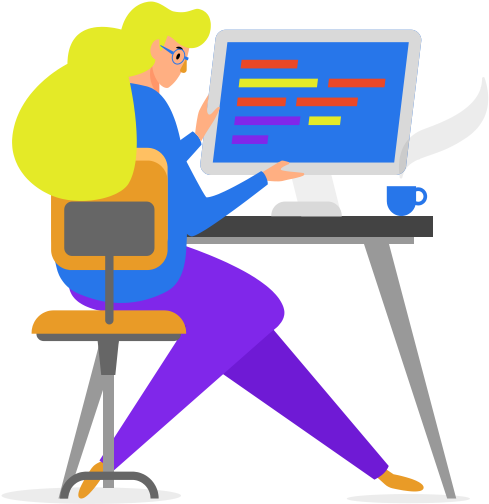


Day 3

Revision, Mind+, and Presentation

Speakers:
ZHOU Siyu (Zoe)
ZHONG Licheng (Simon)
DENG Chunwei (Logan)

What Will We Do Today?



1

Solving Right Triangles

2

Revision on Huskylens

10-min Break

3

Using Mind+

4

Programs of Mind+

10-min Break

5

Preparation of Presentation

6

Preparation of PPT

Solving Right Triangles

- Relationship of Sides and Angles
- Solving Right Triangles
- Exercise

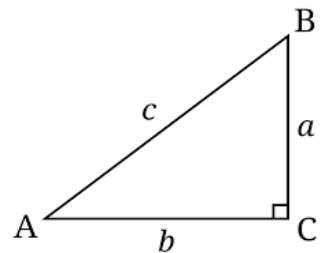


Relationship of Sides and Angles

In a right triangle:

(1) Relationship between sides :

Pythagorean theorem -- the sum of the squares of the two sides is equal to the square of the hypotenuse: $a^2 + b^2 = c^2$



(2) Relationship between angles:

One angle is 90° in the right triangle. Thus, $\angle A + \angle B = 90^\circ$

(3) Relationship between one angle and one angle:

Definitions of sine and cosine, which were introduced in the last workshop).

Relationship of Sides and Angles

If you still do not understand trigonometric functions, do not worry. You can directly use this online calculator and do not need to care about mathematics knowledge behind it.

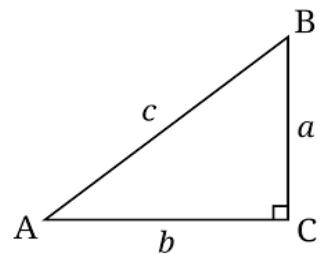
Link: <https://www.omnicalculator.com/math/trigonometry>

In addition, you can use this online software to simulate the geometric transformation.

Link: <https://www.geogebra.org/calculator>

Solving Right Triangles

For a right triangle, one triangle (90°) has been known, and there are still 5 elements unknown, which are three sides and two angles. If we



(1) additionally know **two sides**, we can then calculate the left one side and two angles.

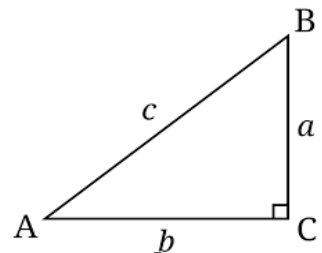
(2) additionally know **one side and one angle**, we can then calculate the left two sides and one angle.

(3) additionally know **two angles**, we **cannot** calculate the left three sides because triangles can be enlarged or compressed in the same proportion while the angles are constant. Thus, these sides are **not fixed**.

Solving Right Triangles

(1) additionally know **two sides**, we first need to use **Pythagorean theorem** to calculate the left one side.

Then, we use **trigonometric functions** to calculate the left two angles.

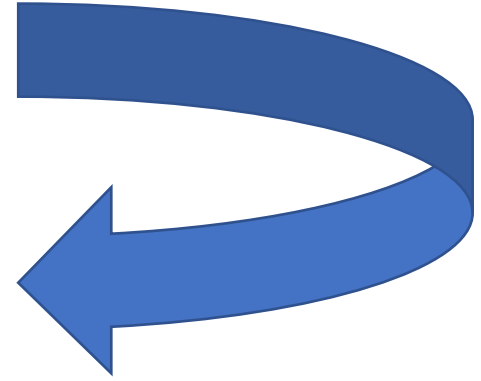
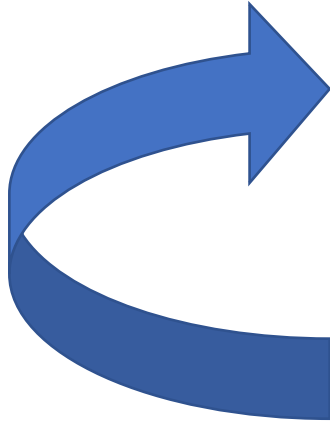


(2) additionally know **one side and one angle**, we first need to calculate the left one angle.

Then, we use **trigonometric functions** to calculate the left two sides.

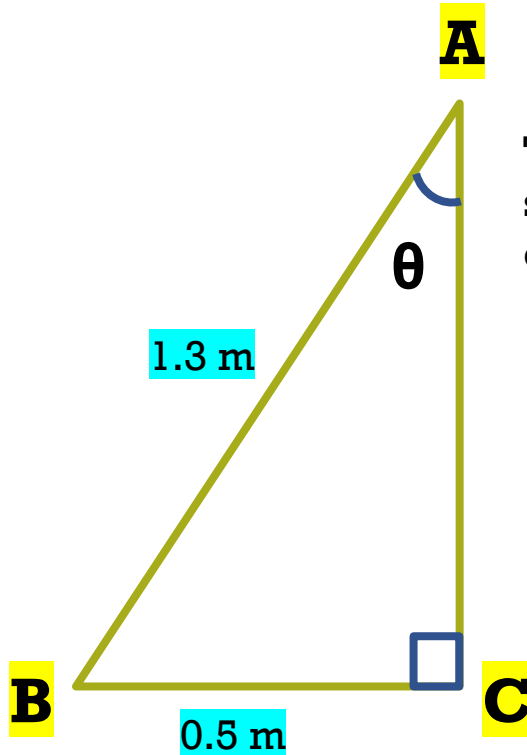
In practice, sides of triangles can be measured easily but angles of triangles can hardly be directly measured on ground. Thus, the **case (1)** will be usually used in the measurement.

Solving Right Triangles



Clockwise

Exercise



The drone starts from this direction.



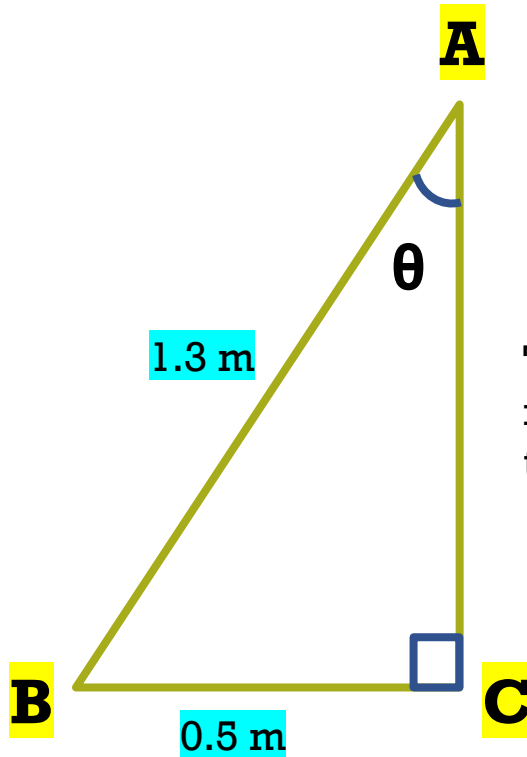
(1) If the drone flies from point A to point C, what are the ~~rotational directions with angles of flying?~~

none

What are the translational directions and distances?

forward 1.2 m

Exercise



The drone is now facing at this direction.



(2) If the drone flies from point C to point B, what are the rotational directions with angles of flying?

clockwise 90°

What are the translational directions and distances?

forward 0.5 m

Exercise

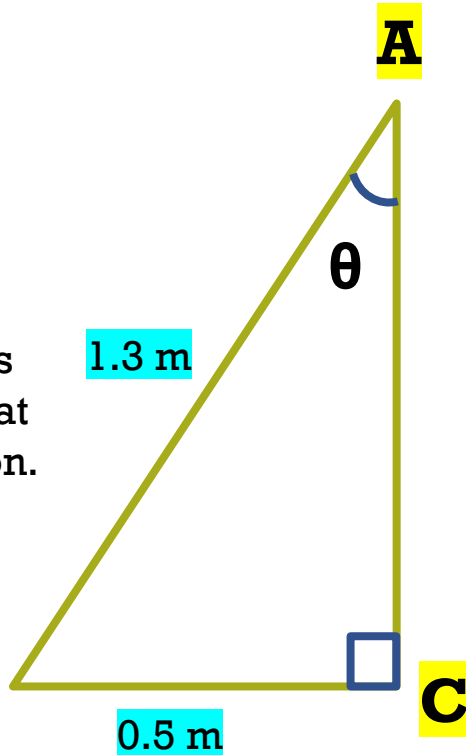
(3) If the drone flies from point B to point A, what are the rotational directions with angles of flying?

clockwise 112.62°

What are the translational directions and distances?

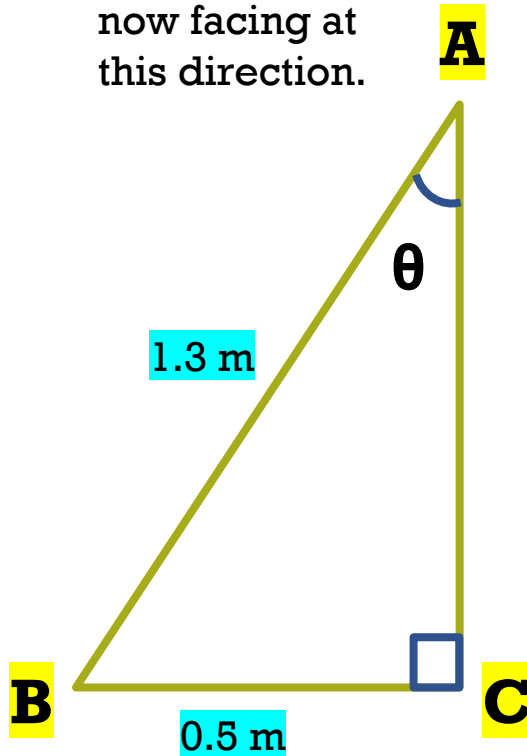
forward 1.3 m

The drone is now facing at this direction.



Exercise

The drone is now facing at this direction.



(4) If the drone flies from point A to point C, what are the rotational directions with angles of flying?

clockwise 157.38°

What are the translational directions and distances?

forward 1.2 m

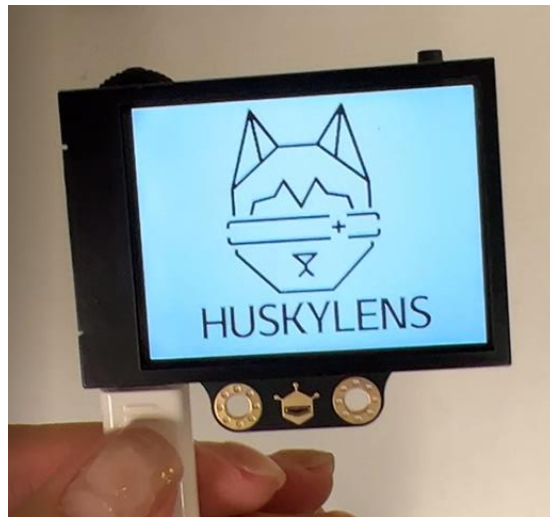
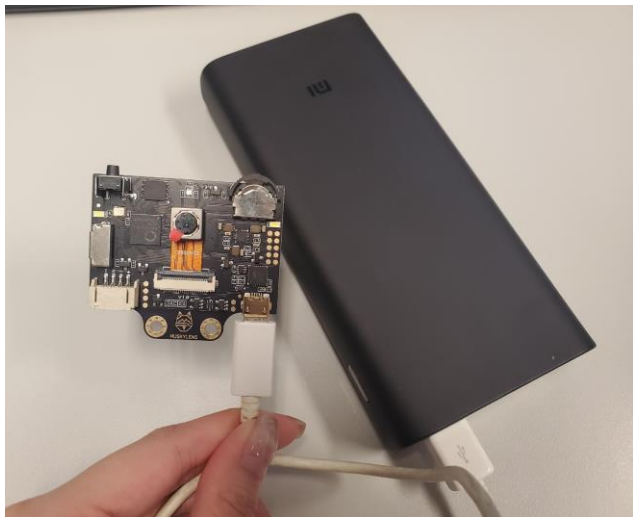
Revision on Huskylens

- [How to Train Huskylens to Learn](#)
- [More about Using Huskylens](#)
- [Practice Using Huskylens](#)



How to Train Huskylens to Learn

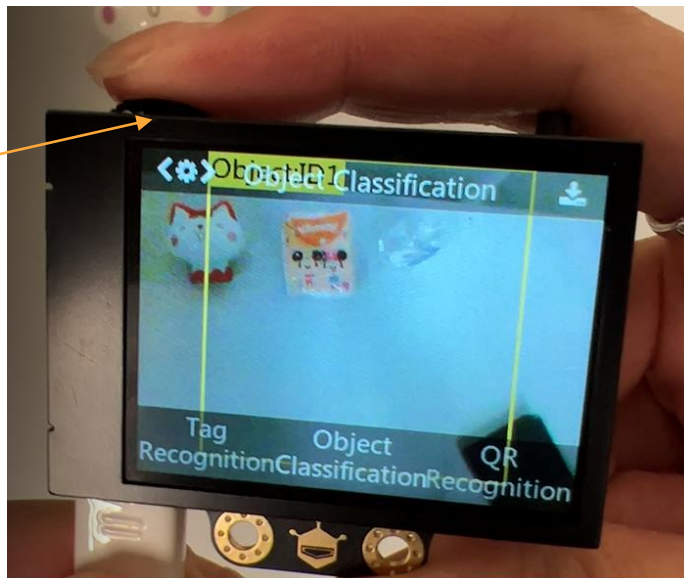
- Step 1: Connect Huskylens to a power bank using micro-USB cable



How to Train Huskylens to Learn

- Step 2: Dial the Function Button to the right to switch to “Object Classification” function

Function
Button



How to Train Huskylens to Learn

Step 3: Long press the Learning Button to capture the images of the object from different angles and distances

(Make sure the object falls within the yellow box on screen)



Learning
button



How to Train Huskylens to Learn

- Step 4: Short press the Learning Button again if you want to continue scanning other object(s)



Learning button

What if You Want to Erase the Training Data?



- Short press the Learning button to prompt the forget window
- Short press the Learning button again to make it forget

The whole set of data will ALL be erased!

You can't specify what to delete!

More about Using Huskylens

After finishing scanning of the last objects, you can use Huskylens to recognize all objects scanned with these steps:

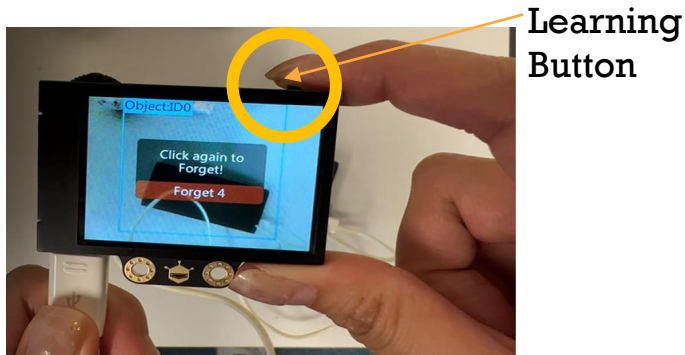
- (1) After stopping the long-press immediately, wait for the count-down seconds passes; Do not take any action (Otherwise, you will go into the “preparation of scanning the next object”);
- (2) Make the object fully fall within the yellow box on screen, and at the same time gaze at the number “ID...” at the top-left corner of the screen.

More about Using Huskylens

Two cases that you may want to erase the trained data. Here are the steps for different cases:

Case 1: You did not finish the “short-pressing” action within the count-down seconds, and the green prompting window disappeared. You need to:

- (1) Firstly **short-press** the “Learning Button” to prompt the red forget window;
- (2) Then **short-press** again the “Learning Button” to make it forget data.

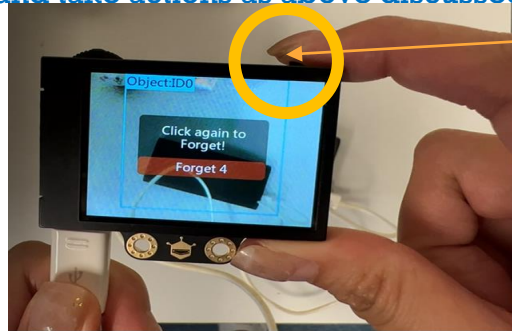


More about Using Huskylens

Case 2: You made some mistakes in scanning process and wanted to restart it. You need to stop the long-press immediately and :

- (1) Firstly **wait for** the count-down seconds passes; Do not take any action;
- (2) Then **short-press** the “Learning Button” to prompt the red forget window;
- (3) Then **short-press** again the “Learning Button” to make it forget data.

Note: If you do not wait for and directly short-press within the count-down seconds, then you will go into the “preparation of scanning the next object”; In such case, you need to quickly go through this scanning process and take actions as above discussed.



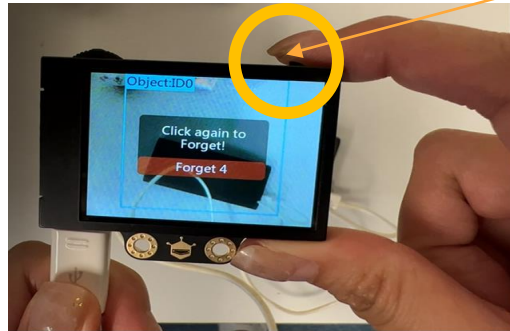
Learning
Button

More about Using Huskylens

Other notices about erasing the trained data:

You cannot specify which groups of data to delete. When you choose “forget” function, **all inputted data will be erased!**

As a result, you need to start over you scanning process from the first object.



Learning
Button

Let's Break!

5 min

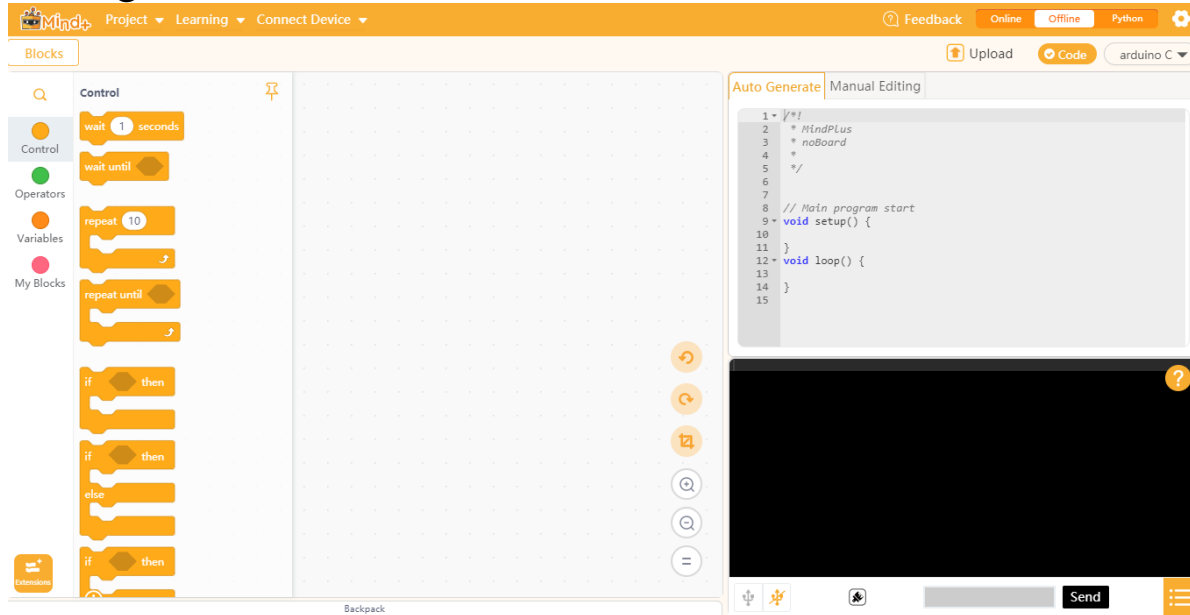


Mind+



What is Mind+

A kids-friendly programming software, similar to the “Scratch”, in which you can build programs by dragging, dropping, and sequencing blocks.



Blocks

upload your program to HUSKEYLEN

Upload

Code

arduino C ▾

Control

wait 1 seconds

wait until

repeat 10 different statement

repeat until

if then

if then

else

if then

+

forever

Drag your statement to here in sequence

Drag

undo

redo

zoom in

zoom out

Extensions

scroll down statement faster

Auto Generate

Manual Editing

```
1  /*!  
2   * MindPlus  
3   * noBoard  
4   *  
5   */  
6  
7  
8  // Main program start  
9  void setup() {  
10  
11  }  
12  void loop() {  
13  
14  }  
15
```

Auto-generated codes

Terminal Area,
Showing your result while running
your codes...

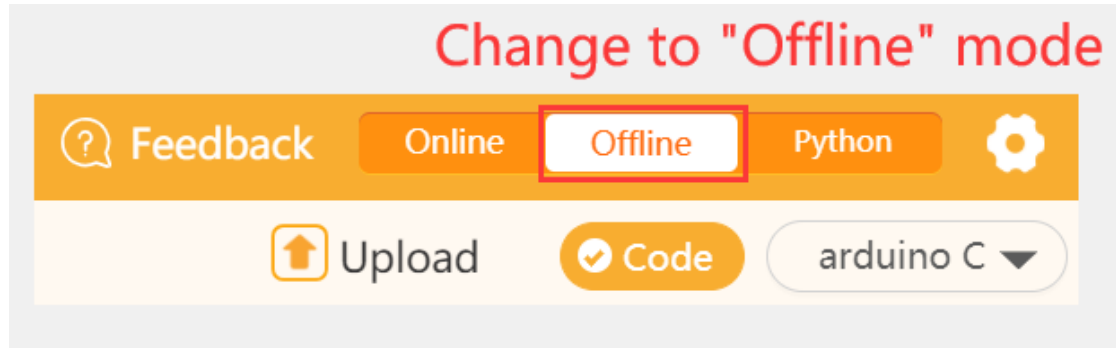
Backpack



Send



Change Setting



Change Setting (con't)



1. Click “Extensions”
2. Click the “Board”, then click the “RoboMaster TT”

[← Back](#)Select Board

Board

Kit

Shield

Sensor

Actuator

Communication

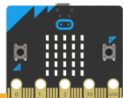
Display

Function

Internet

User-Ext

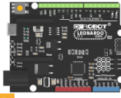
Can't find what you want? [Click here](#) to find more



DFR0497

micro:bit

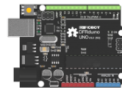
Connect your projects with the physical world.



DFR0221

Leonardo

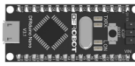
Device controlled by Leonardo



DFR0216

Arduino Uno

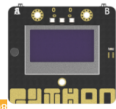
Arduino Uno main control board module



DFR0010

Arduino Nano


Device controlled by Arduino Nano



DFR0608

handpy

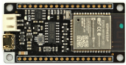
Main control board based on ESP32



DFR0191|DFR0323

Mega2560


Device controlled by Mega2560



DFR0478

FireBeetle ESP32


Device controlled by FireBeetle ESP32



DFR0654


FireBeetle ESP32-E

Device controlled by FireBeetle ESP32



RoboMaster TT(ESP32)

Educational drone with DJI top flight control algorithms, safe & stable



XIT0157|DFR0646

Maixduino


Main control board based on K210 chip

Change Setting (con't)

3. Click “Sensor”, then click “HUSKEYLENS AI Camera”

[← Back](#)

Select Sensor

 Search

Board

Kit

Shield

Sensor

Actuator

Communication


Display

Function

Internet

User-Ext


Can't find what you want? [Click here](#) to find more



SEN0001

Ultrasonic Sensor


Accurate distance detection with the range 2~800cm, compatible with urm and



DFR0067|SEN0137

DHT11/22 Temperature and Humidity Sensor


Detect environment temperature and humidity



DFR0024|KIT0021|DFR0198

DS18B20 Temperature Sensor


Detect ambient temperature with large range of -55~+125°C



SEN0160

Hx711 weight sensor

Measure the Hx711 weight sensor



SEN0305|SEN0336

HUSKEYLENS AI Camera

Artificial intelligence vision sensor that supports face recognition and learning

Change Setting (con't)

4. Click “Function”, then click “MultiThread”

[← Back](#)

Select Function

Board

Kit

Shield

Sensor

Actuator

Communication


Display

Function


Internet

User-Ext


Can't find what you want? [Click here](#) to find more




I2C Scan
Scan all device addresses that connected to I2C interface




Eeprom iic Sensor
Data storage module,32kb



Interrupt
Interrupt pin



MultiThread
Allow multiple programs and the main program to run simultaneously



I2C cascade extender
Used to resolve I2C device address conflicts

3 Extensions

extension 1: RoboMaster TT (ESP22) as “Board” (body - movement)

extension 2: HUSKEYLENS AI Camera as “Sensor” (eye - object recognition)

extension 3: MultiThread as “Function” (brain’s work – do many things at the same time)

How does these extensions work?

How does 3 Extensions work?

RoboMaster TT

Drone

- taking-off
- flying forward, backward, upwards, downwards, to left/right
- rotating
- landing

LED light

- Flashing in different color and frequency



HUSKEYLENS AI Camera

Scanning Function

- Scan images through camera with AI

Functions could do

- Face Recognition
- Object Tracking
- Object Recognition
- Color Recognition
- ...





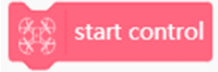
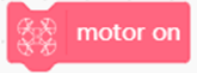



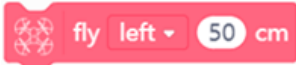
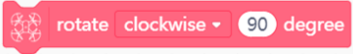
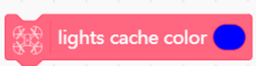
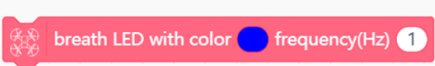
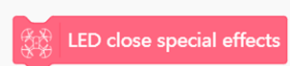
MultiThread

- Run multiple commands simultaneously
- object recognition during flying progress of drone



Extension's Blocks



<div> <div>Robomaster TT (ESP22)</div> <div>  RMTT </div> </div>	Explanation
	Start running codes programmed in the controller
	LED will light up (default color: green) when the drone is ready to take off
	Turn on motor
 	Take off (default height: 80cm); Landing
 	Fly forward, backward, upward, downward, to the left, to the right with a certain distance
	Rotate (counter)clockwise with a certain angle
 	LED lights up in a certain color (flashing at a frequency “X Hz”)
	Close LED

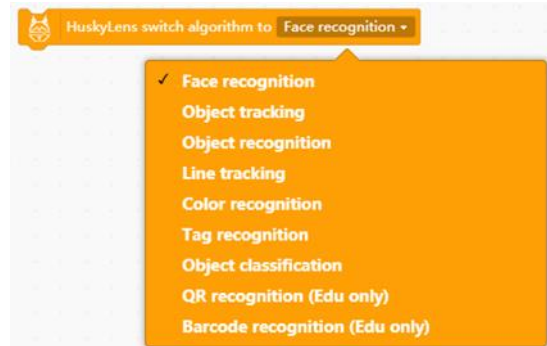
HUSKEYLENS AI Camera



Explanation



HuskyLens starts communicating with controller



Choose the type of built-in functions that should be done for you (In this workshop, we choose “**object classification**”)



HuskyLens starts scanning and saving data in its memory



HuskyLens checks if the object with “ID X” is captured by the camera



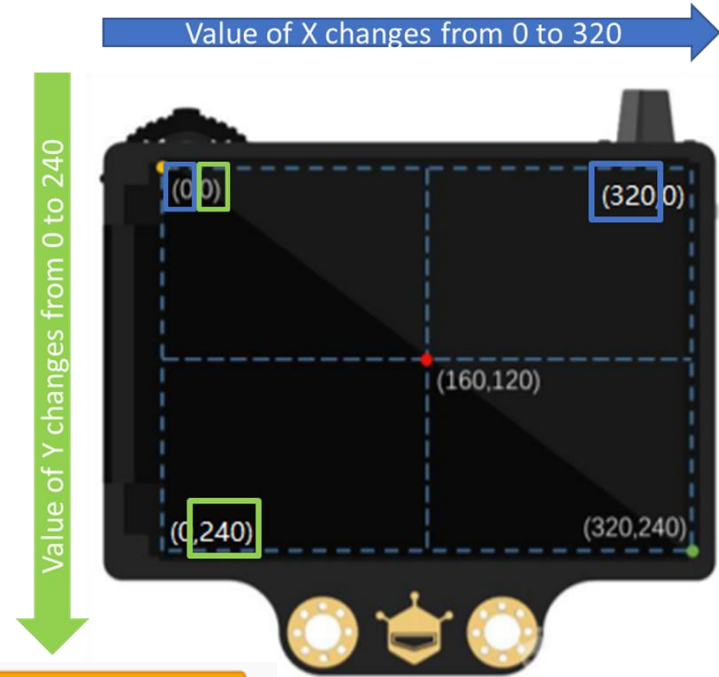
HuskyLens shows the word “XXX” on the screen of at (x, y) coordinates

*Coordinates of the Screen

Format: (x, y)

- from (0, 0) to (320,240)

Note: the center of the coordinate system in HUSKEYLEN's screen is (160,120) which is **different** from the general one (0, 0).

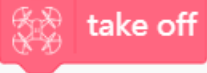


HuskyLens show custom texts "Mind+ " at position x 230 y 35 on screen

MultiThread



start up thread 1 ▾




take off

...(some flying actions)




stop thread 1 ▾




thread 1 ▾ starts


ID 1 is picture of elephant




forever




if HuskyLens check if ID 1 frame ▾ is on screen from the result? then





HuskyLens show custom texts "Elephant" at position x 230 y 35 on screen



breath LED with color blue frequency(Hz) 1



else



Blocks in curly bracket means:

If HuskeyLens detect ID1, screen of HuskeyLens shows “Elephant”,
and show blue color on controller

Else...

Two parts in curly brackets (flying actions and detect object parts) runs together











***RGB System (color system in programming)**



Colors in Mark Scheme

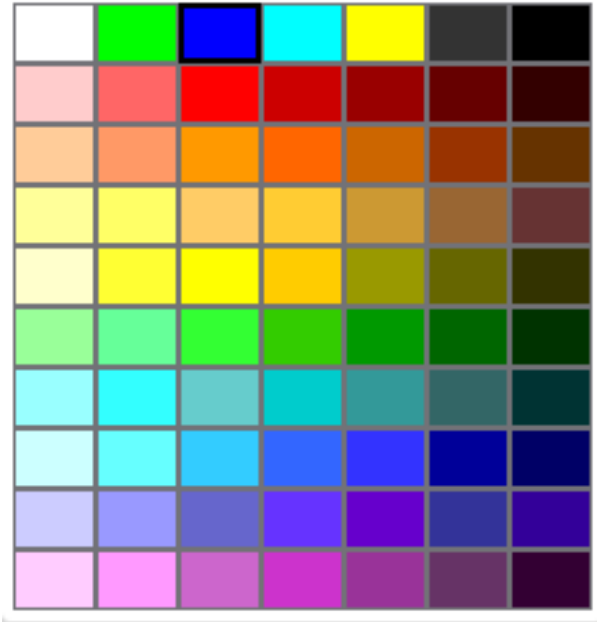
Part I: A.I. National Park Service Ranger

Count the best attempt

Item	Color Scheme	At a reasonable distance (<50cm)	LEDs	Display name on Huskylens	Score
E.g. Object 1	 RGB (0,255,0)	Y	N	Y	0 /25
E.g. Object 2	 RGB (255,255,0)	Y	Y	Y	25 /25
ATTEMPT 1					
Zebra	 RGB (0,255,0)				/25
Tiger	 RGB (255,255,0)				/25
Elephant	 RGB (204,51,204)				/25
Panda	 RGB (0,0,255)				/25
Hunter 1	 RGB (0,255,255)				/30
Hunter 2 (with duck)	 RGB (255,204,0)				/30
Visitor 1 (girl)	 RGB (0,255,0)				/30
Visitor 2 (boy)	 RGB (255,204,255)				/30
Time spent:			Mark deduction <small>see remark:</small>		
Sub-total:					/220

In part of the competition's mark scheme, you can see some special color with special values, so you need to know the relationship between color and these numbers

Colors in Programming



Black = light is off

Colors in Programming

RGB (Red, Green, Blue Color System) three element colors.

Every color is composed of different ratios of intensities of Red, Green, Blue colors.

Visualization link (RGB Calculator): [Colors RGB](#)

Expression form: RGB (red, green, blue)

Intensity of the color: between 0 and 255



Basic Programming Knowledge in Block “Control”

Don't worry if you feel
difficult



Conditional Statement

If (condition1...), then(do...)

Or:

If (condition1...), then(do...)

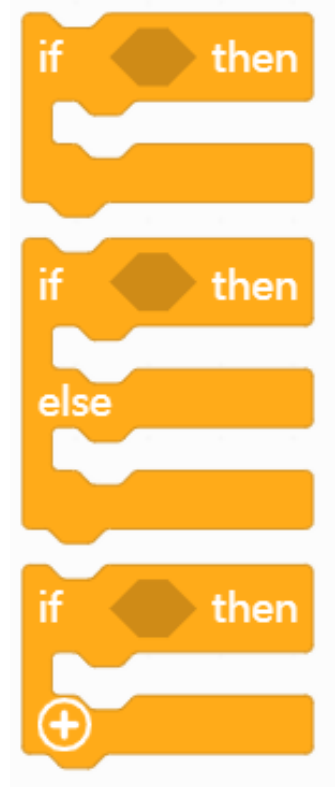
~~else (left conditions...), then (do...)~~

Or:

If (condition1...), then(do...)

~~else if (condition2...), then (do...)~~

~~else (left conditions...), then (do...)~~



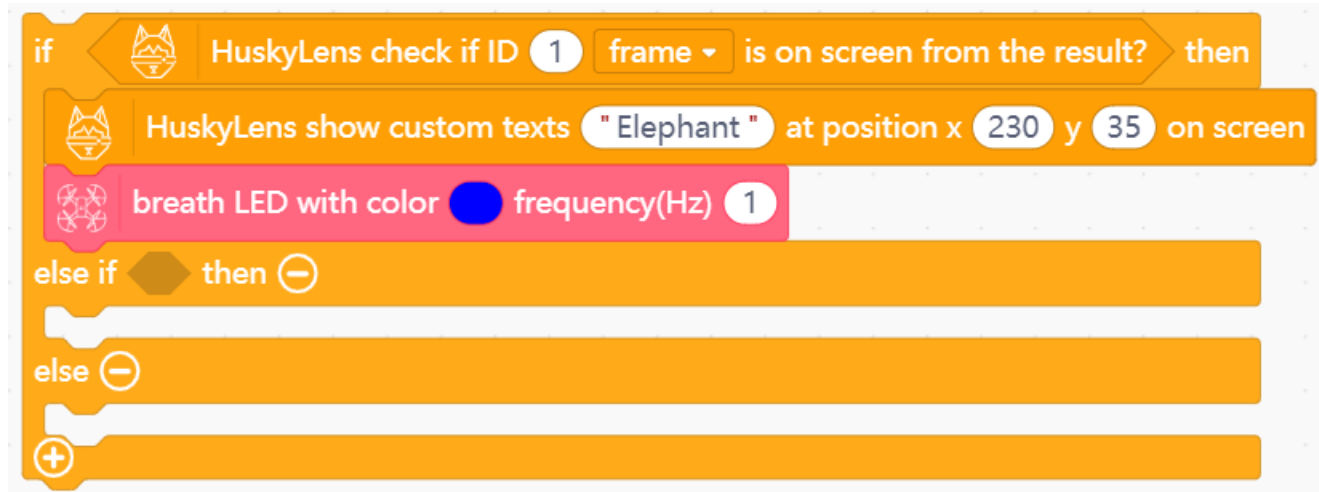
Conditional Statement

If (condition1: Huskeylen detect ID1-picture of elephant)
then (do: show "Elephant" and breath LED in blue color)

else if (condition2...), then (do...)

else (~~left conditions...~~), then (do...)

After else
condition,
stop...



Looping Statement

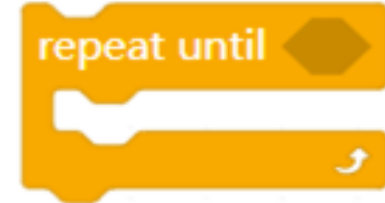
Repeat n times:

repeatedly do... until it reaches n times then stop.



Forever loop - no condition:

(do...) forever



Repeat until (condition met... stop) loop:

do... until (condition met... stop)

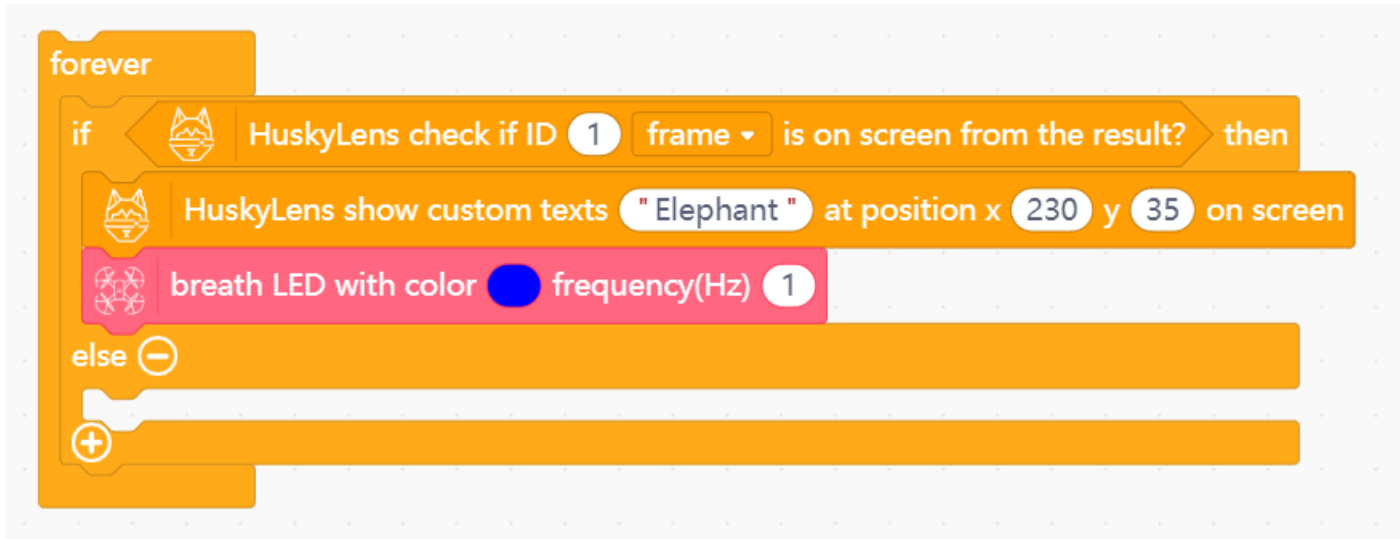


Looping Statement

In competition, we don't need stop for the looping statement because we need to detect picture in the thread of object recognition...

Forever loop - no condition/no stop:

(do (if detect ID1, show "Elephant" and breath LED in blue)) forever



Sample Codes of Drone Flying and Recognition


Next, we will directly show you sample codes. You can [follow us](#) to drag and build the codes and get used to learn about them.

Two parts of codes:

1. control **drone to fly**
2. control HuskyLens to **recognize objects**.

Can you explain now the meaning of following sample codes block by block to me?

Sample Codes of Drone Flying and Recognition



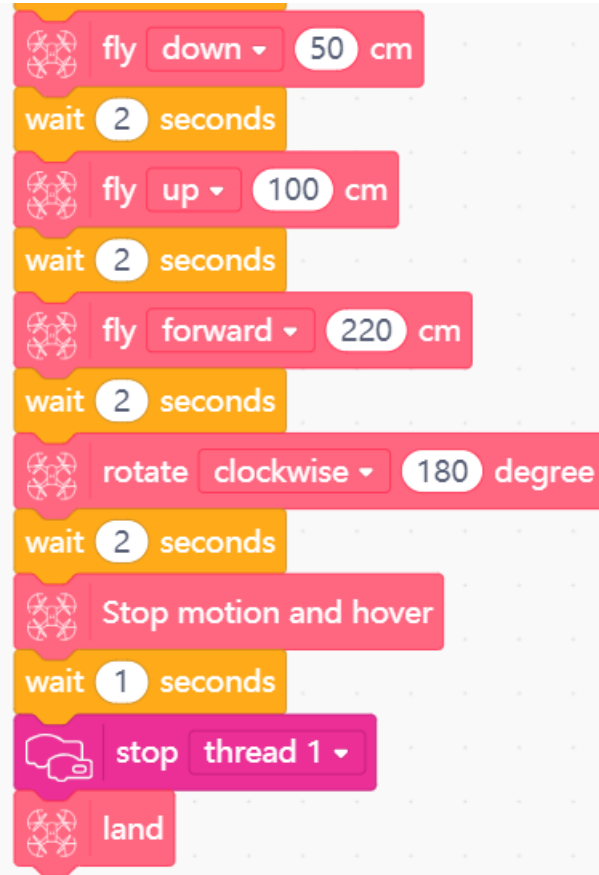
```

RMTT ESP32 starts
HuskyLens initialize pin [ ] until success
HuskyLens switch algorithm to [Object classification]
start control LED lights up(in green as default)
wait 3 seconds
breath LED with color [blue] frequency(Hz) 1
motor on Take off to 80cm high as default
take off
start up thread 1
wait 3 seconds
fly up 50 cm

```

Scratch script for drone initialization and take-off:

- RMTT ESP32 starts
- HuskyLens initialize pin [] until success
- HuskyLens switch algorithm to [Object classification]
- start control LED lights up(in green as default)
- wait 3 seconds
- breath LED with color [blue] frequency(Hz) 1
- motor on Take off to 80cm high as default
- take off
- start up thread 1
- wait 3 seconds
- fly up 50 cm



```

fly down 50 cm
wait 2 seconds
fly up 100 cm
wait 2 seconds
fly forward 220 cm
wait 2 seconds
rotate clockwise 180 degree
wait 2 seconds
Stop motion and hover
wait 1 seconds
stop thread 1
land

```

Scratch script for drone flight sequence:

- fly down 50 cm
- wait 2 seconds
- fly up 100 cm
- wait 2 seconds
- fly forward 220 cm
- wait 2 seconds
- rotate clockwise 180 degree
- wait 2 seconds
- Stop motion and hover
- wait 1 seconds
- stop thread 1
- land



Follow me to drag
your blocks to
compose same
codes

What You Need to Program for Competition

Revise few parts

Drone flying:

- **Flying path:** direction, distance, rotation directions with angles

Object recognition:

- **Conditions:** Detected objects' ID numbers
- **Do:** Shown name of objects, (coordinates on the screen)

**After finish
programming...
(Upload...)**



Upload your program to controller

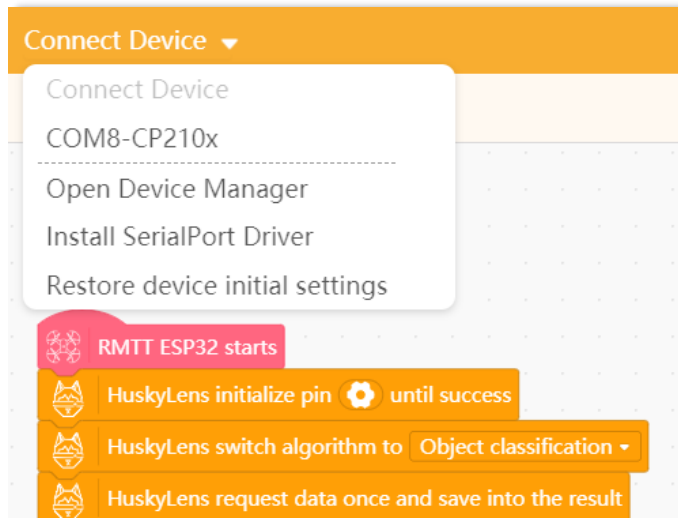
1. Connect your computer to the controller by a micro-USB cable which supports data transmission



Upload your program to controller (con't)

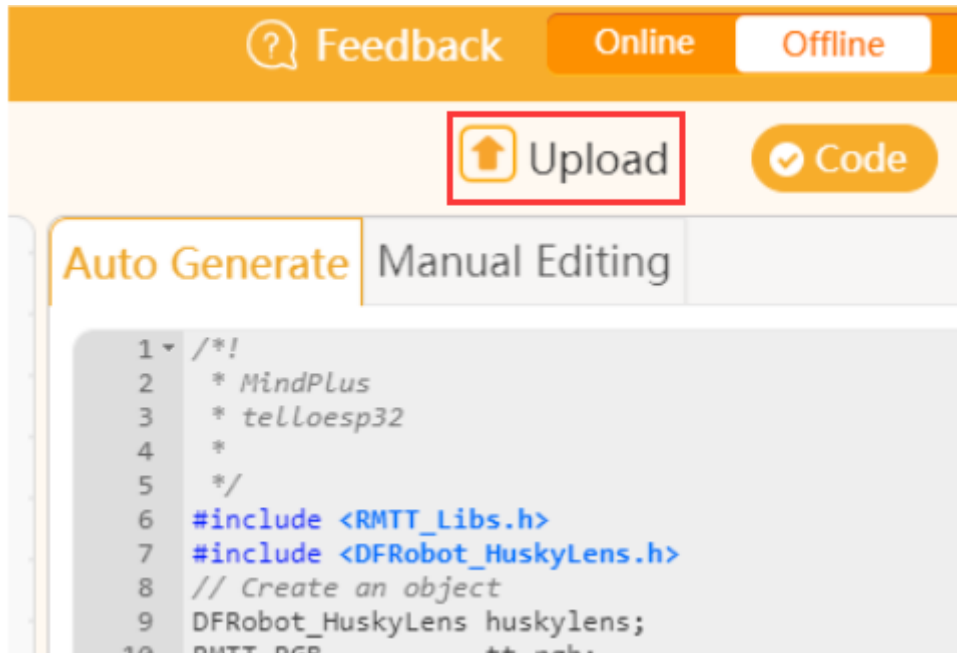
2. Click the “Connect Device”, select your device.

If you can't see your device, click “Install SerialPort Driver”.



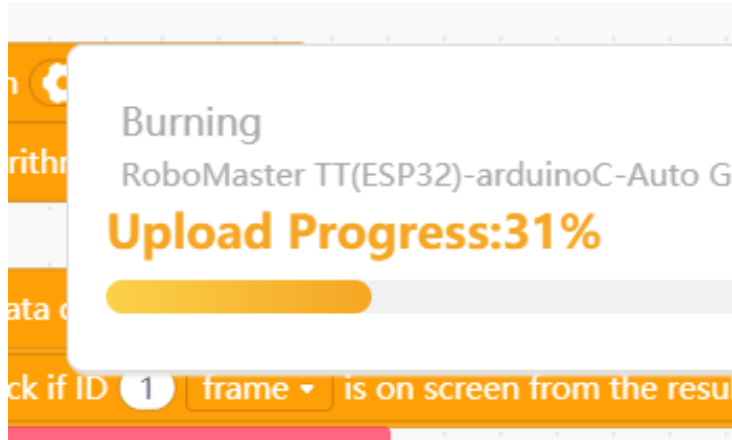
Upload your program to controller (con't)

3. Click the “Upload” button on the top-right corner.



Upload your program to controller (con't)

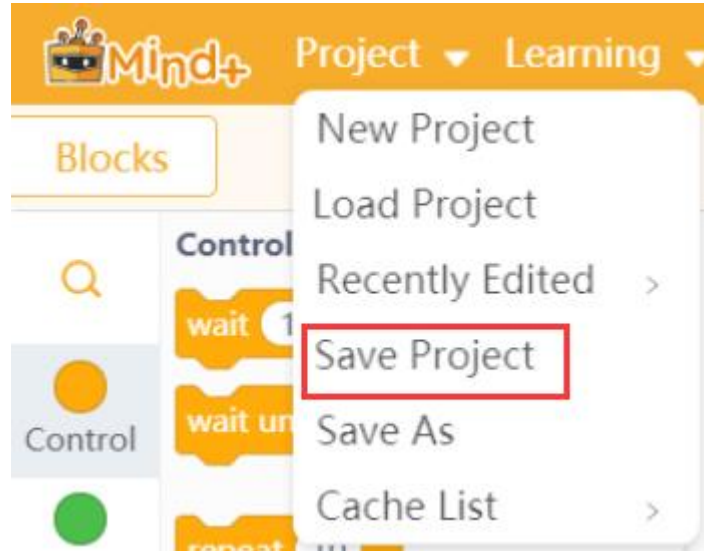
4. Mind+ will pop up a window to show you the progress



Save your program

Click “Project”

then click “Save Project”



Reopen your program

Click “Project”

then click “Load Project”

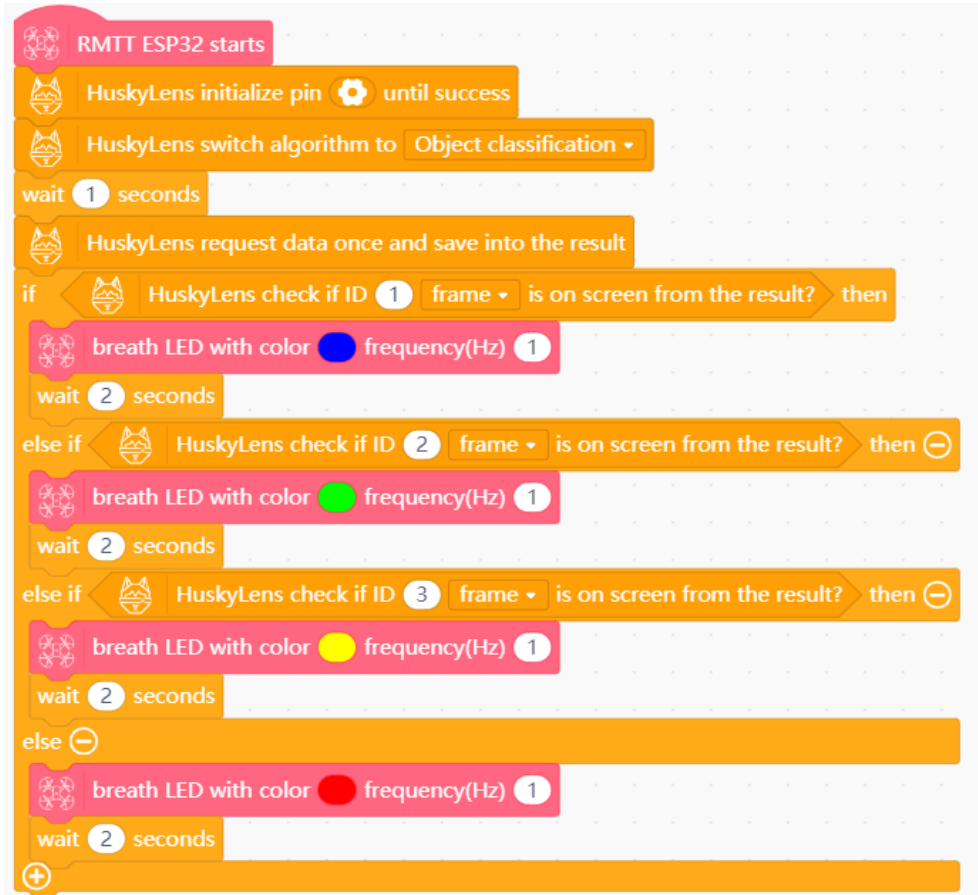
then choose previous saved program



Practice after Learning Basic Statements

Think about that are there any bugs in this paragraph of codes?

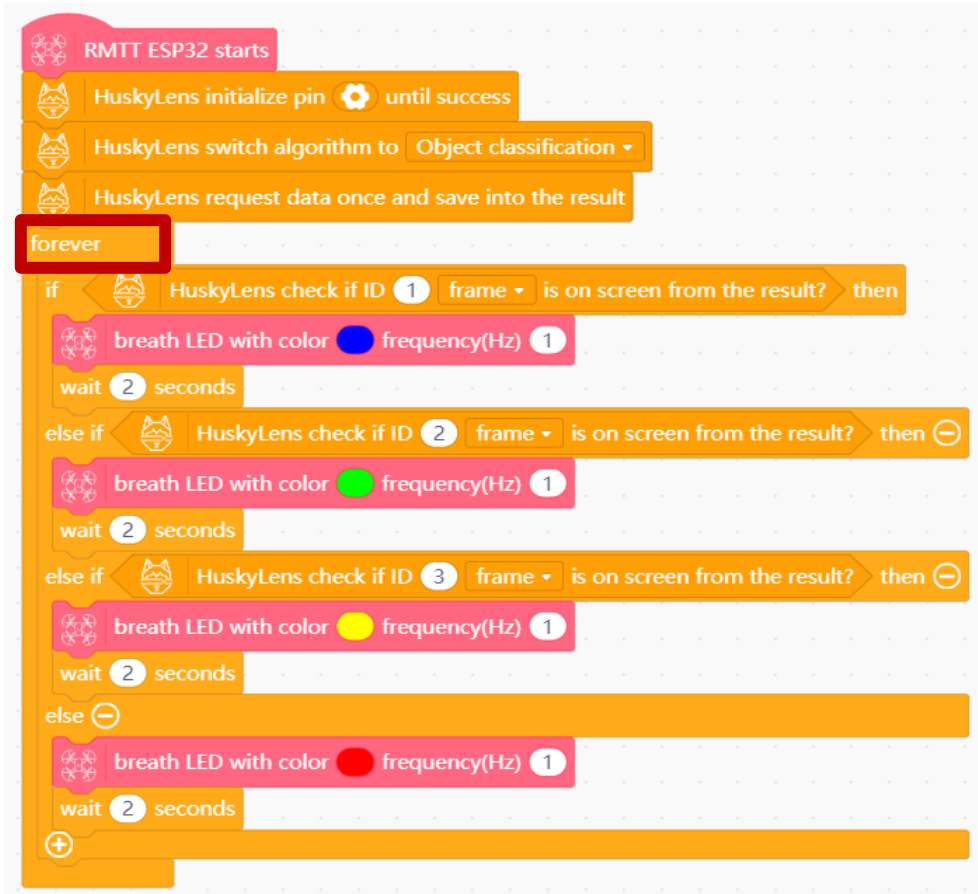
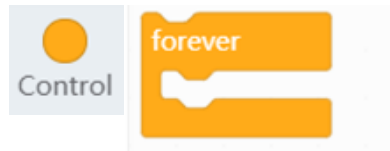
This program only run once and directly stop!



Practice after Learning Basic Statements

How should we improve this paragraph of codes?

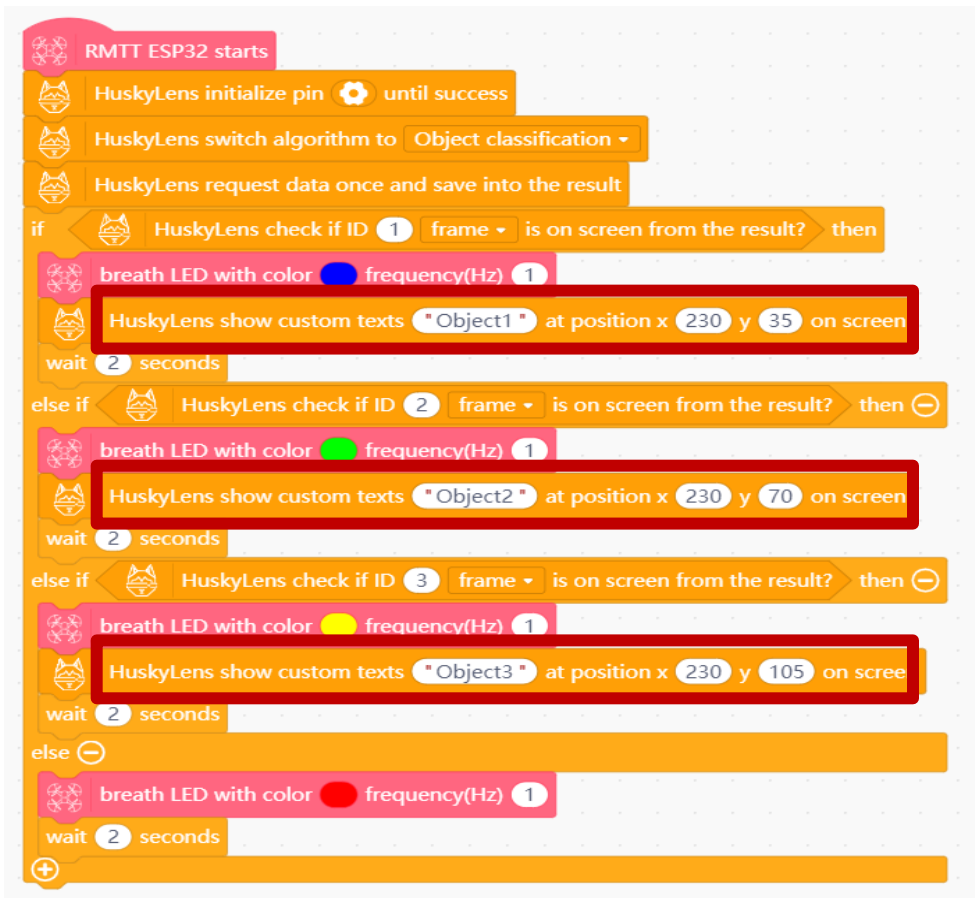
First, insert a forever loop.



Practice after Learning Basic Statements

How should we improve this paragraph of codes?

Then, display object names on the screen.



Let's Break!

5 min



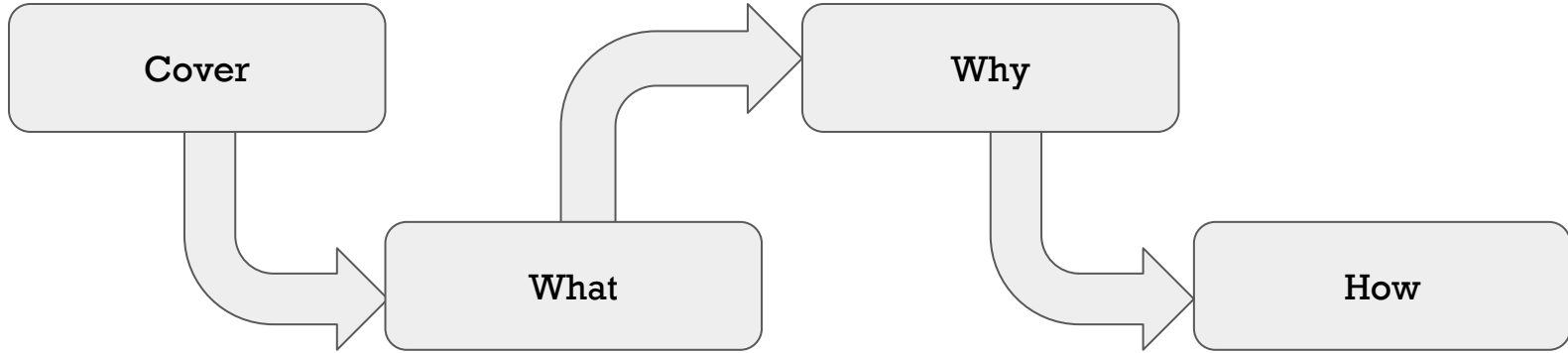
Preparation of Presentation

- Structure of a Presentation
- Presentation Information
- Preparation for PowerPoint

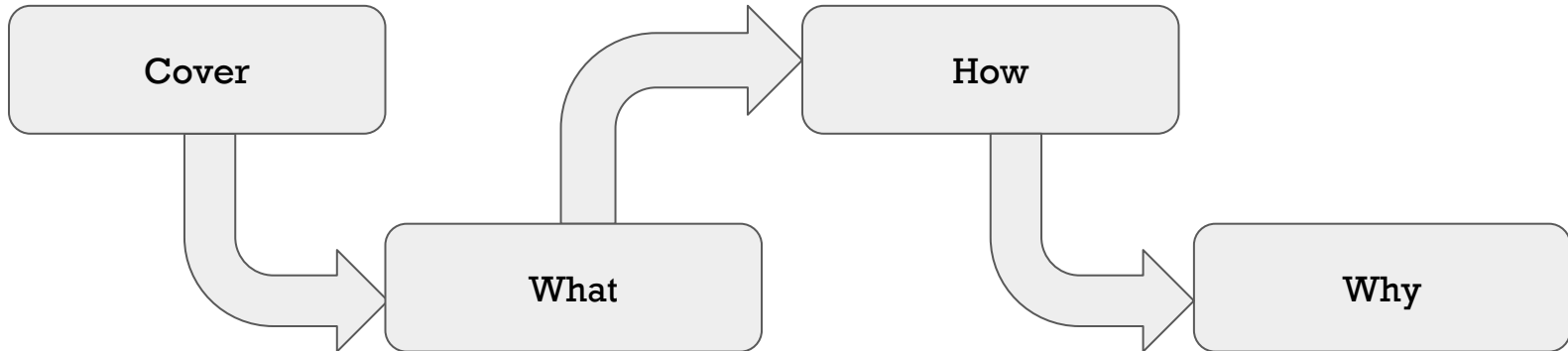


Recommended Structure

Common structure:



It can also be:



Recommended Structure

Use “what-why-how” or “what-how-why” structure to describe things or analyze things in presentations, essays, or other formal occasions:

What:

What is the meaning of sth (**definition: connotation + extension**)?

Why:

Why does sth. work/happen (**causes**)?

Why is sth. **good** for sb. (**pros**)? / why is sth. **bad** to sb. (**cons**)?

Why is sth. **significant** (**functions**)? / why is sth. **inadequate** (**flaws**)?

How:

How can sth. be used for sb. (**application**)?

How does sb. take **advantages** of sth.? / how does sb. avoid **disadvantages** of sth.?

How does sb. learn from sth.? / how does sb. make improvements for sth.?

Content Sample

Future Developer for A.I. Application

E.g., Apply AI drone in rescue mission or disaster relief

How do people deal with the issue nowadays or in the past?

What are the limitations?

How could your idea be a cure?

For details, please refer to "Competition Details.pdf" on Blackboard



Presentation Information

Recall that we introduced the overview of two parts of competition in Day 1 workshop. Now let's focus on Part II "Future Developer for A.I. Application". The following information is extracted from the competition rules:

Present an original and creative idea on how **A.I. object recognition and drone** can be applied for **social goods in daily life** and make **a positive impact** to the community.

You can incorporate the use of other technologies into your innovative design.

Presentation **duration: 3-5 minutes**

Presentation material: **max. 5 slides**

Presentation will be recorded via Zoom.

Presentation Information

Presentation Criteria:

- (1) Originality and Creativity
- (2) Adherence to the theme
- (3) Presentation Clarity

Criteria	Description	Marks
(1) Originality and Creativity	Show imagination and originality, able to give audience surprises	30
(2) Adherence to the Theme	Highly correlates to the theme “A.I. for social good” and demonstrate impact to the community	30
(3) Presentation Clarity	Well-structured, speaks confidently, materials are clear with good use of visual aids	20

Presentation Information

Key words: “A.I. for social goods”

Link: <https://www.microsoft.com/en-us/ai/ai-for-good>

Time (recommended): 4-5 minutes

PPT (recommended): 4-5 slides

Structure (recommended): what-how-why

Cover (1): Title, picture, presenter names, (and any other words if needed).

What (1): What is it? What is its connection with **object recognition and drone**?

How (1-2): How does it work? How can it be applied for **social goods**?

Why (1): Why does it make **a positive impact** to the community?

Optional Resource

Link: <https://www.youtube.com/watch?v=d8l2a7qG9Kw>



Thank you for listening!