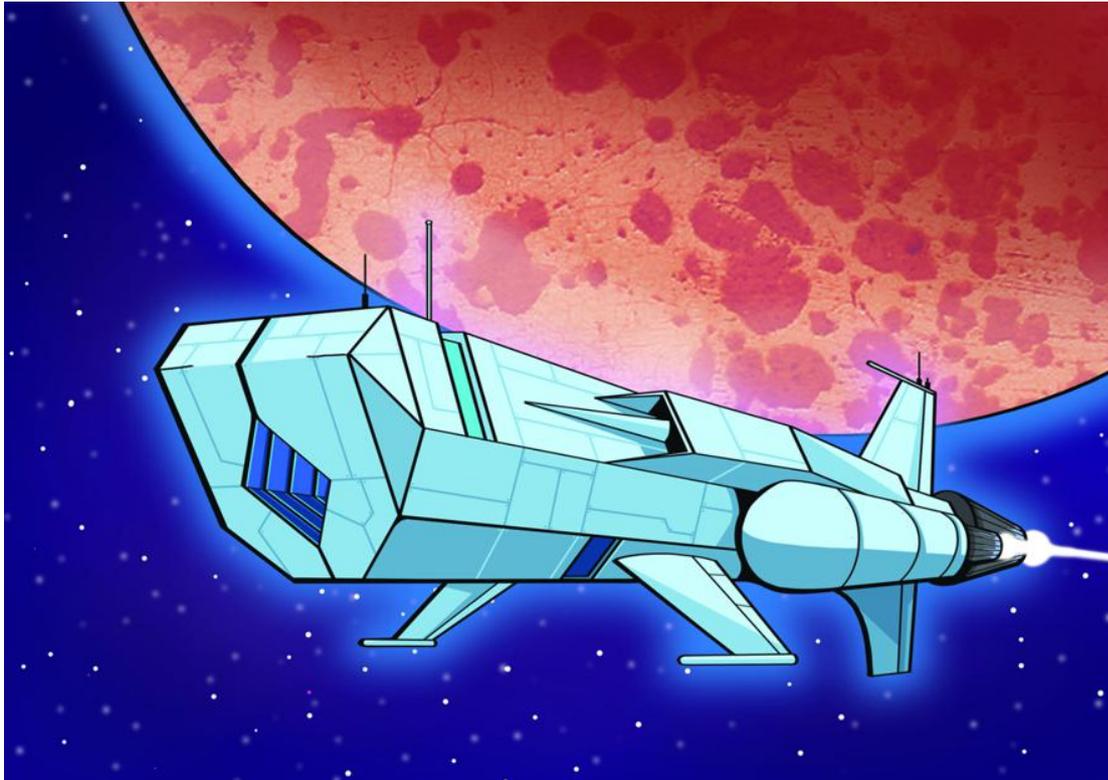
Adjust the waiting time or repeat number appropriately and your breathing light will shine rapidly or slowly.

In addition to the changes of brightness of red light, you can also increase the variable, change the brightness value of other color shade to create a variety of breathing lights.

## Conclusion of This Chapter

Ranger has 12 LED lights, which are arranged in ring and create many interesting changes to Ranger robot, such as direction light that can be used to turn left and right, brake light that can move forward and backward, intensity indicator that can indicate intensity as well as the most popular horse race lamp. Through adjusting red, blue and green primary colors, it can show a variety of colors, so that the robot is full of vitality as if it has life.

Do you have any good idea of making full use of the diverse nature of LED lights and using a variety of sensors? Ranger will give you more inspiration, please try it!



The original six-wheel architecture of Curiosity has disappeared, but its body does not touch the ground, instead floating forward at an altitude of about 20 cm. Peter closely follows, constantly looks at the magic conversion of Curiosity.

Except Jennifer who is reluctantly stayed in the Ranger Tank for the preparation of the task, the other players came to a door under the guidance of "Curiosity". At that time, Curiosity sends two high-frequency signals; the door slowly opens after the door sensor sends a low-frequency signal response!

"Welcome the brave people from earth, we are from the so-called the Pegasus constellation M38, a member of the Atlantis Alliance. The people of our planet's mission is to guide the civilization of space navigation capability, enhance the capability of exploring the vast universe. If you can see this film, it represents that you have pass our test, we believe that you can also look forward to joining the Atlantis Alliance.

In this spacecraft, we have provided enough building demonstration and believe that you can build interstellar channel through the gravity control technology provided by our ship's knowledge system, thus travelling freely in the solar system with the same channel. The light fluctuation engine located in the power cabin is operated via sun's energy, which is an important component for navigating in the solar system. Its design blueprint and

principles are also stored in the knowledge base. We hope that this gift can be used as welcome gift to the people of the Earth, and also look forward to the day of the meeting. "

While the film disappears, the solar system's three-dimensional space graphics is displayed at the center of spaceship. All people look incredible.

"In this vast universe, we are small but not alone. A hundred years ago, we move one step to the moon with the efforts and contributions of countless people, which has sent a message to the depths of the universe. Now, we take the United Nations carrier to Mars, and obtain one gift from vast universe for all humanity. No moment is more meaningful than this time in my life. "Dr. Qiu said with emotion

Mark connects the Rex data fiber with Curiosity through the adapter, launches the Atlantis spacecraft with the help of curiosity