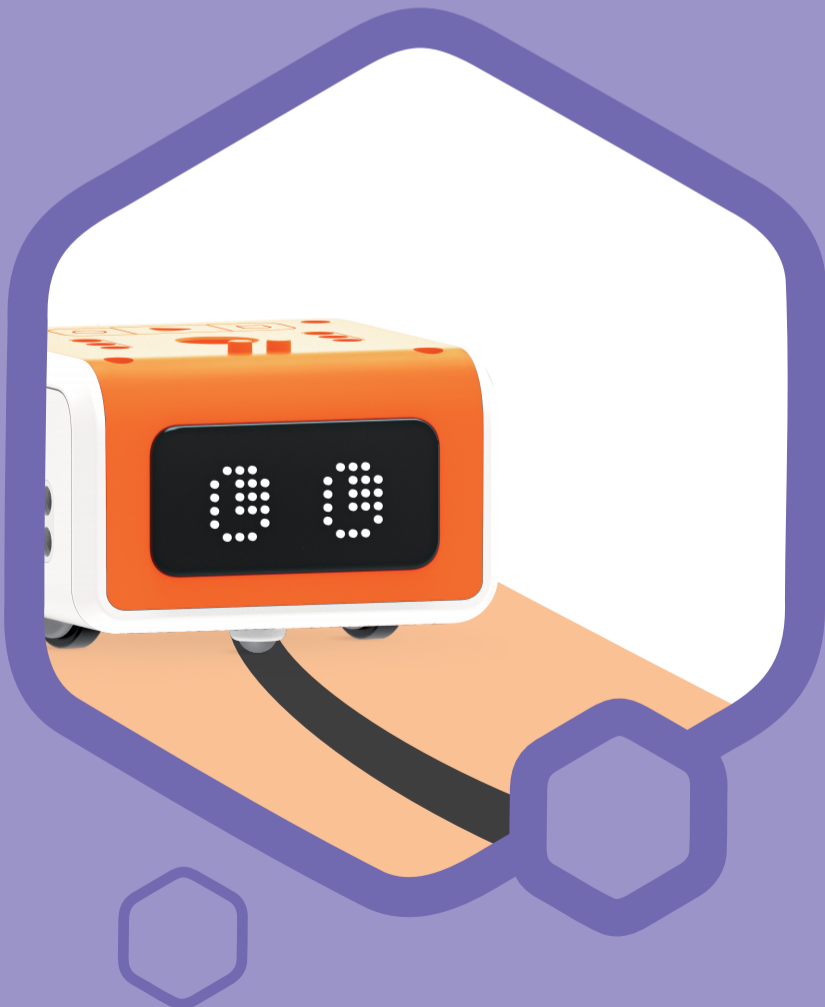


Coding *and* Robotics

with VinciBot



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Teacher Guide

Lesson

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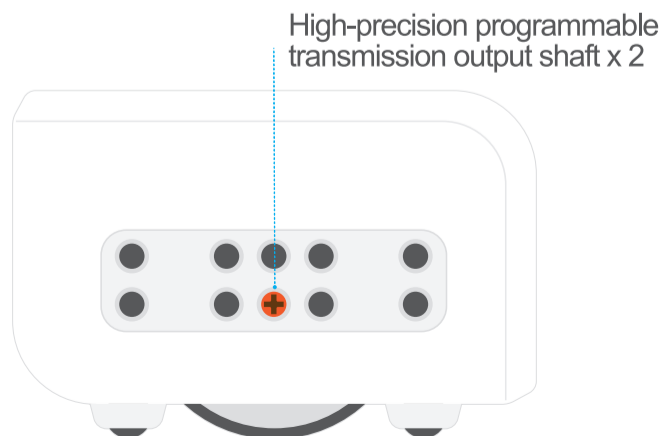
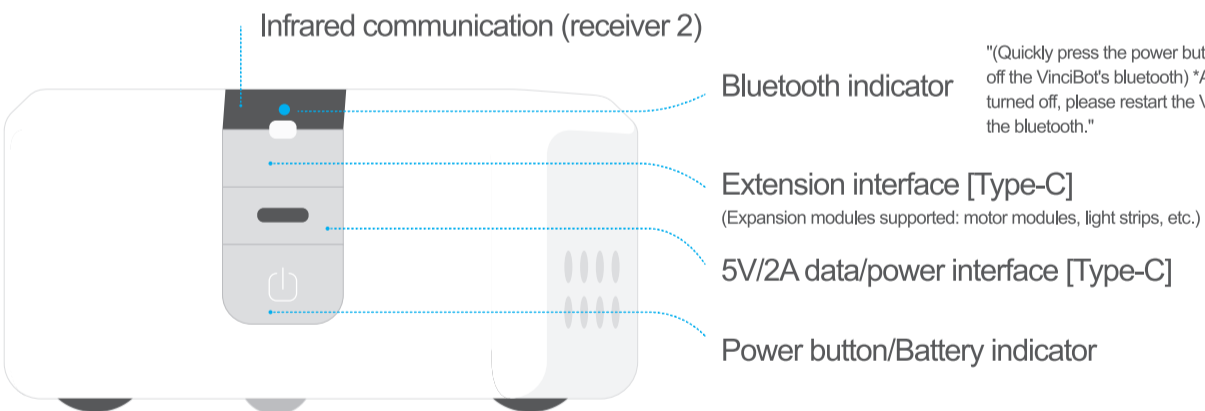
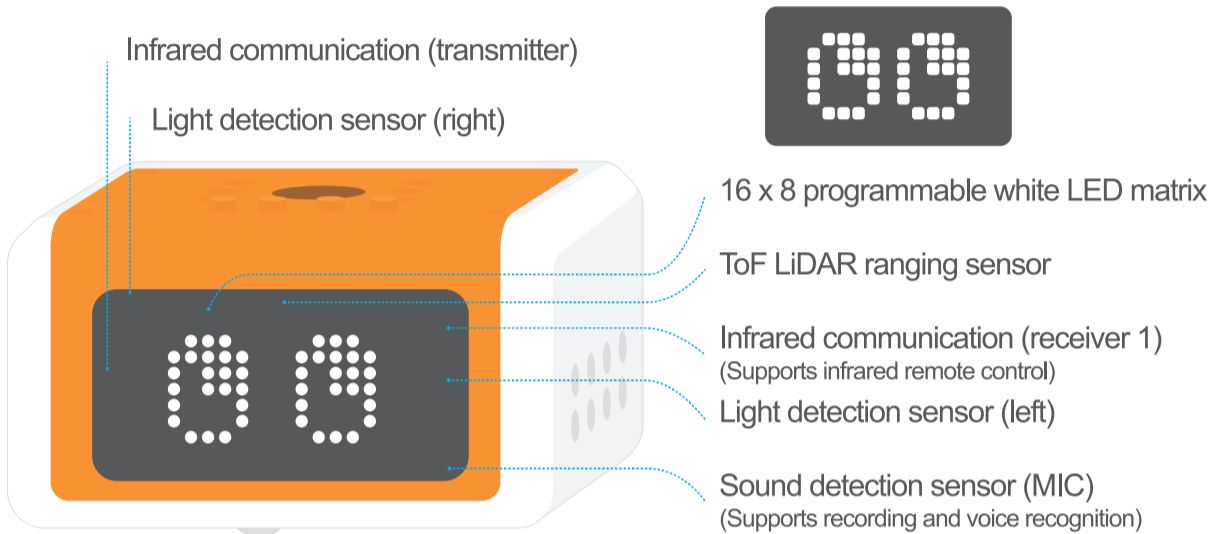
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Teacher Guide



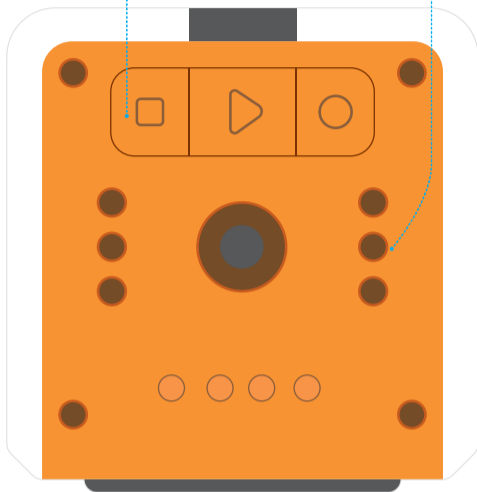
VinciBot Overview

VinciBot

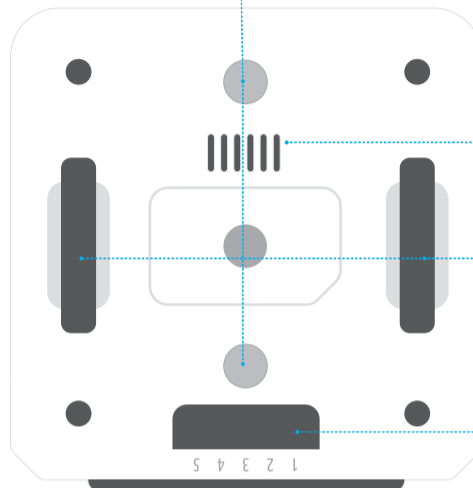


Six 16 million full-color programmable light guide pins
(Can be used with optical fiber strips, acrylic boards and cardboards)

3 programmable buttons



Front and rear omni-directional wheels



Speaker

Left and right wheels

Five-way line follower/color sensor
(Supports line following and cliff detection)

Press and hold the Power button for 2 seconds to turn VinciBot on. The power indicator turns on.

Press and hold for 2 seconds to turn on and off



* If VinciBot is not turned on, charge it first.

Battery status



Low




Medium



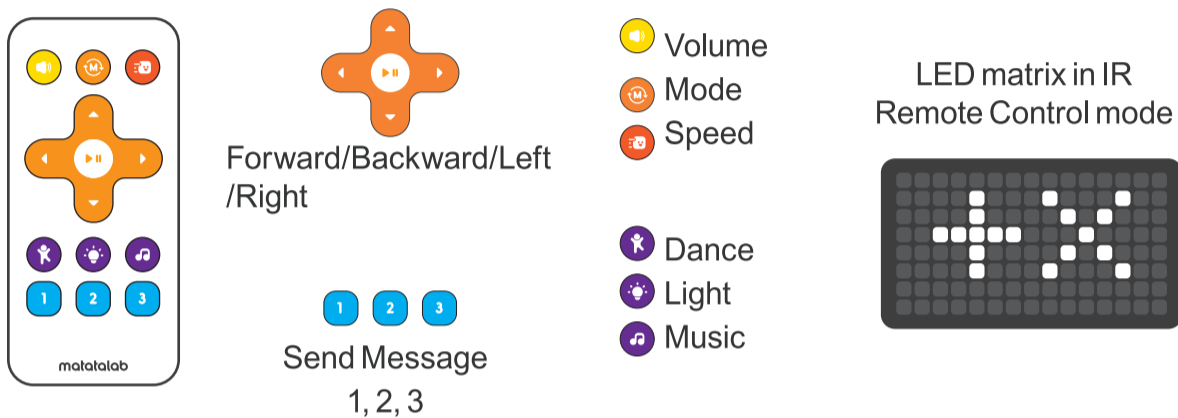
High

IR remote control

There are three modes preset: IR Remote Control mode, Line Following mode and Drawing mode. You can switch between them through the  button on the remote control. Start your coding journey with VinciBot now!

- IR Remote Control mode

An IR remote control is included in the box with VinciBot. It can be used to change the speed and direction of the robot or adjust the volume, etc. Operate the robot on a smooth and flat playground.

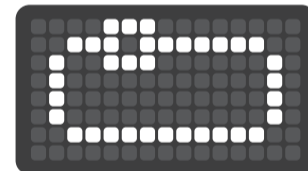


- Line Following mode

In Line Following mode, VinciBot moves automatically along the black lines on the map.



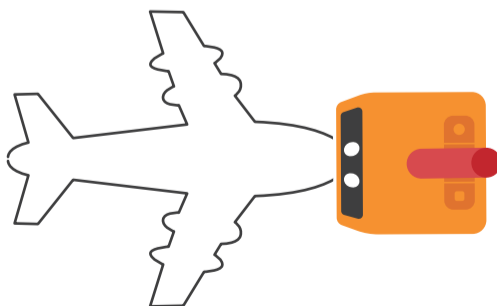
LED matrix in Line Following mode



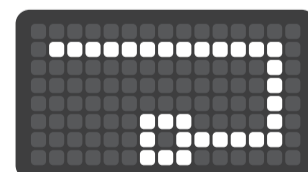
 Start/Stop

- Drawing mode





In Drawing mode, VinciBot draws a picture automatically.



LED matrix in Drawing mode



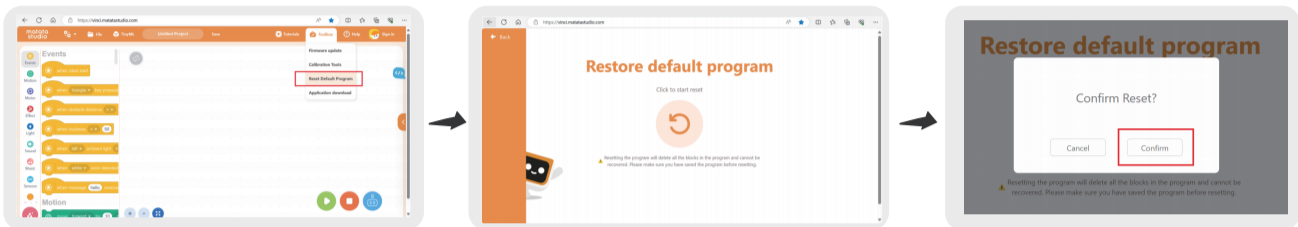
 Start/Stop

Press    on the remote control to select a preset program. Press  the robot starts drawing.

Note: If there is a situation where the infrared remote control cannot control the VinciBot, it indicates that there is a program in the VinciBot that we need to delete in order to use the infrared remote control to control the VinciBot.

Step 1: Link VinciBot to PC/Pad (link method below);

Step 2: On the programming platform, first click on "Reset Default Program" in the "Toolbox", then click , and then click "Confirm" in the pop-up window.



Others



Instructions



Map
(line following map / blank map)



Washable marker

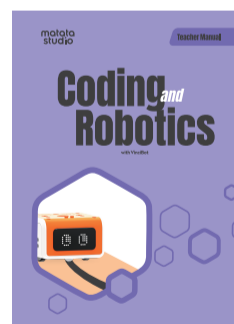
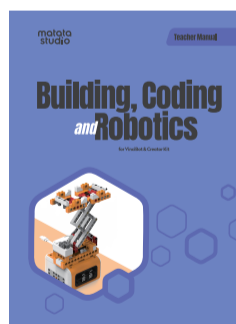
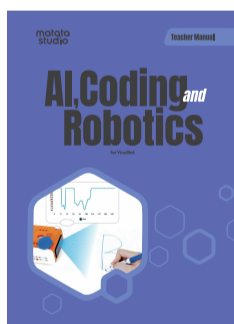


USB-C cable
(The USB-C cable can be used to charge VinciBot or to connect it to PC/Pad.)



Curricula for VinciBot

Teacher Manual



Activity Cards

There are a total of 75 cases in the five stages of ABCDE, which can help students learn VinciBot step by step from simple to difficult.



Core Activities Scope & Sequence

Now that you know how to program your robot, it's time to learn how to make it do more things. This is where you learn how to make your robot do more things.

| Activity | Topics | Concepts |
|----------|--------------|------------------------------|
| A | Sequences | Loops (Repeat, Repeat Until) |
| B | Events | Loops (Repeat, Repeat Until) |
| C | Conditionals | Loops (Repeat, Repeat Until) |
| D | Conditionals | Variables |
| E | Conditionals | Infrared Communication |

A1 Hello, VinciBot!

1. Press **Q** to enable the robot to three preset modes: IR Remote Control Mode, Line Following Mode, and Drawing Mode.

Drawing Mode is a mode where the robot can draw a picture on a piece of paper.

IR Remote Control Mode is a mode where the robot can be controlled by an IR remote control. It is used to control the robot's movement and actions.

Line Following Mode is a mode where the robot can follow a line on the ground.

B1 VinciBot is Pretending to be Sleepy

1. This event coding block judges the loudness of a sound, and allows VinciBot to start the next action after hearing a sound of a certain loudness.

2. After hearing the sound, VinciBot says "I'm sleepy" and then makes a "Sleepy" sound.

3. After waiting 5 seconds, VinciBot will blink and light up to read a book.

C1 Autopilot I

1. Set up the last screen set up an obstacle (paper cup) and a end point.

2. Three subroutines can be written to have VinciBot move forward (subroutine 1), to automatically bypass obstacles and continue to move forward (subroutine 2), and to stop when the end point (end) is detected (subroutine 3).

D1 The Magic Air Piano

1. Draw seven equal distances on the white paper (approximately 2 cm) and label them with the letters Do, Re, Mi, Fa, Sol, La, and Ti on each space.

2. Learn the meaning and usage of the "MIDI, On, and Off" coding blocks. The MIDI block is used to send a note to the piano. The On block is used to turn the piano on. The Off block is used to turn the piano off.

3. Put your hands on the "keys" and play beautiful piano songs.

4. When the "far" ranging sensor measures different distance ranges, different notes are played.

E1 Smart Cruise

1. VinciBot detects the distance from the obstacle in front of it. When the distance is less than 10 cm, it will stop.

2. In order to change speed in real time, VinciBot needs to constantly detect the distance from the obstacle in front of it. When the distance is less than 10 cm, it will stop.

3. Set the movement speed of VinciBot at different distances from the obstacle in front of it. When the distance is less than 10 cm, it will stop.

Online Tutorials

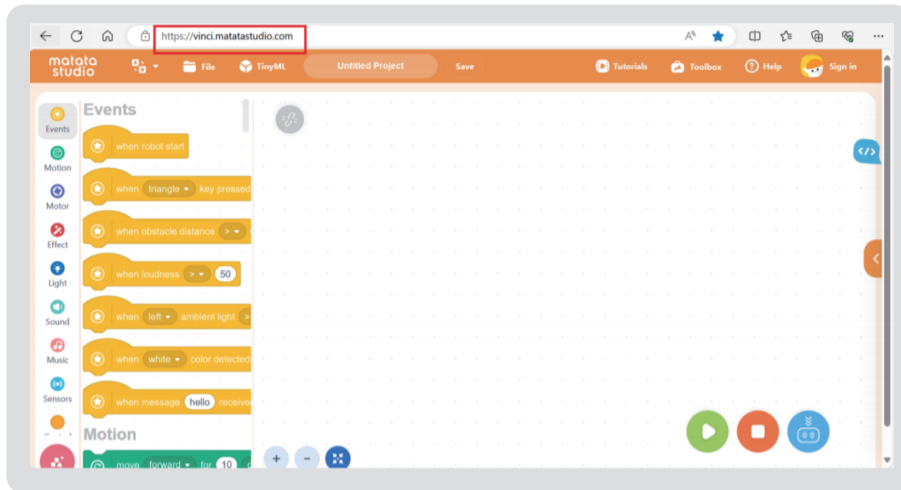
The screenshot shows the Matato Studio software interface. At the top, there's a menu bar with 'File', 'TinyML', 'Untitled Project', 'Save', 'Tutorials', 'Toolbox', 'Help', and 'Sign in'. Below the menu is a workspace with a grid. On the left, there are two panels: 'Events' and 'Motion'. The 'Events' panel contains several blocks like 'when robot start', 'when triangle key pressed', 'when obstacle distance', 'when loudness', 'when left ambient light', 'when white color detected', and 'when message hello received'. The 'Motion' panel contains a 'move forward for 10' block. At the bottom, there's a 'Choose a Tutorial' section with a search bar and several filter tabs: 'All', 'Basic Activity', 'IOT', 'TinyML', 'Drawing', 'Line Following', and 'Engineering construction'. Below the tabs are six tutorial cards, each with a small image of the robot and a title: 'A1 Hello, VinciBot!', 'A2 Programming the VinciBot', 'A3 Nice to Meet You', 'A4 Information Transfer', 'A5 Six Facial Expressions', and 'A6 Stone Lover'.



MatataCode for VinciBot

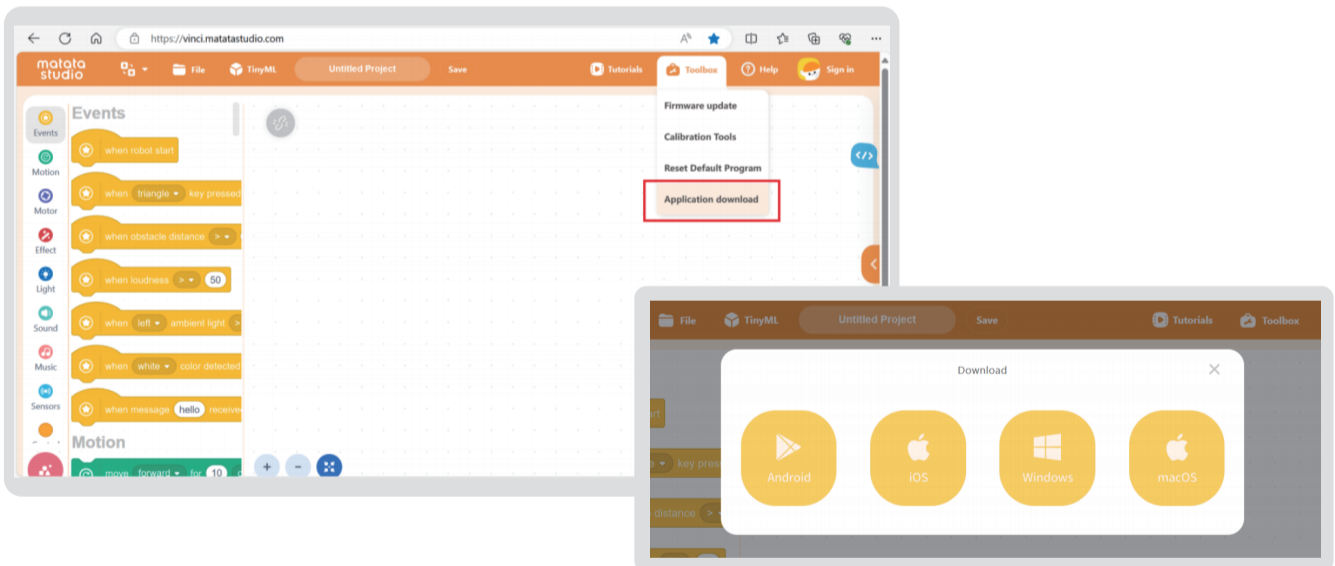
Programming platform website: <https://vinci.matatastudio.com/>

Use graphical programming to write VinciBot program.



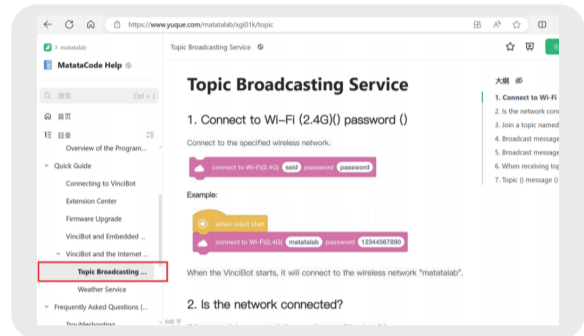
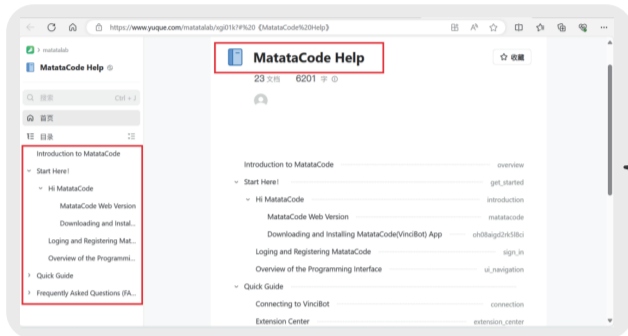
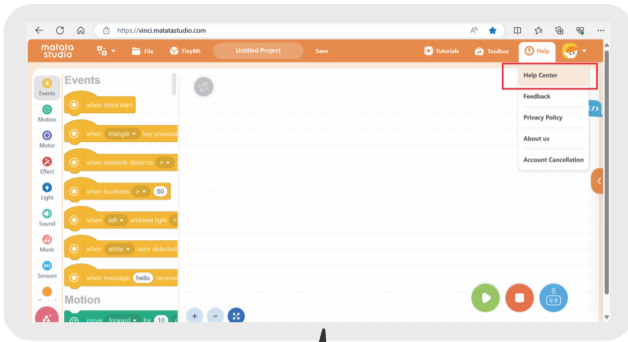
APP download method

On the programming platform, click on "Application download" in the "Toolbox" to download the VinciBot App. Choose to download the Android or Apple version of the App based on your tablet or computer's system.



Introduction of Help Center

On the programming platform, click on "Help Center" in "Help" to enter a website where you can see the documentation for "MatataCode Help" and the directory on the left. Here, you can clearly understand the basic operation of MatataCode, instructions for the built-in sensors of VinciBot, and solutions to some common problems.



Connection and Firmware Upgrade

Connection method of VinciBot and MatataCode

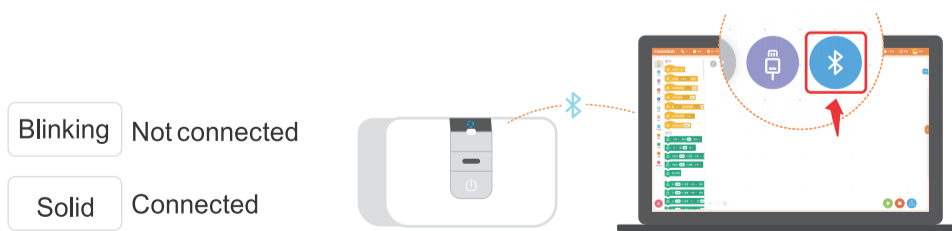
VinciBot supports block-based coding and text-based coding, allowing children to easily learn coding from entry-level to advanced.



Method 1: Connect VinciBot to a computer via the USB-C cable.

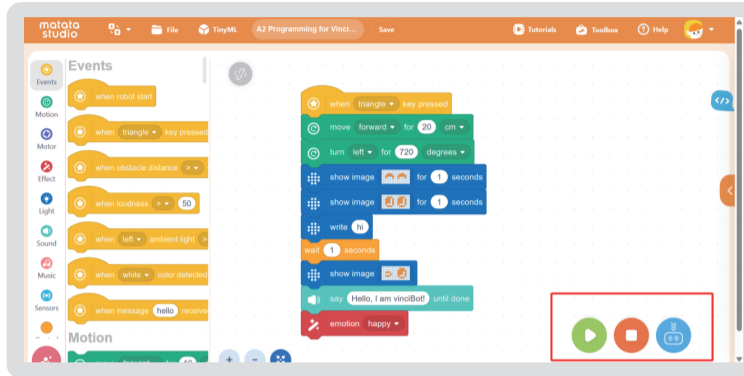


Method 2: Connect VinciBot to a computer via Bluetooth.



Running and downloading of programs

Firstly, link VinciBot and PC/Pad (the link method is described in "Connection and Firmware Upgrade" later); Next, there are three option buttons in the bottom right corner of the programming platform.



Click this button, and VinciBot will run the program on the programming platform. (Online operation)



Click this button, and VinciBot will stop running the program.(No matter running online or offline, it will stop)

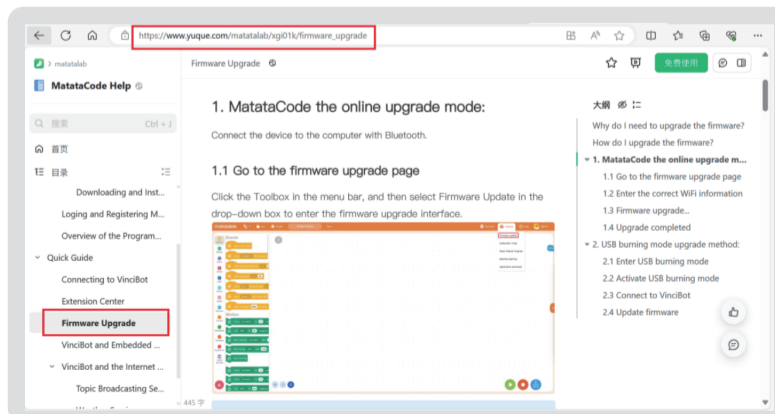


Clicking this button will download the program from the programming platform to VinciBot.(Offline operation)

Note: Each VinciBot can only download one program, and when a new program is downloaded, the VinciBot will overwrite the previous program.

Firmware upgrade

The detailed steps for upgrading the VinciBot firmware can be found in the "Help Center" of the programming platform.



Lesson 1

Program VinciBot

Overview

In this lesson, students will learn the concepts of sequences, bug, and debugging; and students will familiarize with VinciBot's programming blocks for events, motion, effects, lighting, etc., and use these programming blocks to write several simple programs for VinciBot.

Programming Skills

Sequences, bug and debugging

VinciBot's Functions being Used

Motion, sound, fun effect, the matrix screen (image)

Learning Objectives

- Know well the concept of sequences.
- Get to know bug and debugging
- Familiarize with VinciBot's programming blocks for events, motion, effects, lighting, etc.
- Can write basic sequence statement programs for VinciBot.

Standards

ISTE:1a, 3d, 4b, 4c, 5a, 5c, 6a

CSTA (Grade 3-5) : 1B-CS-02, 1B-CS-03, 1B-AP-10, 1B-AP-11, 1B-AP-15

Materials

VinciBot, PC/Pad

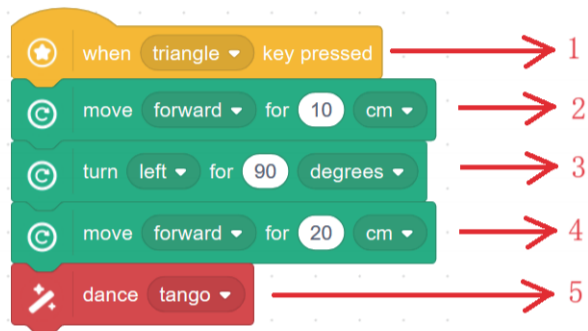
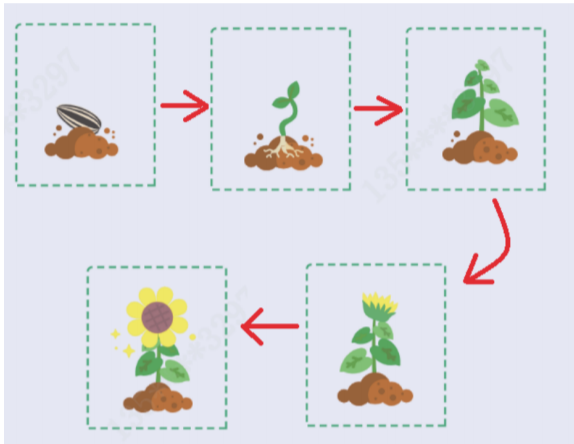


Instructions for Students

Sequences

In mathematics, a sequence is an object (or event) which has been arranged in a column. Each element is either before or after the other elements.

We can simply understand that sequence refers to arranging in a certain order. For example, the sunflowers growth process (seeds, germination, seedlings, flower buds, flowering) progresses in a certain order; the instructions in the program are also arranged in a certain order.



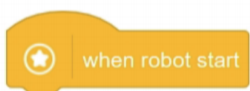
Bug and debugging

"BUG" is mostly used to refer to errors in programs. If there are bugs, the program cannot run successfully or achieve the desired effect. The process of program repair is called "debugging."



Familiarize with some of VinciBot's event, motion, light, effect and sound coding blocks.

Some Event Coding Blocks

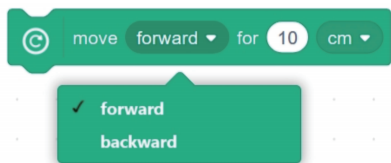
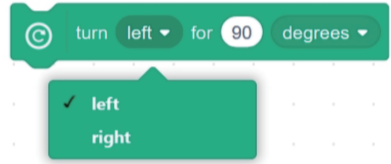


After VinciBot starts, the corresponding program will run.

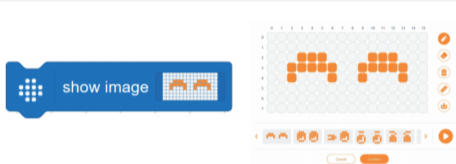


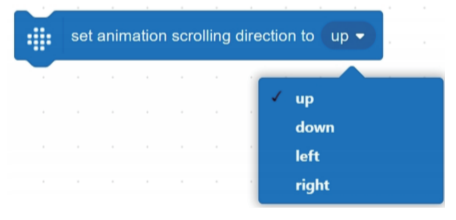


When the triangle, square, or circular buttons of VinciBot are pressed, the corresponding program will run.


Some Motion coding blocks

| | |
|---|--|
|  | <p>Control the specific distance or time for VinciBot to move forward/backward.</p> |
|  | <p>Control the angle, number of turns, or timing of VinciBot's left/right turns.</p> |

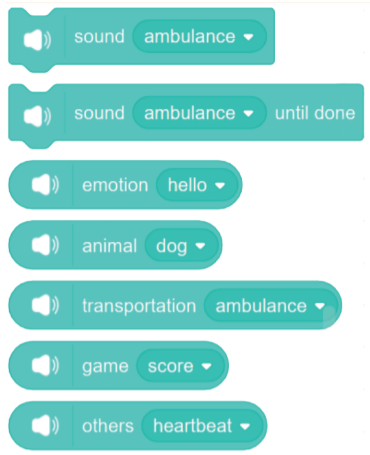

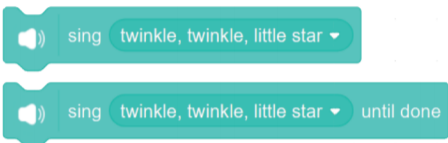
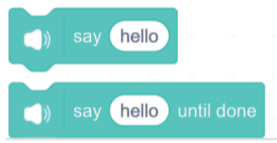
Some Light coding blocks

| | |
|---|--|
|  | <p>Show image (the image can be chosen or designed).</p> |
|  | <p>Show image for 2 seconds.</p> |
|  | <p>Display characters (English/Number).</p> |
|  | <p>Set the scrolling direction of the animation on the VinciBot screen (up/down/left/right).</p> |

The Effect coding blocks

| | |
|---|---|
|  | <p>There are three interesting effect coding blocks for VinciBot: dance, emotion, and action.</p> |
|---|---|

The Sound coding blocks

| | |
|--|--|
|  | VinciBot can play some sound effect. For example,  |
|  | VinciBot can sing the songs. |
|  | VinciBot can say English or Chinese. |

Note: There are some similar blocks that come in pairs, the only difference being that there is one block that uses an "until done" function at the end. This function ("until done") means that the instructions of this block will continue to run until completion before beginning the next set of instructions. When the "until done" function is not utilized, the instructions of this block will be executed at the same time as the next series of instructions. However, if the instructions of this initial block conflict with the next series of instructions, the instructions of the first block will be interrupted.

| | |
|---|--|
|  |  |
|---|--|



Activity

A1 Hello, VinciBot!

Sequences



Task : Get familiar with the structure, functions and characteristics of VinciBot by exploring the three preset modes of VinciBot.

- 1 Press to explore VinciBot's three preset modes: IR Remote Control Mode, Line Following Mode, and Drawing Mode.

Drawing Mode

In Drawing Mode, VinciBot draws a picture automatically.



IR Remote Control Mode

An IR remote control is included in the box with VinciBot. It can be used to change the speed and direction of the robot or adjust the volume, etc. Operate the robot on a smooth and flat playground.



Line Following Mode

In Line Following Mode, VinciBot moves automatically along the black lines.

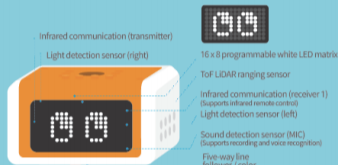


- 2 Explore the three preset modes of VinciBot, and choose its functions or characteristics.

- Sound
- Music
- Preset Dances
- Drawing
- Line Following
- LEDs Lights
- Dot-matrix screen that can display images, numbers and letters



Bonus: Observe the explosion diagram of VinciBot and guess what other functions and usage scenarios it has?



A2 Programming the VinciBot

Sequences



Task: Familiarize with VinciBot's programming platform and how to program VinciBot.

- 1 Open VinciBot's programming platform.

Website



<https://vinci.matatastudio.com>

Android App



<https://play.google.com/store/apps/details?id=com.matatalab.vinciBot>

IOS APP



<https://apps.apple.com/us/app/matacode-vinciBot/id1661920538>

- 2 How to connect VinciBot and access its programming platform.

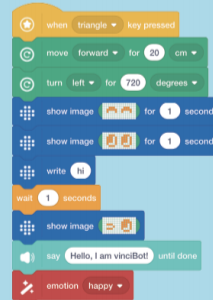
Connect via USB cable



Connect via Bluetooth



- 3 Referring to the demo program, drag the programming blocks from the list on the left to the programming area to write a program.



- 4 Run this program to view the results of VinciBot.



A3 Nice to Meet You

Sequences

Task: Familiarize with the motion, sound, and effect blocks; program VinciBot to walk up to a toy, say hello to it, and dance.

1 When writing a program, the first step is to choose an event block that starts the robot.



2 In order to make VinciBot "walk to the toy", "say hello", and "dance", the following coding blocks must be used.

```

    when robot start
    move forward for 10 cm
    turn left for 90 degrees
    say hello until done
    dance tango
  
```

3 Try to change the input parameters in the blocks and write a new program.

```

    when triangle key pressed
    move forward for 30 cm
    turn left for 90 degrees
    move forward for 10 cm
    say Hey Mike,Let us dance together! until done
    dance tap
  
```



Bonus: Explore more motion, sound, and effect coding blocks, and write more fun programs for VinciBot.

Motion Effect Sound

A4 Information Transfer

Sequences

Task: Familiarize with motion, sound, and light blocks. Program VinciBot to walk up to a toy, sing a song, and then display the message "I Love You" on the dot-matrix screen.

1 Test and consider the following: "What is the difference between these two programs?"

```

    when triangle key pressed
    sing twinkle, twinkle, little star
    move forward for 20 cm
    dance tango
    turn left for 90 degrees
    move forward for 10 cm

    when triangle key pressed
    sing twinkle, twinkle, little star until done
    move forward for 20 cm
    dance tango
    turn left for 90 degrees
    move forward for 10 cm
  
```

Knowledge points:
 There are some similar blocks that come in pairs, the only difference being that there is one block that uses an "until done" function at the end. This function ("until done") means that the instructions of this block will continue to run until completion before beginning the next set of instructions. When the "until done" function is not utilized, the instructions of this block will be executed at the same time as the next series of instructions. However, if the instructions of this initial block conflict with the next series of instructions, the instructions of the first block will be interrupted.



Bonus: Program VinciBot to walk up to a toy and say "May I be your friend?" while displaying that information on the screen.

```

    when triangle key pressed
    move forward for 30 cm
    say May I be your friend?
    set animation scrolling direction to left
    write May I be your friend?
  
```

2 In order to make VinciBot "walk to the toy", "sing a song", and finally display "I Love You" on the dot matrix screen, we need to use the following coding blocks.

```

    move forward for 10 cm
    sing twinkle, twinkle, little star until done
    write hello
    set animation scrolling direction to up
  
```

3 The demo program.

```

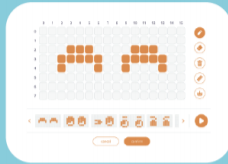
    when triangle key pressed
    move forward for 30 cm
    sing to alice until done
    set animation scrolling direction to left
    write I Love You
  
```

A5 Six Facial Expressions



Task: Use the "show image" blocks in the light and the sound effect blocks; program VinciBot to display six distinct expressions.

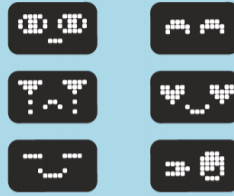
- 1 Get to know the "show image" coding blocks; explore the preset images and master how to set and store new images.



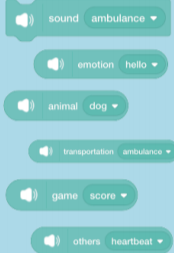
When developing the different expressions, which one of these two coding blocks do we need to choose?



- 2 Program VinciBot to make six different facial expressions in a row.



- 3 Add an interesting sound after each expression.



- 4 The demo program.



Extension Activity



Students discuss, create, and share

1. What is sequence? Please provide an example to describe.
2. What is bug and debugging in the program?
3. Today, what programming blocks did you learn about? What effects can these programming blocks respectively make VinciBot present?
4. What is the function of programming blocks of type "until done"?

Lesson 2

Multi-talented VinciBot

Overview

In this lesson, students will learn the concept of loop. Then, using simple loop programming, experience the flickering of VinciBot's LED lights, animation production on the screen, and playing repetitive music melodies.

Programming Skills

Loops

VinciBot's Functions being Used

6 LED lights, the matrix screen (image), music

Learning Objectives

- Learn the concept of loops and be able to write simple loop statements in programs.
- Familiarize with VinciBot's light coding blocks and music coding blocks.
- Master the usage of VinciBot's LEDs programming blocks.
- Apply VinciBot's dot matrix screen-related coding blocks to create animation effects on the screen.
- Utilize VinciBot's music coding blocks to compose looping music melodies.

Standards

ISTE: 1a, 3a, 3d, 4a, 5c

CSTA (Grade 3-5): 1B-CS-02, 1B-AP-10, 1B-AP-11, 1B-AP-15

Materials

VinciBot, PC/Pad



Instructions for Students

What is loops in graphical programming?

Loops are a fundamental programming concept that allow you to repeat a set of actions multiple times.

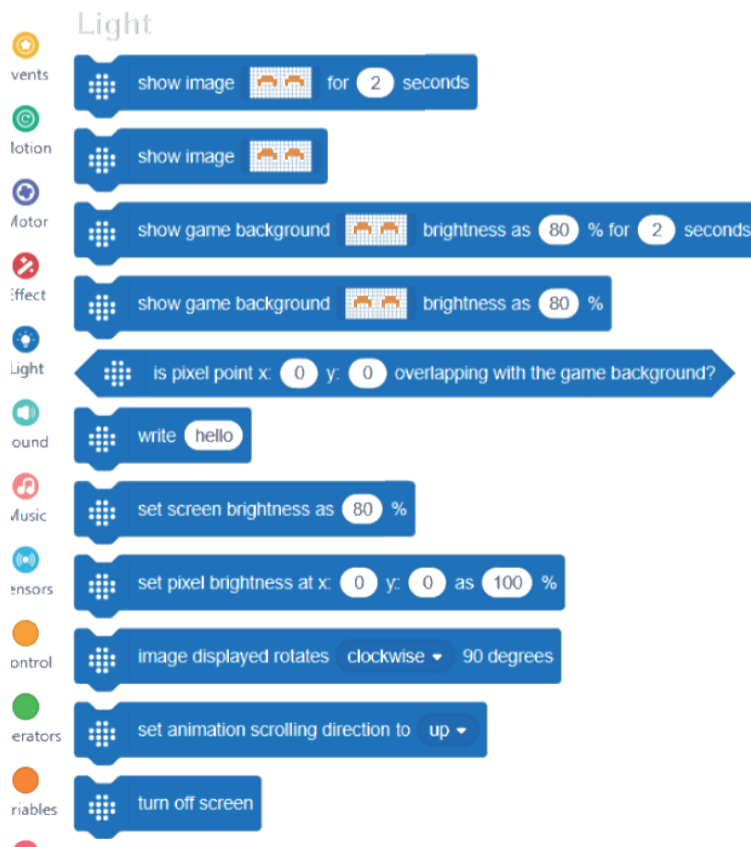
Here are the coding blocks related to loops.



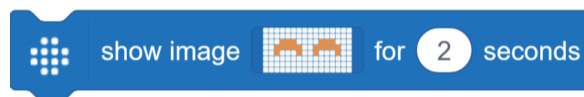
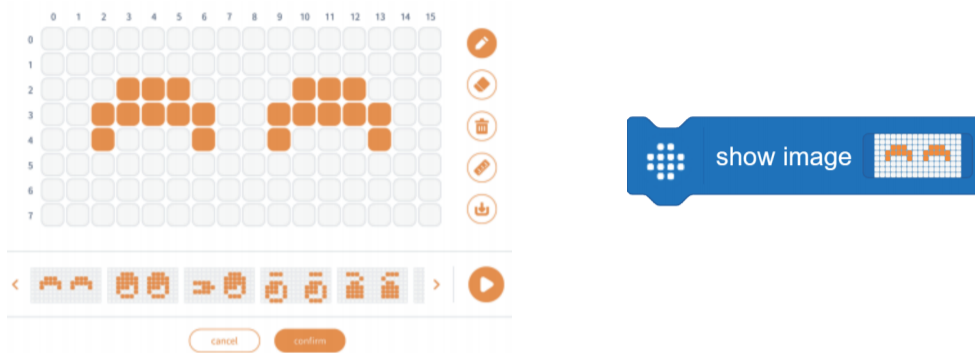
Familiarize with VinciBot's light coding blocks and music coding blocks.

There are two parts of VinciBot's light coding blocks: the matrix screen related coding blocks and the LEDs coding blocks.

The matrix screen related coding blocks



Let's familiarize several important coding blocks related to dot matrix screens:
1. "Show images" coding blocks

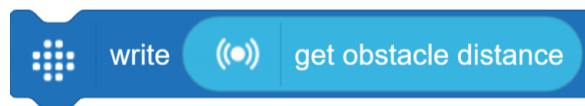


Show images such as expressions or icons.

2. "Write" coding blocks



Displays English letters, words, or numbers.

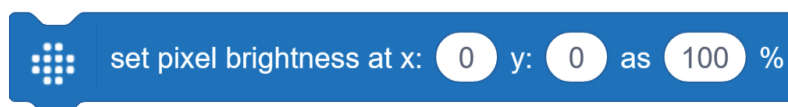


Displays the values of detected ambient light, distance and sound, etc.

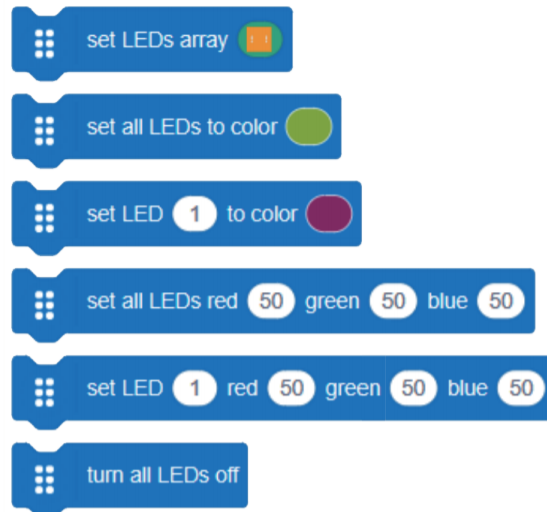


Displays the operation result.

3. The Pixel Coding Blocks

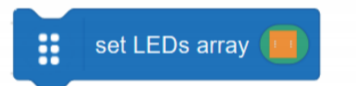
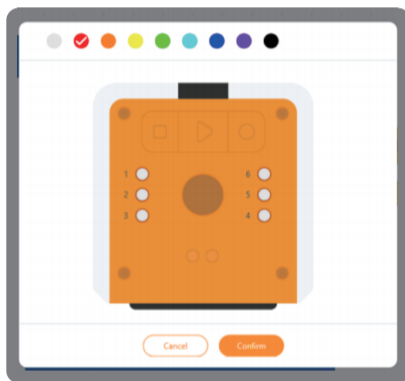


The LEDs coding blocks



Let's familiarize several important coding blocks related to LEDs:

1. Set LEDs array, and choose the color for each LED.



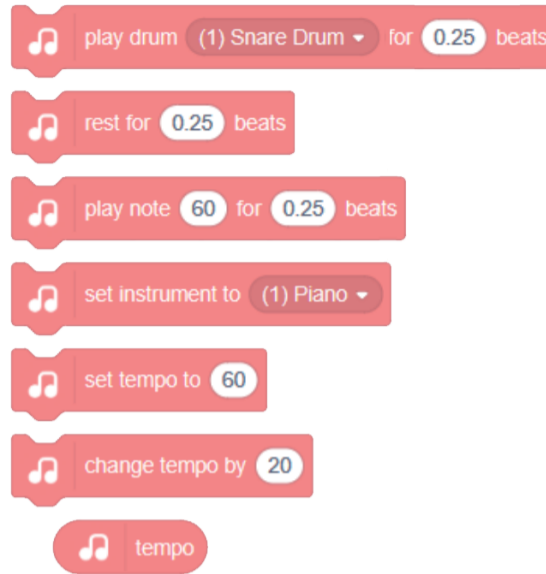
2. Set all LEDs to the same color.



3. Similar coding blocks that the parameter could be changed according to variables.



The music coding blocks



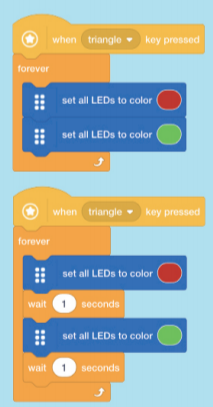
Activity

A10 The Rainbow Light

Loops
(Repeat Forever)

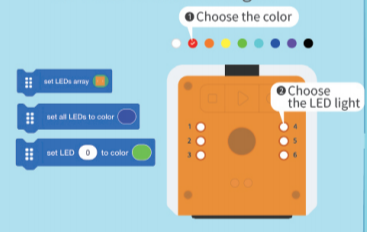
Task: Familiarize with the LED light coding blocks; use the LED light coding blocks and repeat coding blocks to create a beautiful rainbow light.

1 What is the difference between these two programs?

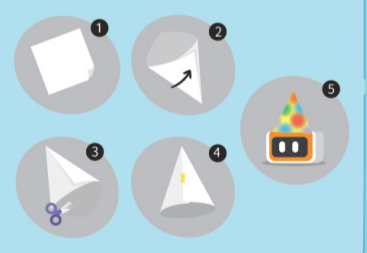


Knowledge points:
When several "state" blocks of the same category are used continuously before and after, the previous state will end instantly, and only the last state will appear. In order to ensure that each state can be displayed, it is necessary to use the wait coding block.

2 Explore the usage of various LED light coding blocks and try editing the color of each LED light.



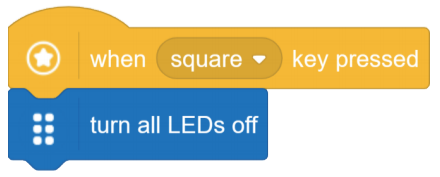
3 Use paper to make a lampshade for VinciBot and put it over the LED lights.



4 Use repeat coding block to program and transform VinciBot into a rainbow light.



Note: To stop the rainbow light, you can either turn off VinciBot or add a program (thread) as shown below.



A11 The Beating Heart

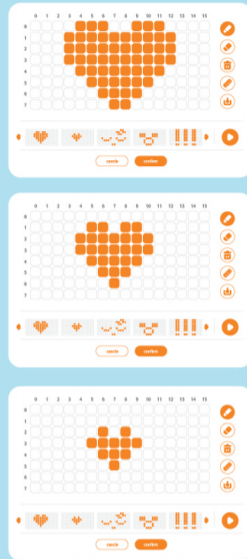
Loops
(Repeat Forever)

Task: Understand the principle of generating animation. Use the "show image" coding blocks and "repeat" coding block to display the beating heart on VinciBot's dot matrix screen.

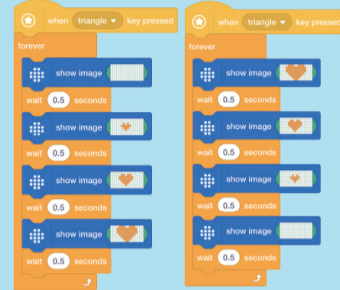
1 Animation is the effect formed by the rapid playback of continuous related images.



2 Let's make an animation of a beating heart. First, edit three hearts from big to small on the edit page of the show image panel.



3 Add the repeat coding block to make the heart keep beating!



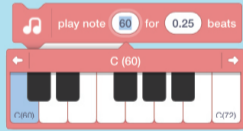
Bonus: Make an animation of beating number 2.

A13 VinciBot is a Musician

Loops
(Repeat X)

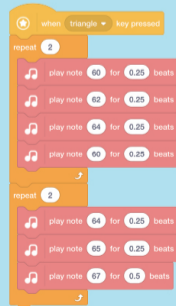
Task: Explore the "music" coding blocks, and program VinciBot to play "Are you Sleepy?" and other songs with different instrument sounds.

1 This music block can be used to set the pitch and duration.

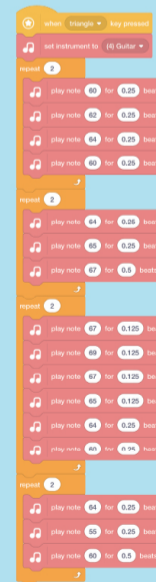


Bonus: Find additional music scores and program VinciBot to play them!

2 Based on the musical score for "Are You Sleepy?", write a music program and attempt to simplify it by using loops.



3 Play "Are You Sleepy?" (You can set up the instrument before playing.)





Extension Activity



Students discuss, create, and share

1. What is the main function of loops in graphical programming?
2. What two commonly used loops did we use in this lesson?
3. What are the functions of VinciBot's dot matrix screen?
4. How many LEDs does VinciBot have totally? What color model is used to set the LEDs colors?
5. What are the uses of VinciBot's music coding blocks? What can we do with them?