

Steam Up 2gether – Lesson 7

Robotics Coding with WhalesBot AI Module 1

Introduction to Fan Graphic Coding

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Facilitator: Emily Tseng



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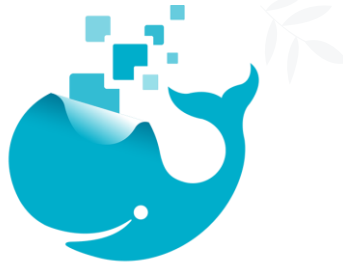
Feihong Ye

Chief Content Officer @ WhalesBot

PhD in Optical Communication from
Technical University of Denmark

Extensive teaching and curriculum
development experience in Coding and
Robotics Education for Kids





Whales Bot



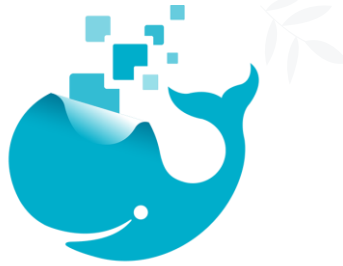
About us

Focus on Robotic design, R&D, ODM, Marketing, Sales service & STEAM education



What we do?

WhalesBot uses interactive programming software such as Graphical coding, Scratch, Python, C and different kinds of structural parts to guide young kids to communicate with robots.



Whales Bot



Environment

We are helping kids aged from 7 to 18 to touch and learn new technologies so that they can be creative and problem solvers.



Feedback

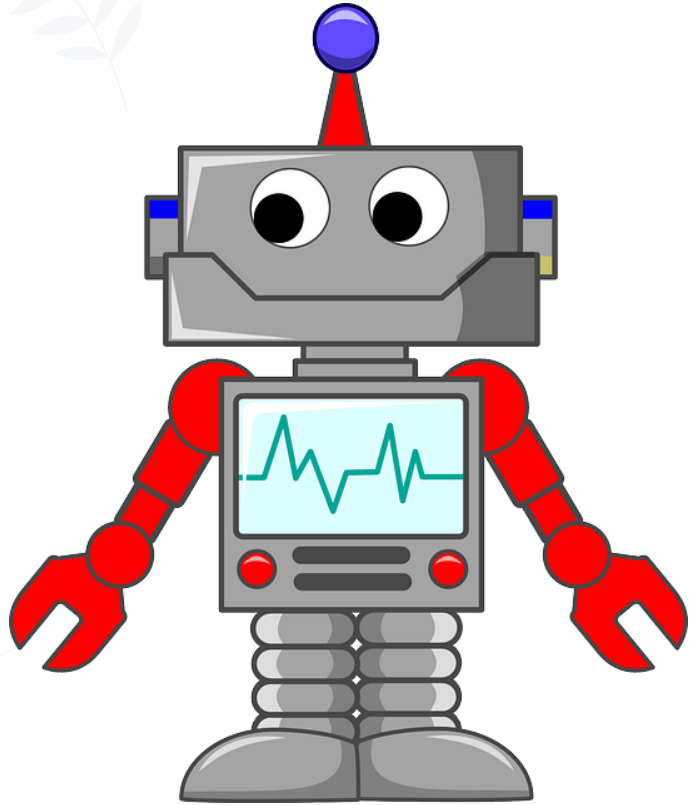
We saw the teenagers become smarter and innovative simply by playing with WhalesBot. We aim to improve human's life quality by using Robots.



Part 1: Robot and AI Module 1



What is robot?

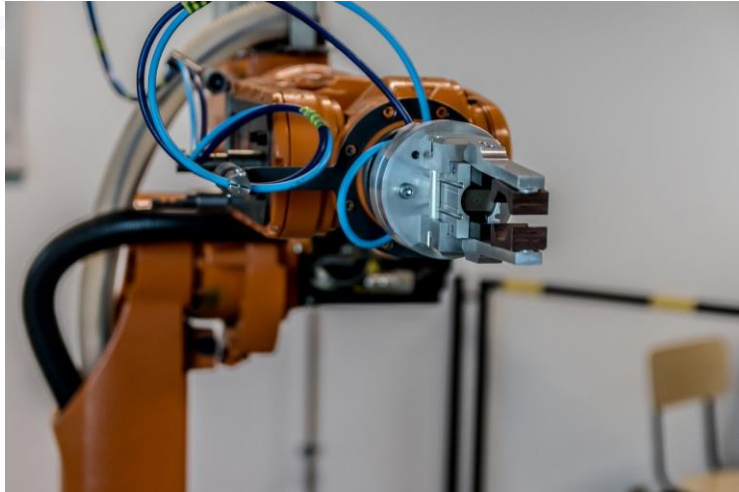


A robot is a machine — especially one programmable by a computer — capable of carrying out a complex series of actions automatically.

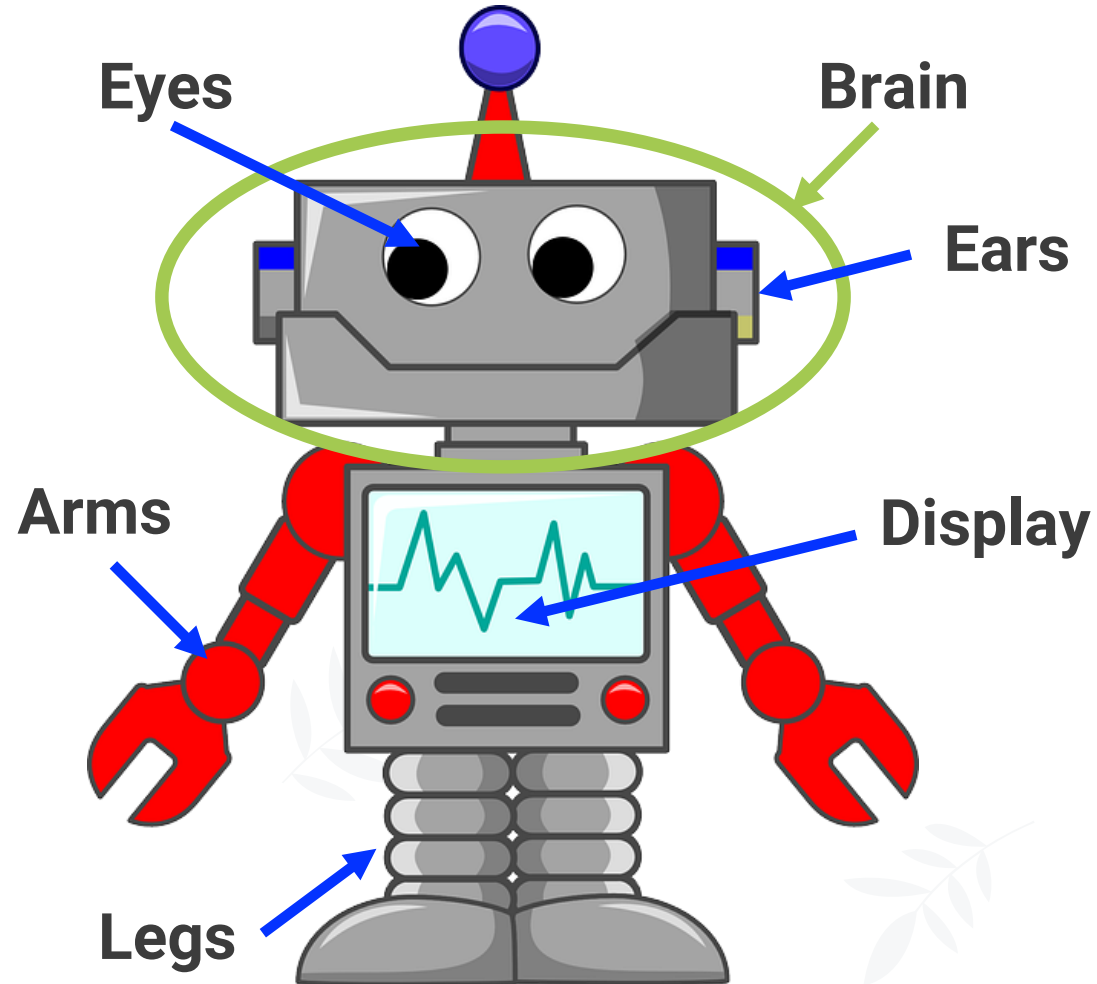
Robots can be guided by an external control device or the control may be embedded within.

Robots may be constructed on the lines of human form, but most robots are machines designed to perform a task with no regard to their looks.

Which of the following can be considered as robots?



Overview of Robots

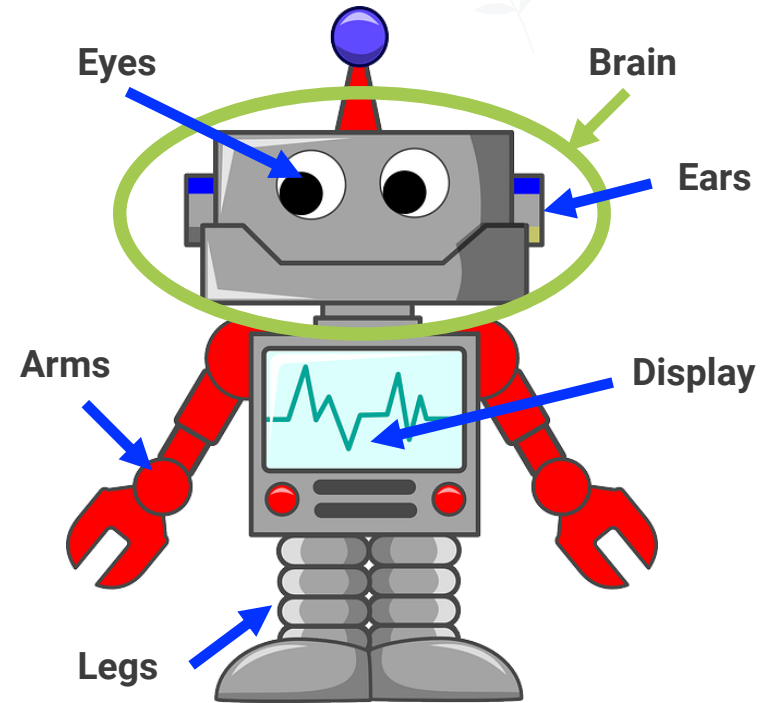


Fundamental Parts of a Robot

Controller: the brain of robot

Actuator: a mechanism that puts something into automatic action, for instance, arms, legs, display

Sensor: a device for sensing and measuring light, pressure, or temperature, and sending information back to a computer, for instance: eyes, ears



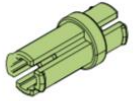
Get to Know AI Module 1

AI Module 1 BLOCK ROBOT

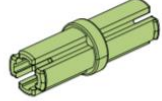
SMART SPECIFIC VIVID



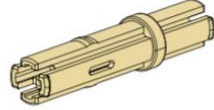
Structural Parts



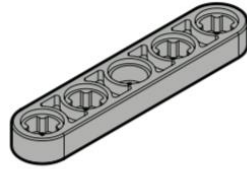
1.5 Double Bolt x35



2 Double Bolt x140



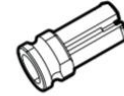
3 Double Bolt x35



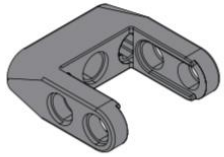
50 Single Beam x18



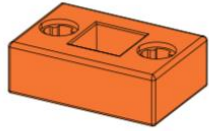
2 Double Step Bolt x4



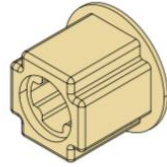
1 Double Step Bolt x8



U-Shaped Beam x3



Motor Transfer Bracket x4



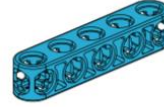
1 Square Cotter x4



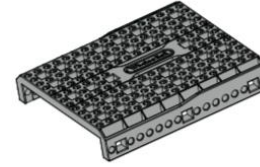
20 Beam x15



30 Beam x20



50 Beam x21



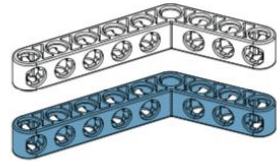
General Chassis x1



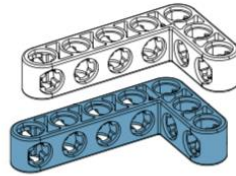
70 Beam
White x12
Orange x8



110 Beam
White x6
Orange x8



126° 4X6 Beam
White x6
Blue x4

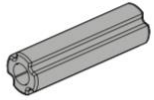


90° 3X5 Beam
White x10
Blue x6

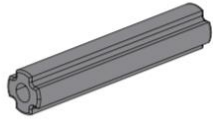


5X7 Square Beam x4

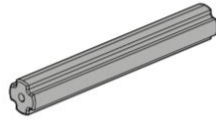
Transmission Parts



20 Axle x6



30 Axle x4



40 Axle x14



50 Axle x6



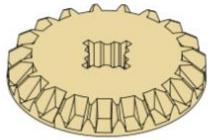
60 Axle x4



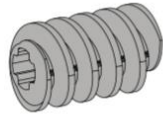
80 Axle x6



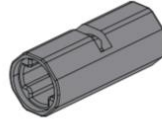
12 Half High Bevel Gear x6



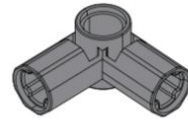
20 Half High Bevel Gear x4



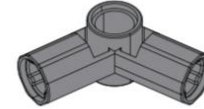
Worm x2



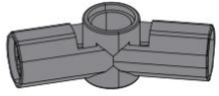
20 Coupler x2



90° Coupler x4



112.5° Coupler x6



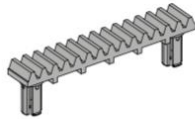
157.5° Coupler x4



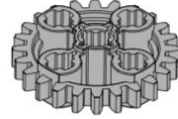
12 Cone Gear x2



20 Cone Gear x4



Rack (Hole Beam) x4



24 Straight Tooth x2



Universal Coupling x2



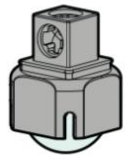
Caterpilla x60



Chain Wheel x6



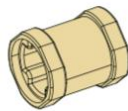
6018 Tyre x2



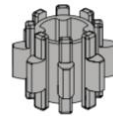
Universal Wheel x1



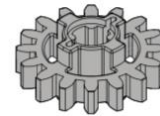
0.5 Pulley Axle Sleeve x30



Axle Sleeve x15

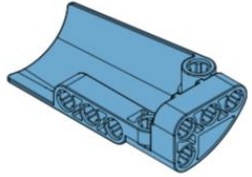


8 Straight Tooth x2

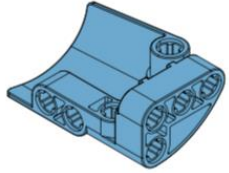


16 Straight Tooth x2

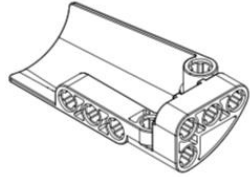
Decoration Parts



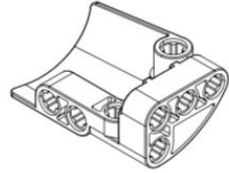
3X7 Left Decorative Part
Blue x3



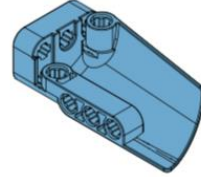
3X5 Left Decorative Part
Blue x3



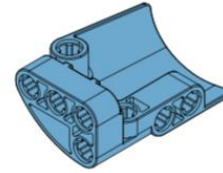
3X7 Left Decorative Part
White x2



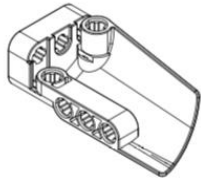
3X5 Left Decorative Part
White x4



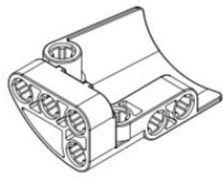
3X7 Right Decorative Part
Blue x3



3X5 Right Decorative Part
Blue x3



3X7 Right Decorative Part
White x2



3X5 Right Decorative Part
White x4



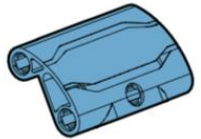
126° Decorative Part
Blue x6



126° Decorative Part
White x2



126° Decorative Part
Gray x1



3X5 Corner Decoration
Blue x6



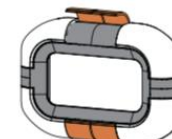
3X3 Panel Decoration
Blue x4



3X5 Corner Decoration
White x7



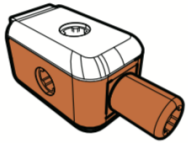
3X3 Panel Decoration
Orange x4



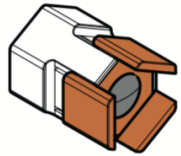
Facial Decoration
x1

Electronic Components of AI Module 1

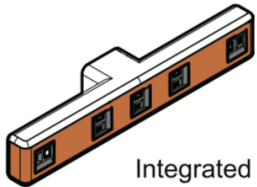
Sensors



Touch Sensor x2

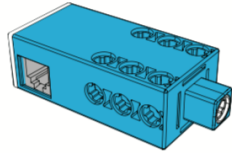


Infrared Sensor x1



Integrated Grayscale Sensor x1

Actuators

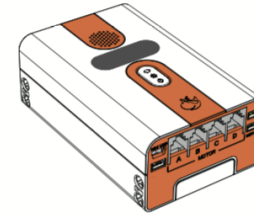


Closed-loop Motor x3



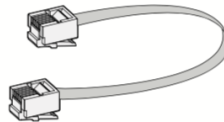
Expression Screen x2

Controller



Controller x1

Connection Wires

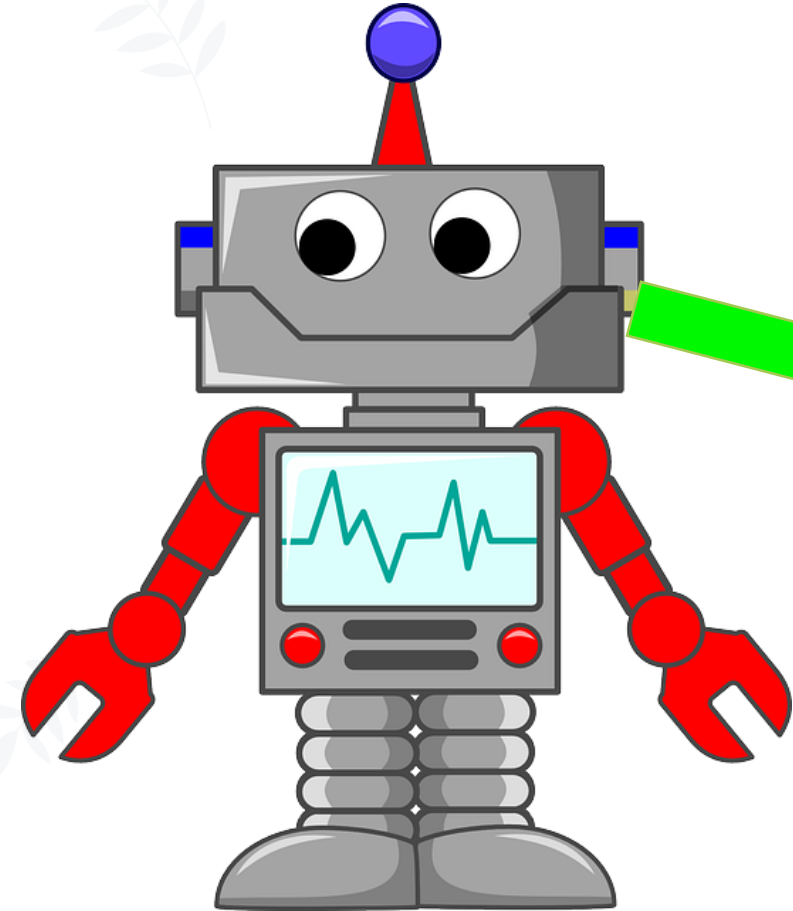


6PIN Connection Wire x8



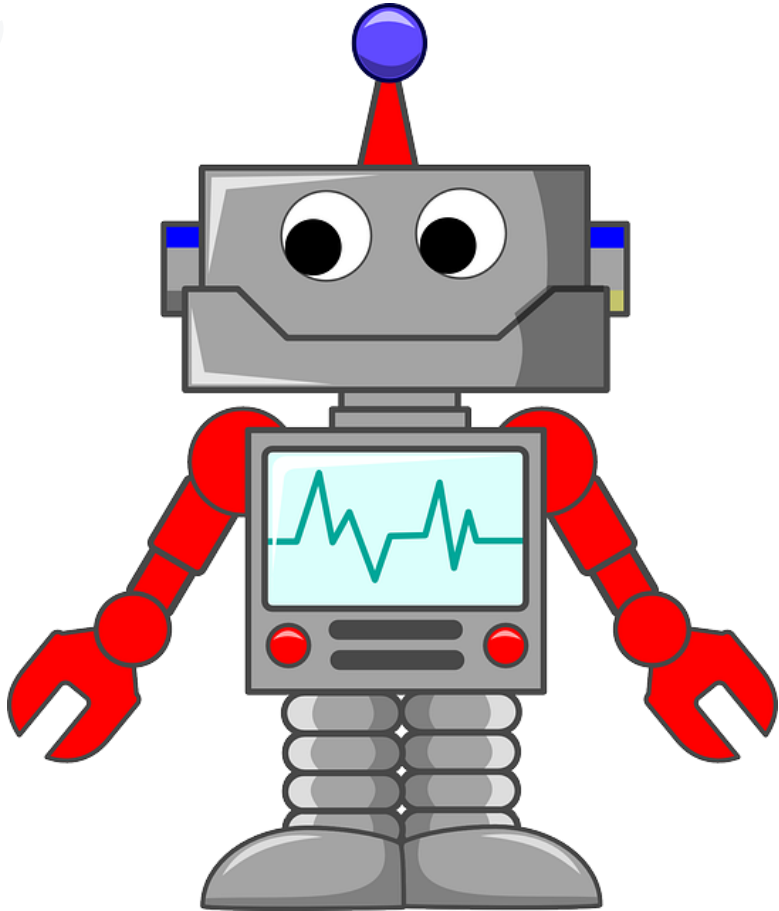
Cable x1

Controller: The Brain of Robots



Controller of AI Module 1

Sensors: The Eyes and Skin of Robots

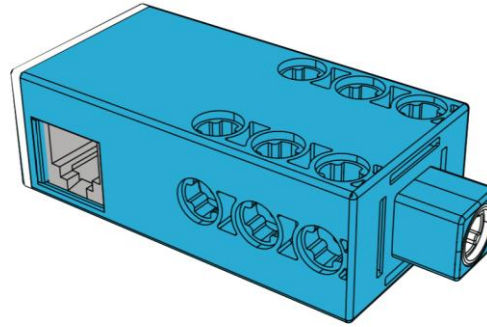
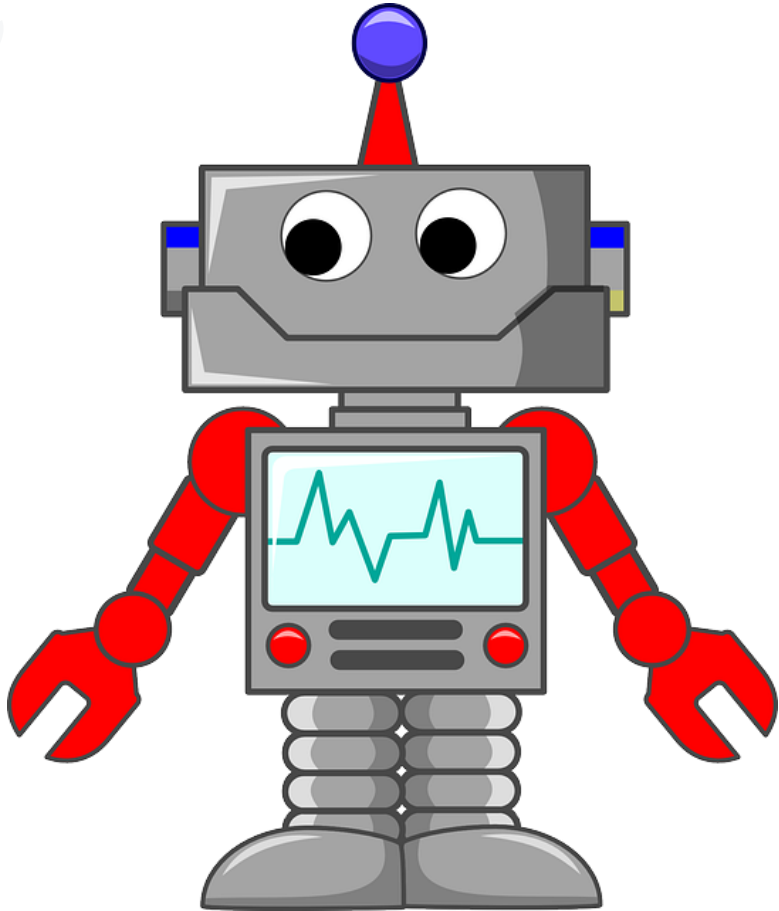


Infrared Sensor

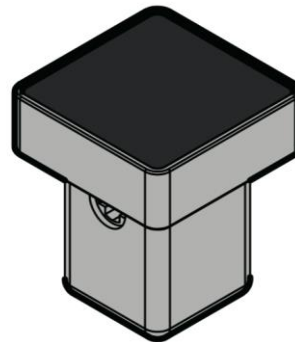


Touch Sensor

Actuators: The Arms and Legs of Robots



Motor



Emotional Screen

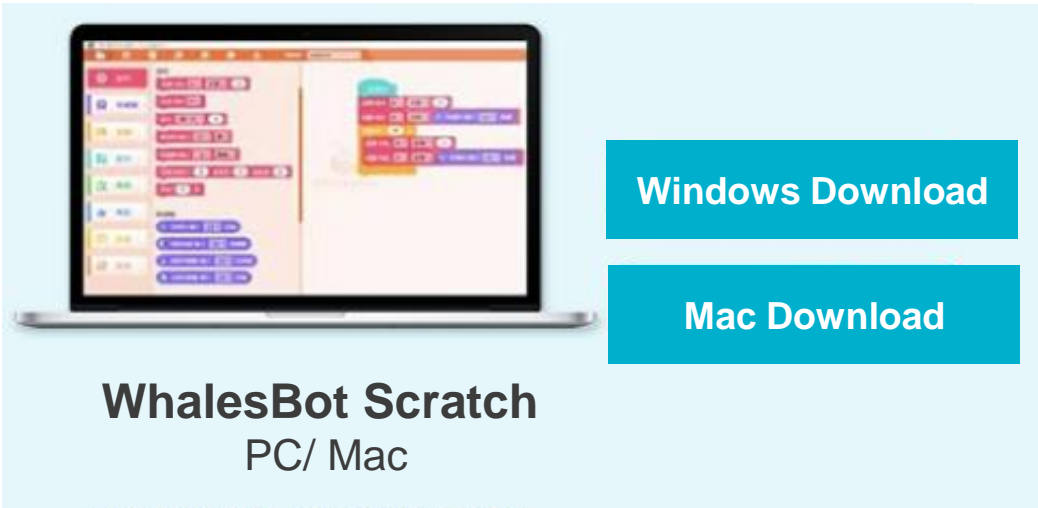
Install WhalesBot Software



WhalesBot APP
iOS/ Android



WhalesBot Scratch
iOS/ Android

The image shows a laptop screen displaying the WhalesBot Scratch software interface. The screen is filled with colorful Scratch-style code blocks. To the right of the laptop are two teal buttons: "Windows Download" and "Mac Download".

WhalesBot Scratch
PC/ Mac

Windows Download

Mac Download

Question 1

Please complete in Corelab

What are the three main parts of a robot?

- A. Legs, hands and head
- B. Controller, sensors and actuators
- C. Structural parts, transmission parts and decoration parts

Question 1 - Reference answer

What are the three main parts of a robot?

A. Legs, hands and head

B. Controller, sensors and actuators

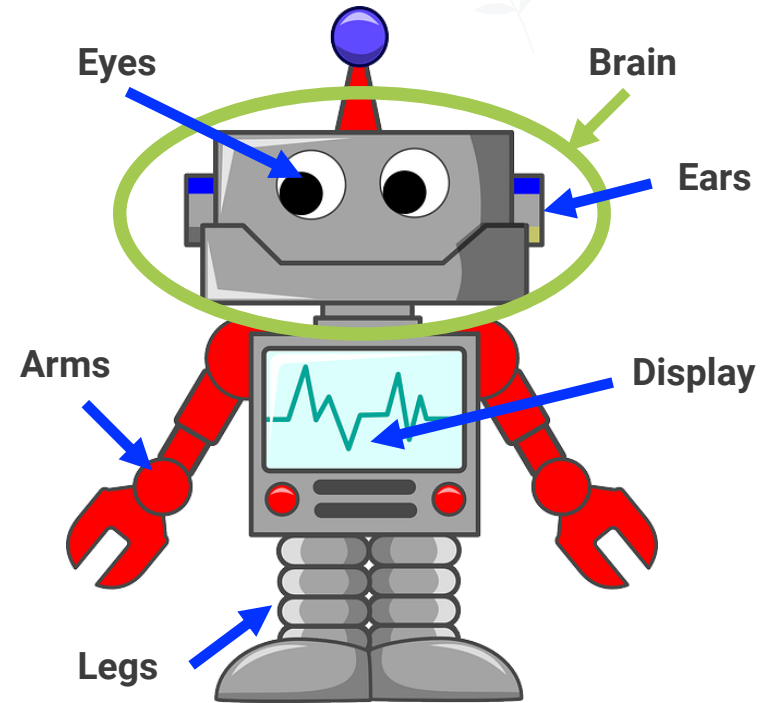
C. Structural parts, transmission parts and decoration parts

Fundamental Parts of a Robot

Controller: the brain of robot

Actuator: a mechanism that puts something into automatic action, for instance, arms, legs, display

Sensor: a device for sensing and measuring light, pressure, or temperature, and sending information back to a computer, for instance: eyes, ears

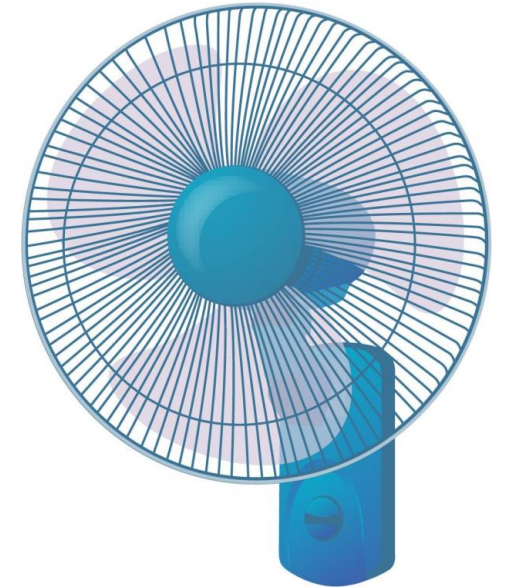




Part 2: Hand-controlled Fan



Different Types of Fan





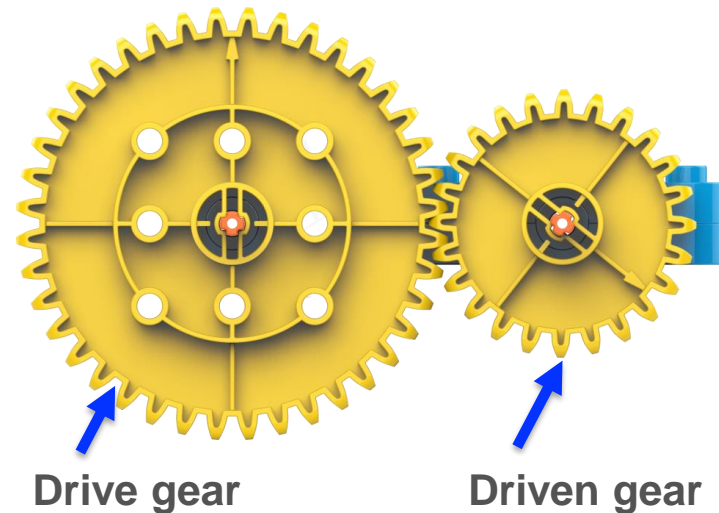
Live Demo: Gear Drive



Gear Ratio

In mechanical engineering, a gear ratio is a direct measure of the ratio of the rotational speeds of two or more interlocking gears.

As a general rule, when dealing with two gears, if the drive gear (the one directly receiving rotational force from the engine, motor, etc.) is bigger than the driven gear, the latter will turn more quickly, and vice versa.

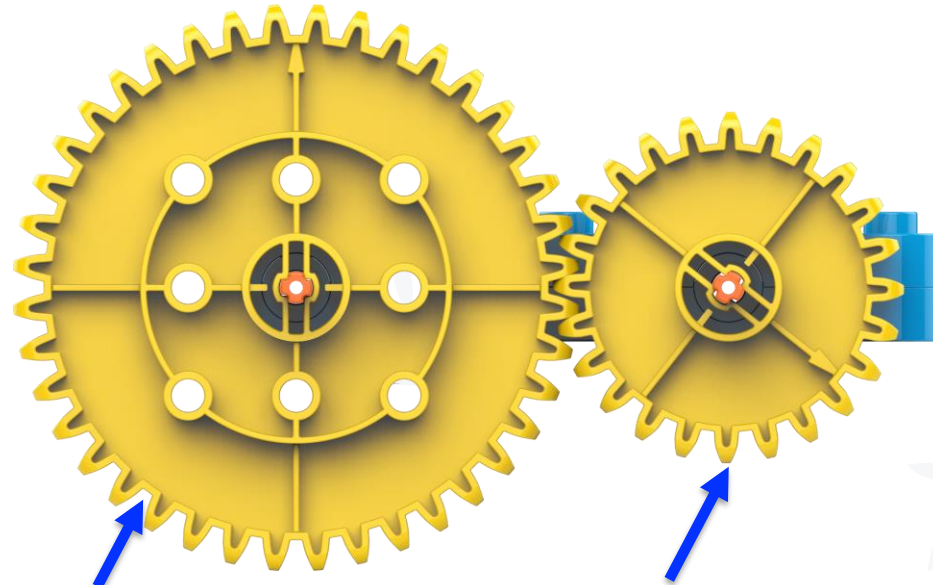


Gear Ratio Calculation

$$\text{Gear ratio} = T2/T1$$

T1 is the number of teeth on the first gear (drive gear)

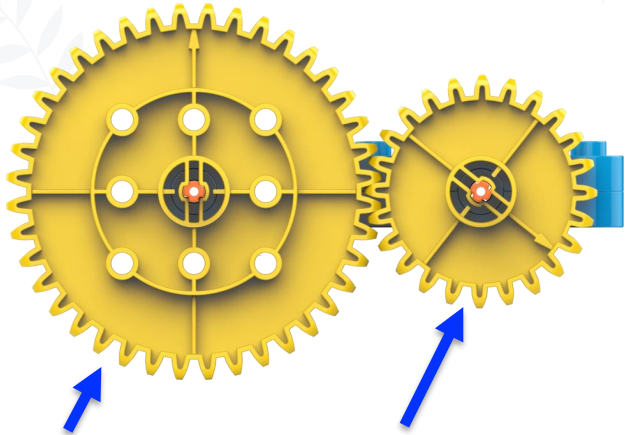
T2 is the number of teeth on the second gear (driven gear)



T1: drive gear

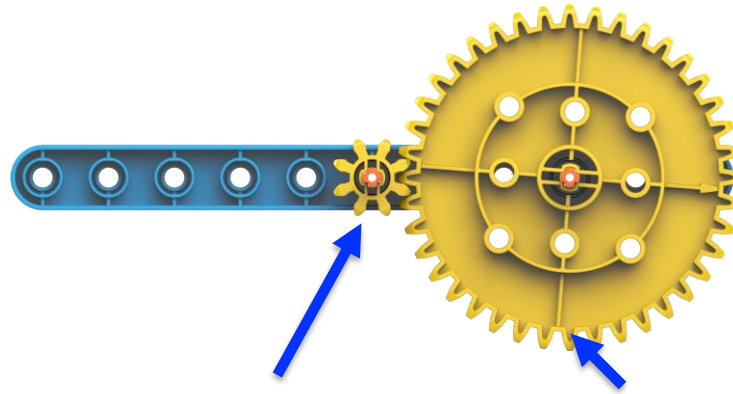
T2: driven gear

Gear ratio = $T2/T1$



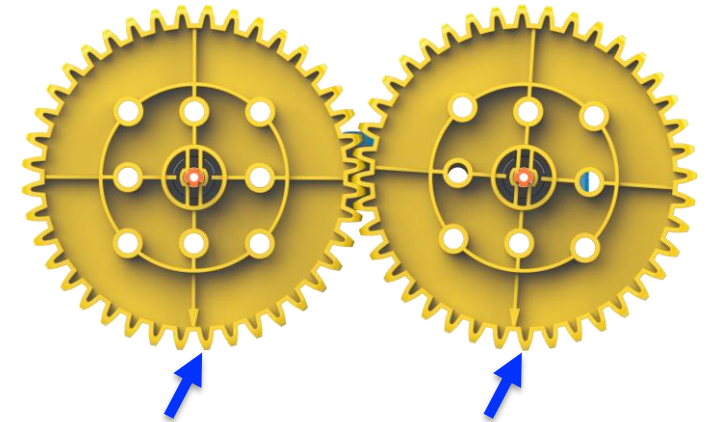
T1: drive gear T2: driven gear

Gear ratio < 1 ,
T2 will accelerate.



T1: drive gear T2: driven gear

Gear ratio > 1 ,
speed of T2 will decrease.



T1: drive gear T2: driven gear

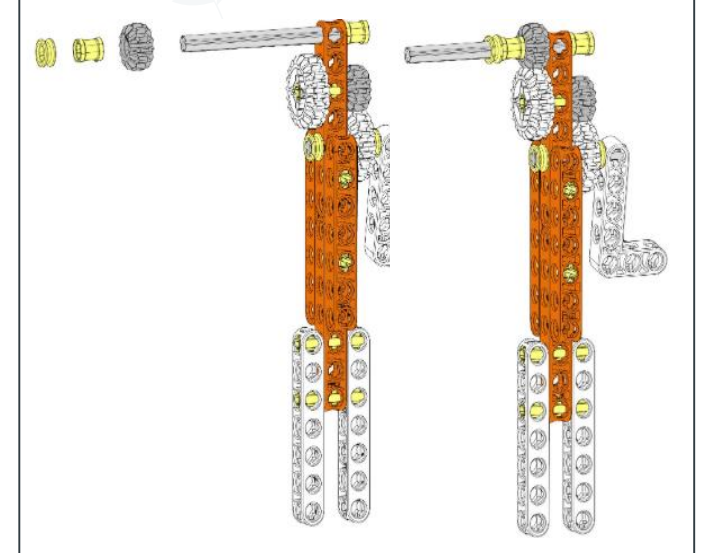
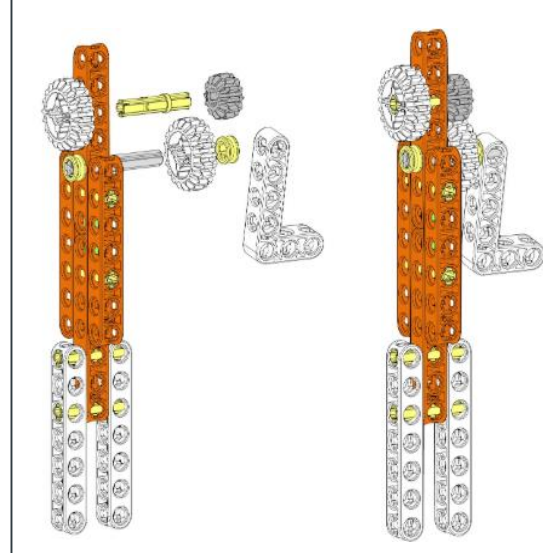
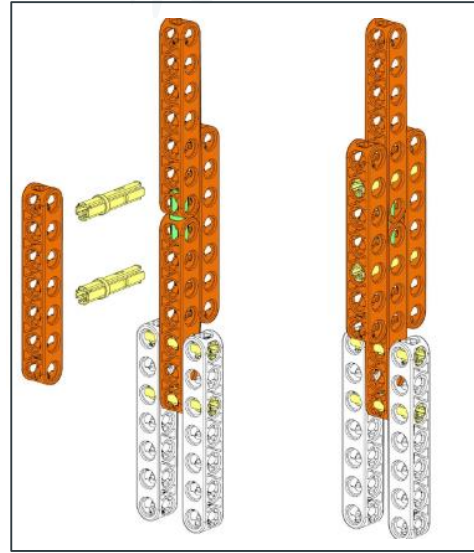
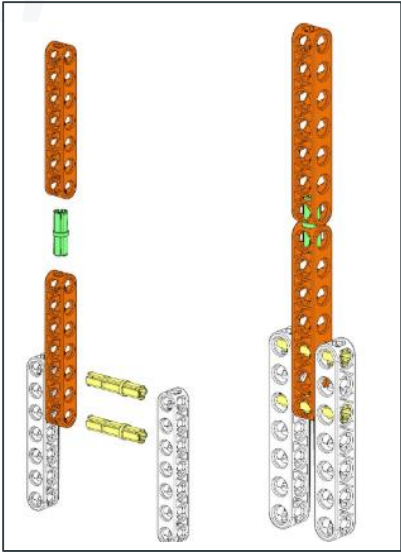
Gear ratio = 1,
same rotation speed.



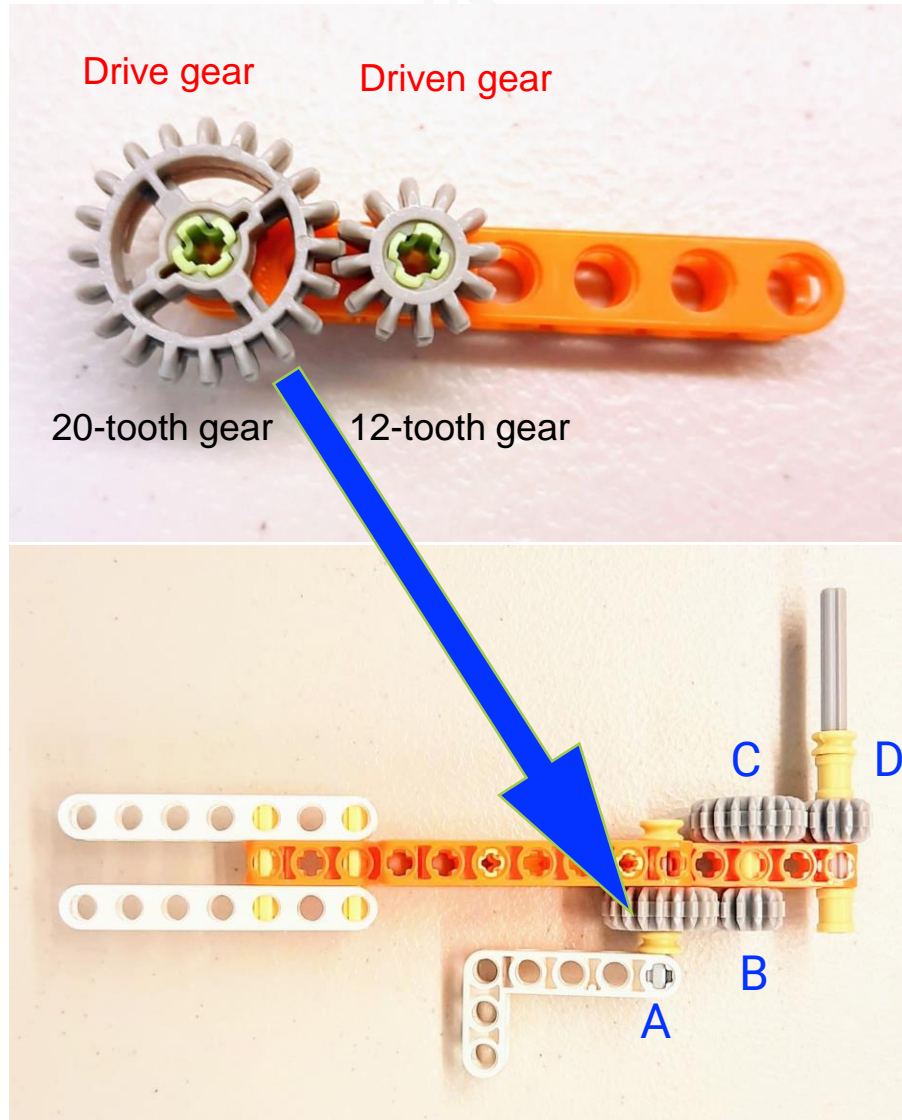
Live Demo: Gear for Fan



Hand-controlled Fan - Building Steps



Gear Ratio Calculation for Fan

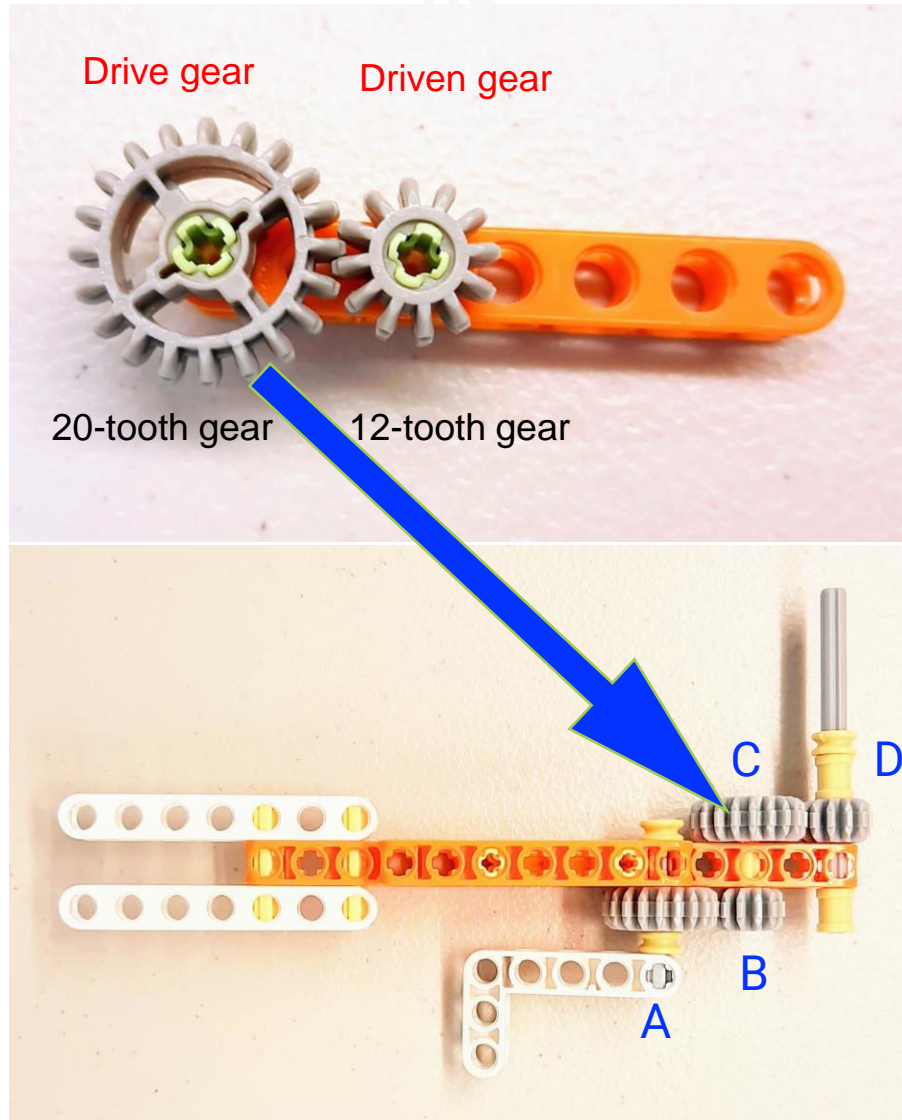


The 20-tooth gear (A) is the drive gear and 12-tooth gear (B) is the driven gear.

Gear ratio: $12 \div 20 = 3/5 < 1$

Speed of 12-tooth gear (B) can be increased.

Gear Ratio Calculation for Fan

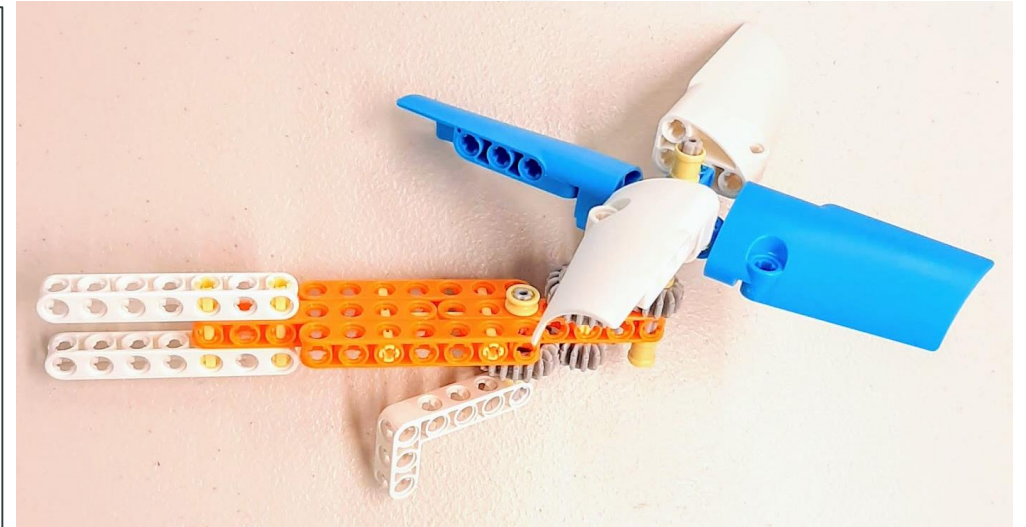
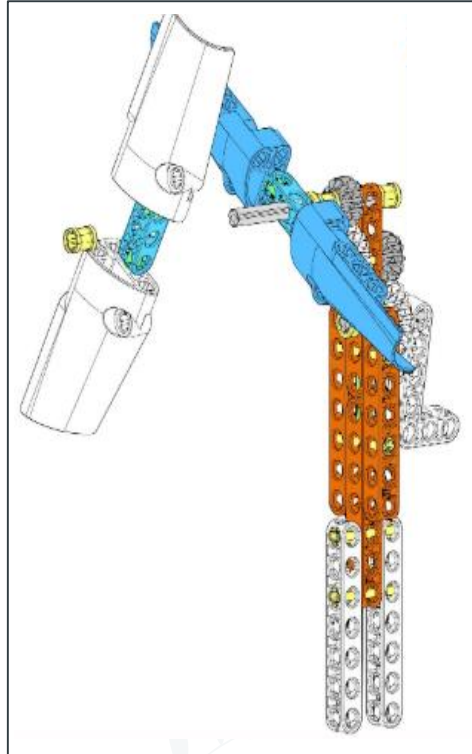
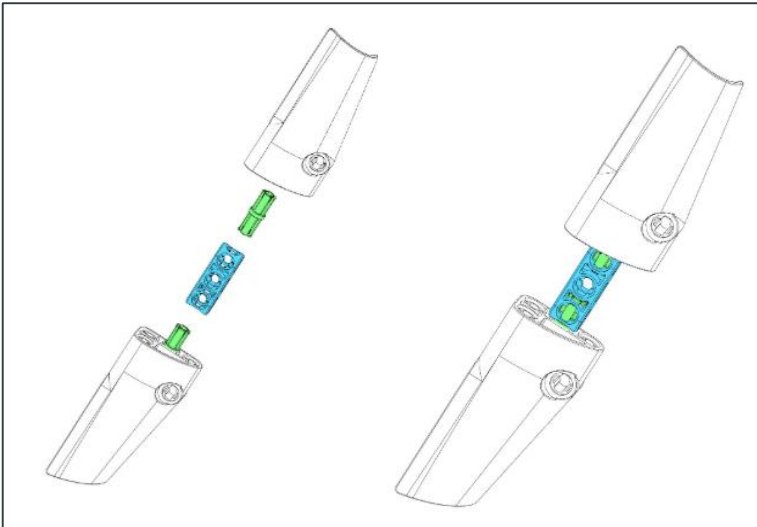
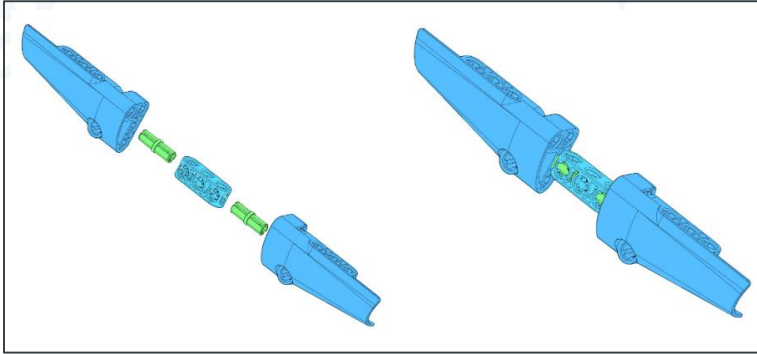


The 20-tooth gear (C) and the 12-tooth gear (B) are connected on the same axle, they have the same rotation speed, the gear ratio of D to C is the same as B to A, which is $\frac{3}{5}$, the gear ratio of D to A:

$$(D/C) * (B/A) = (12 \div 20) * (12 \div 20) = (\frac{3}{5}) * (\frac{3}{5}) = \frac{9}{25} < 1$$

The speed of 12-tooth gear (D) can be increased.

Hand-controlled Fan - Building Steps





Live Demo: Hand-controlled Fan



Question 2

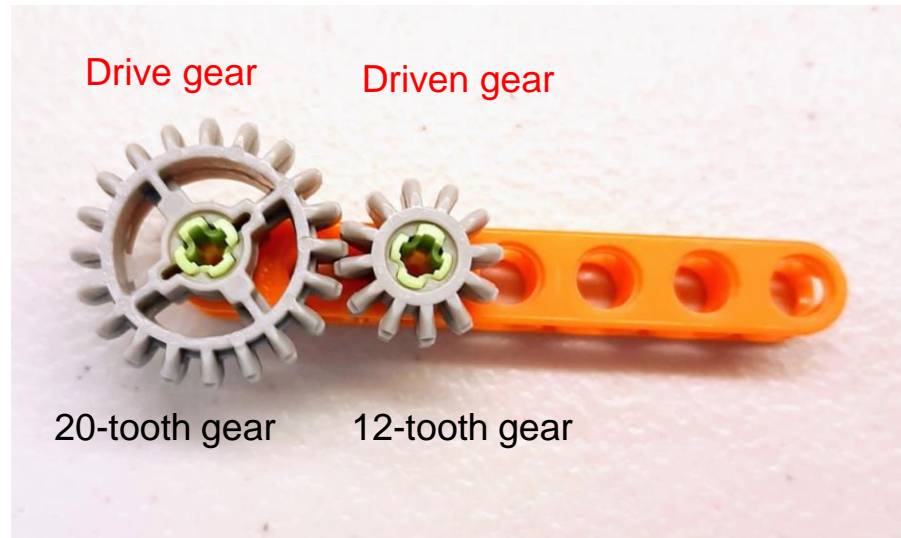
Please complete in Corelab

If the 20-tooth gear rotates 3 turns, how many times the 12-tooth gear will rotate?

A. 1.5

B. 5

C. 1.8



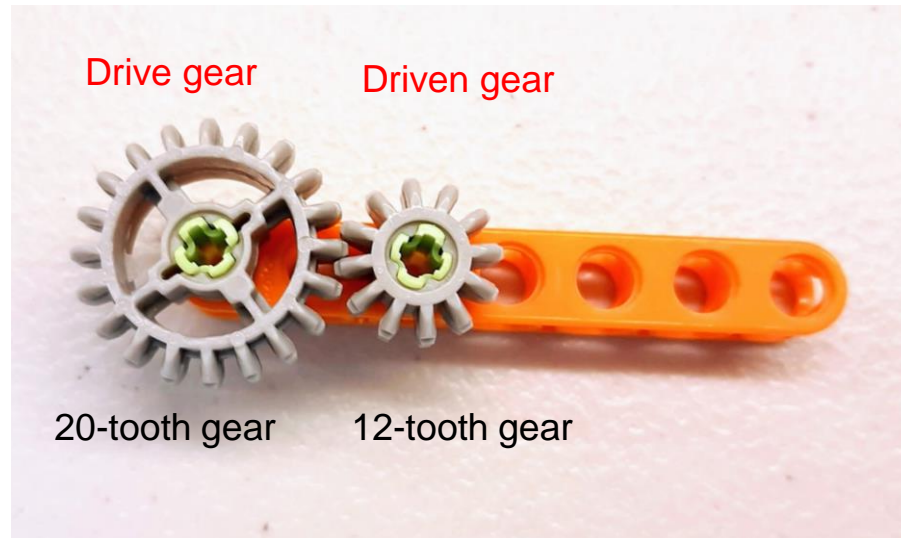
Question 2 - Reference Answer

If the 20-tooth gear rotates 3 turns, how many times the 12-tooth gear will rotate?

A. 1.5

B. 5

C. 1.8

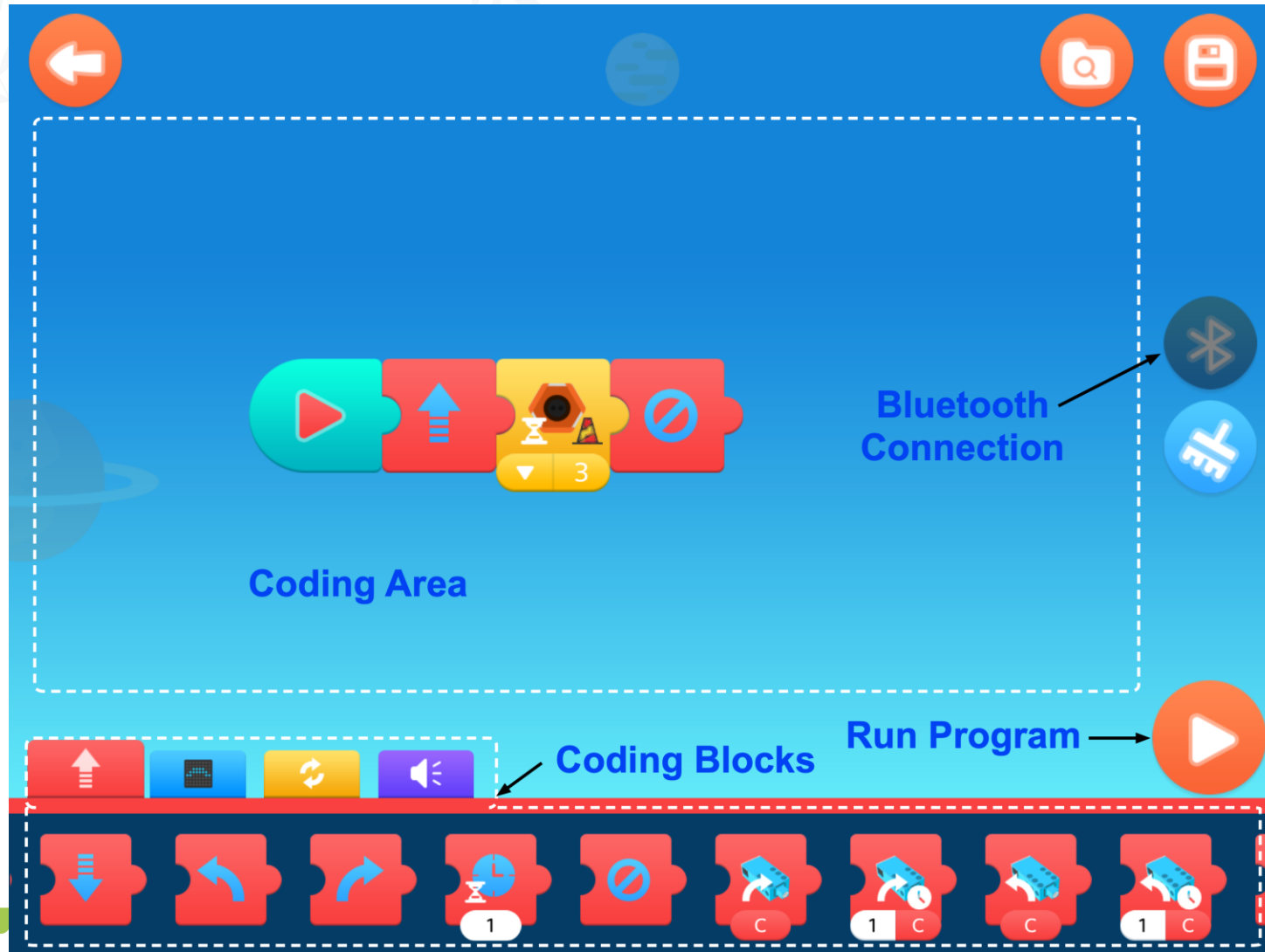




Part 3: Sensor-triggered Fan



Mobile WhalesBot APP (Graphical Coding) Interface



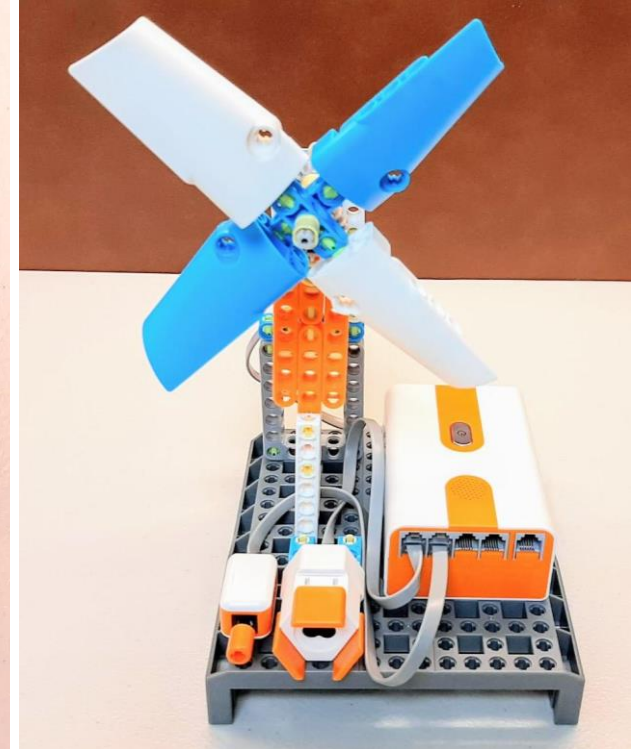
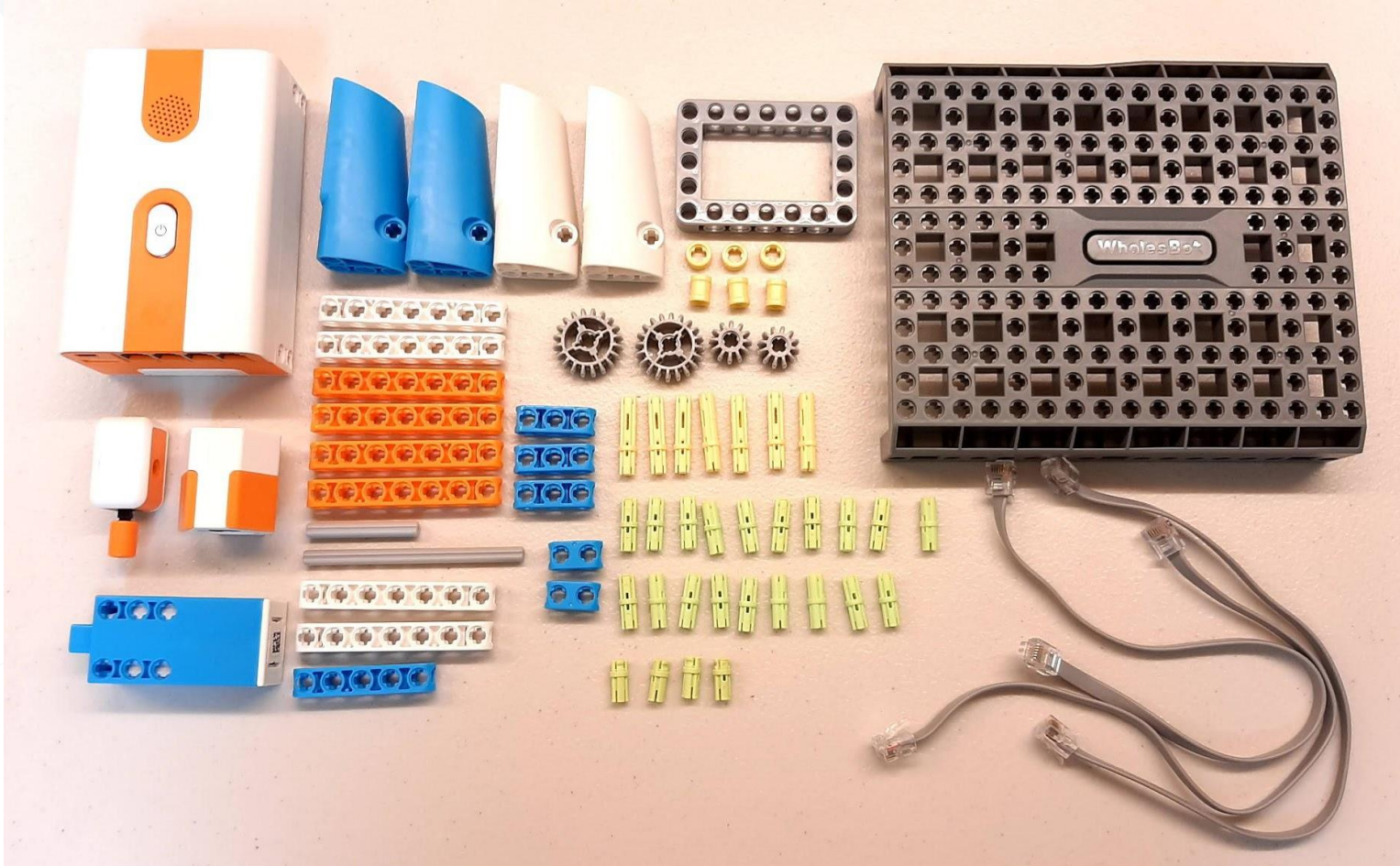
Mobile WhalesBot Scratch Interface

The image shows the Scratch interface for a project named "MC 101". The interface is divided into several sections:

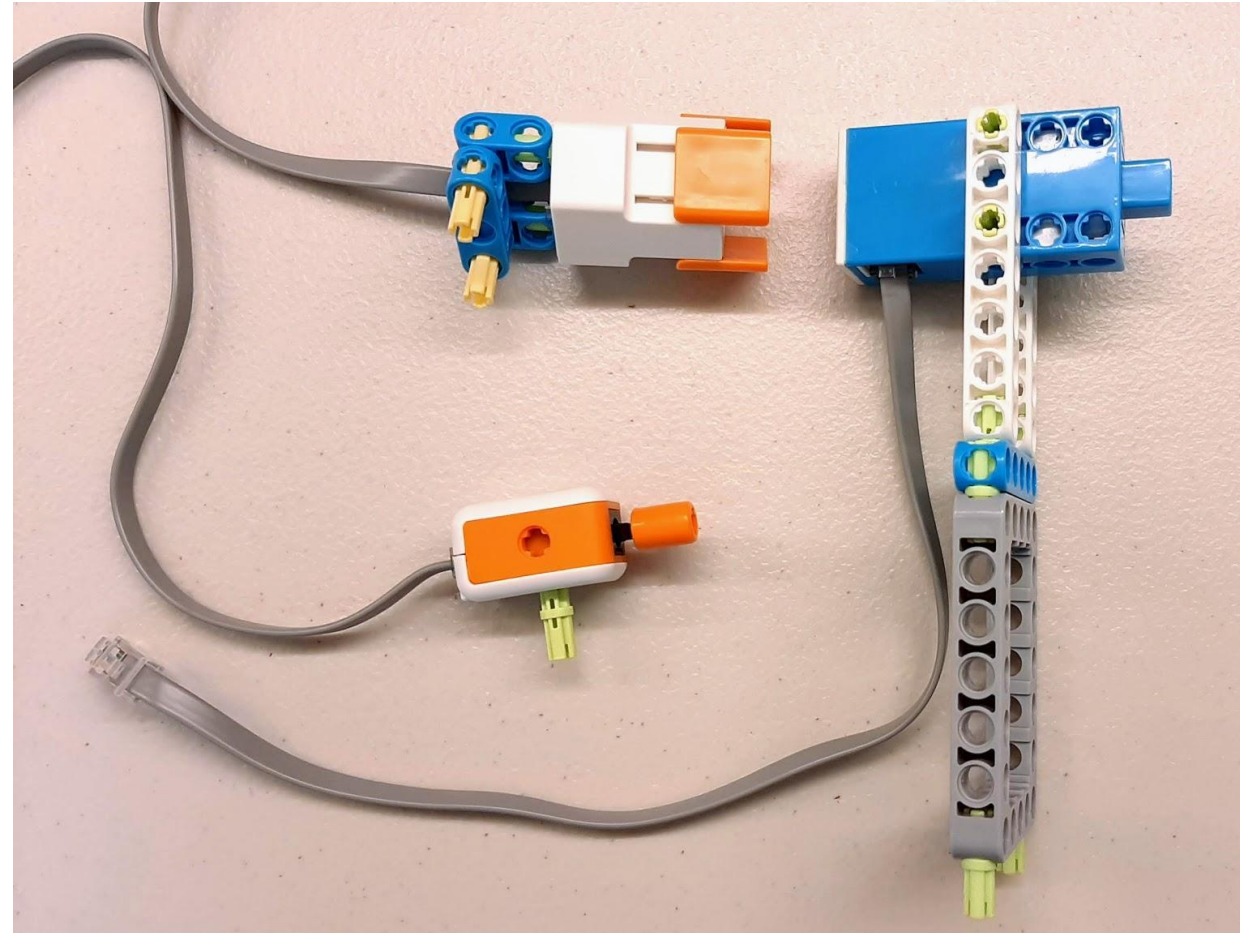
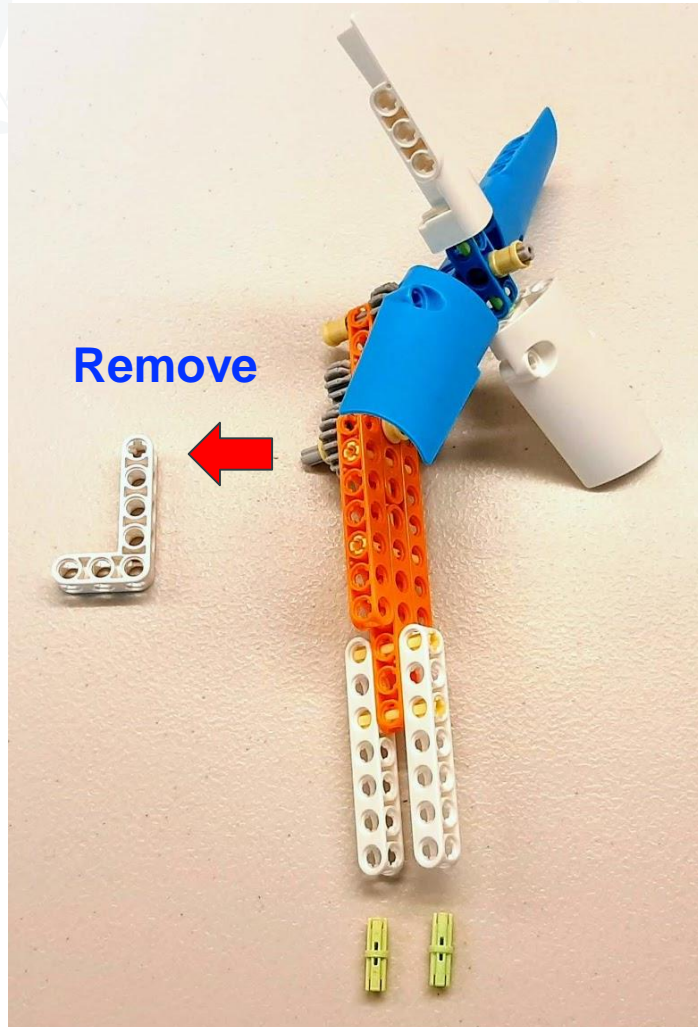
- Coding Blocks:** A vertical sidebar on the left contains categories: Motion, Light Speaker, Sensor, Event, Loop, Logic, Math, and Variable.
- Coding Area:** The main workspace contains a script:

```
when green flag clicked  
  repeat forever  
    if touch switch 1 pressed then  
      set left motor A right motor B Forward power 30 %  
    else  
      stop left motor A right motor B
```
- Bluetooth Connection:** A panel on the right side of the coding area, titled "Bluetooth Connection", is currently inactive. An arrow points to the Bluetooth icon in the top right corner of the Scratch window.
- WhalesBot:** A watermark logo of a whale is visible in the center of the coding area.
- Run Program:** A large orange play button is located at the bottom right of the interface.

Sensor-triggered Fan - Finished Model

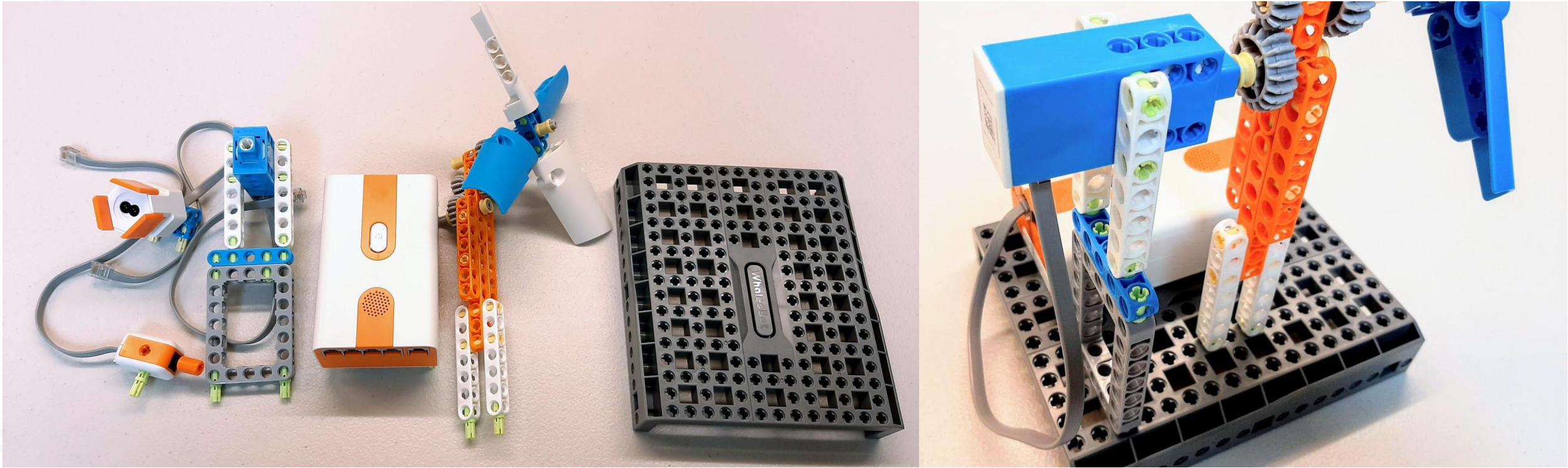


Sensor-triggered Fan - Part A



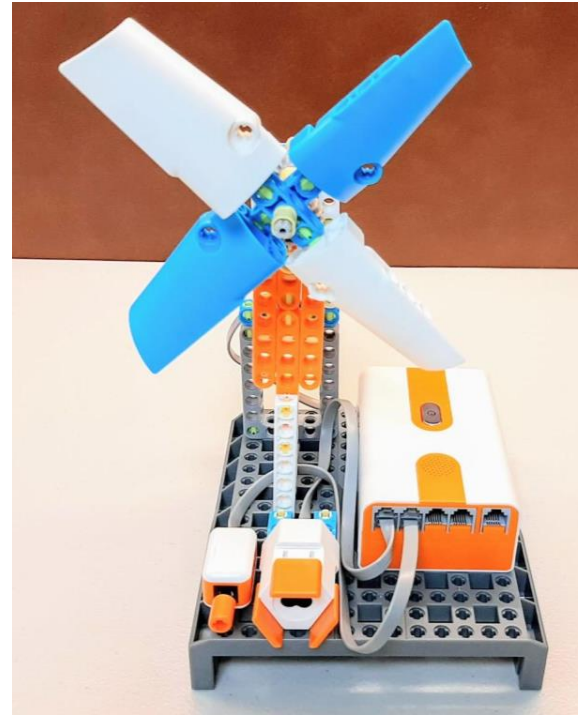
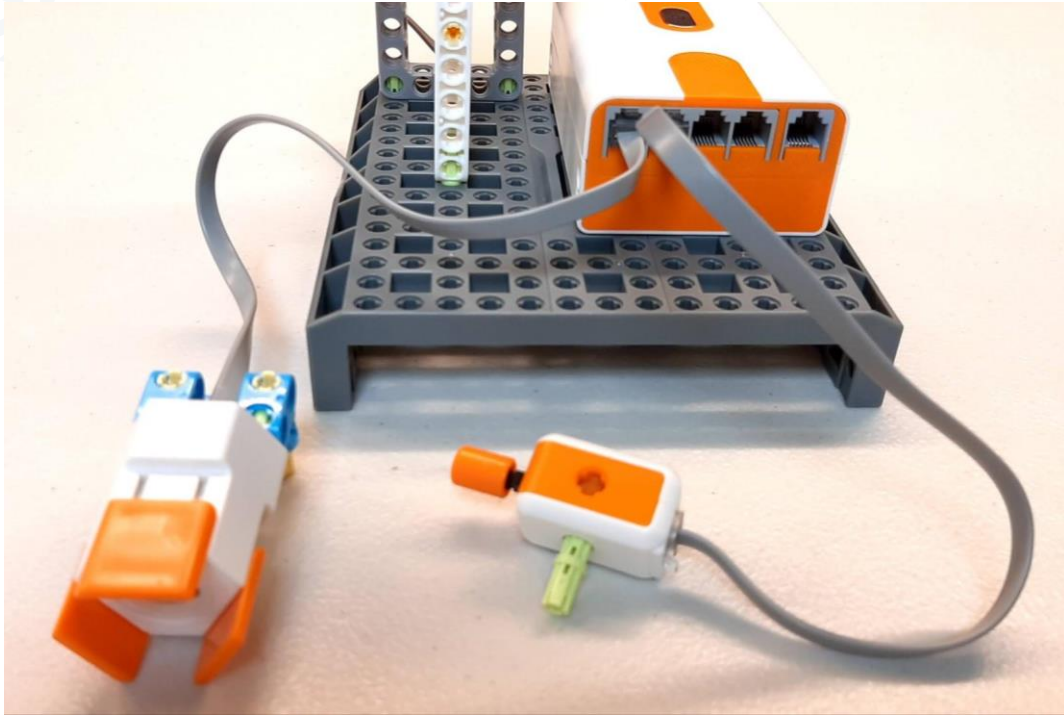
Prepare motor and infrared sensor and touch sensor.

Sensor-triggered Fan - Part B



Connect the fan, motor and sensors.

Sensor-triggered Fan - Part C



Connect sensors to port 1 and 2.



Live Demo:

Alternating-direction Fan

By Graphical Coding





Live Demo:

Infrared Sensor-triggered Fan
By Mobile WhalesBot Scratch



Question 3

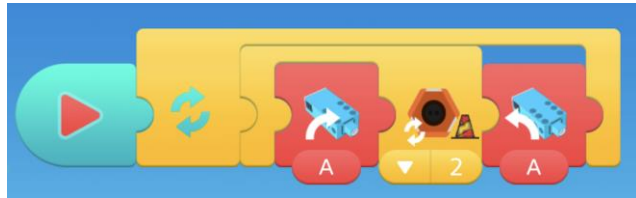
Please complete in Corelab

If you wish to make fan to rotate clockwise at first, when infrared sensor detects obstacle, it rotates counter-clockwise, and the fan will repeat the same action. Which of the following is correct?

A.



B.



C.



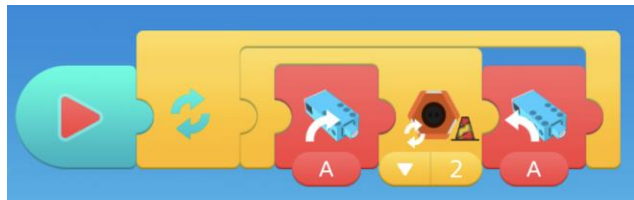
Question 3 - Reference Answer

If you wish to make fan to rotate clockwise at first, when infrared sensor detects obstacle, it rotates counter-clockwise, and the fan will repeat the same action. Which of the following is correct?

A.



B.



C.



Question 4

What of the following is correct about the program?

- A. If touch switch is pressed, motor A will always rotate in the same direction.
- B. As touch switch is pressed, motor A will rotate with 20% and -20% power, the eventual result is motor A will not rotate at all.
- C. If touch switch is pressed, motor A will rotate in one direction, if touch switch is pressed again, motor A will rotate in an opposite direction.

Please complete in Corelab

```
when green flag clicked
repeat forever
  wait until touch switch 1 pressed
  set motor A power 20 %
  wait until touch switch 1 pressed
  set motor A power -20 %
```

The image shows a Scratch script starting with a 'when green flag clicked' event block. This is followed by a 'repeat forever' loop. Inside the loop, there are four blocks: a 'wait until touch switch 1 pressed' block, a 'set motor A power 20 %' block, another 'wait until touch switch 1 pressed' block, and a 'set motor A power -20 %' block.

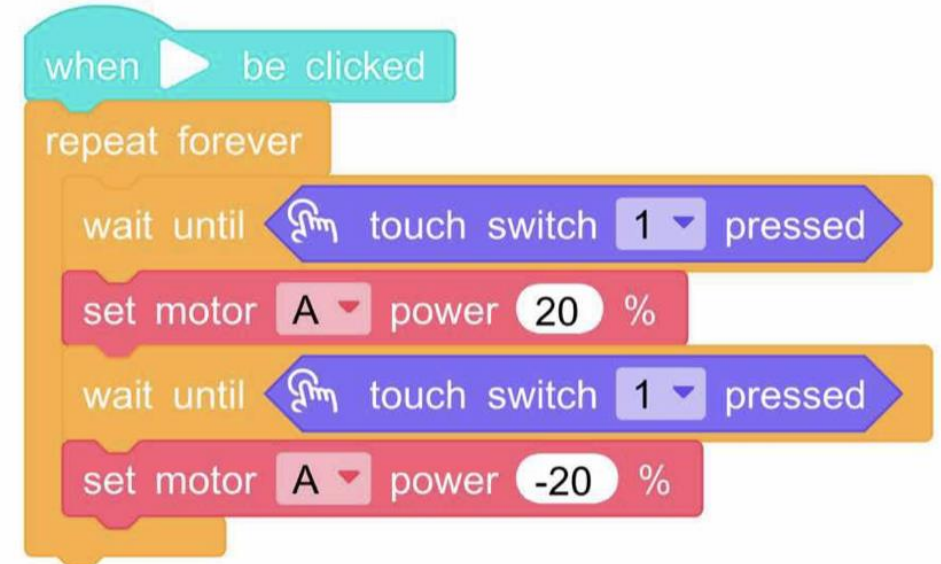
Question 4 - Reference Answer

What of the following is correct about the program?

A. If touch switch is pressed, motor A will always rotate in the same direction.

B. As touch switch is pressed, motor A will rotate with 20% and -20% power, the eventual result is motor A will not rotate at all.

C. If touch switch is pressed, motor A will rotate in one direction, if touch switch is pressed again, motor A will rotate in an opposite direction.



```
when green flag clicked
  repeat forever
    wait until touch switch 1 pressed
    set motor A power 20 %
    wait until touch switch 1 pressed
    set motor A power -20 %
```

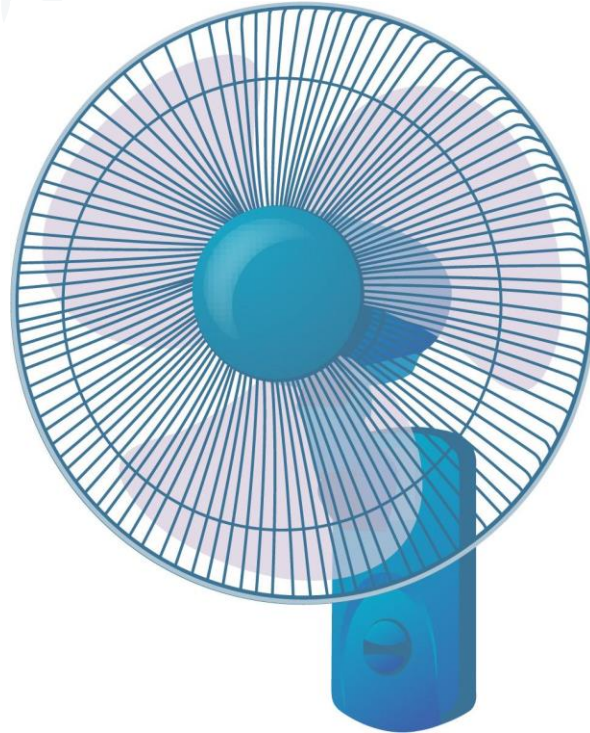
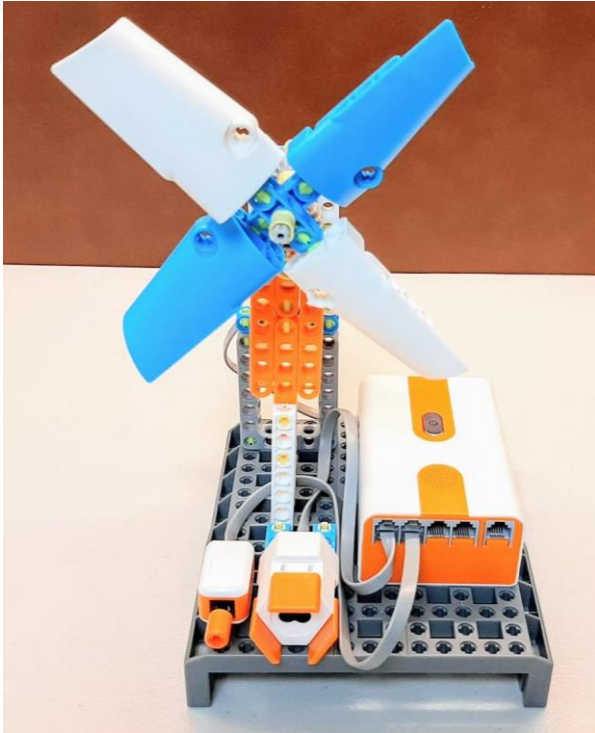
The image shows a Scratch script. It starts with a 'when green flag clicked' event block. This is followed by a 'repeat forever' loop. Inside the loop, there are four blocks: a 'wait until touch switch 1 pressed' block, a 'set motor A power 20 %' block, another 'wait until touch switch 1 pressed' block, and a 'set motor A power -20 %' block.



Part 4: Speed-changing Fan



Current Problem

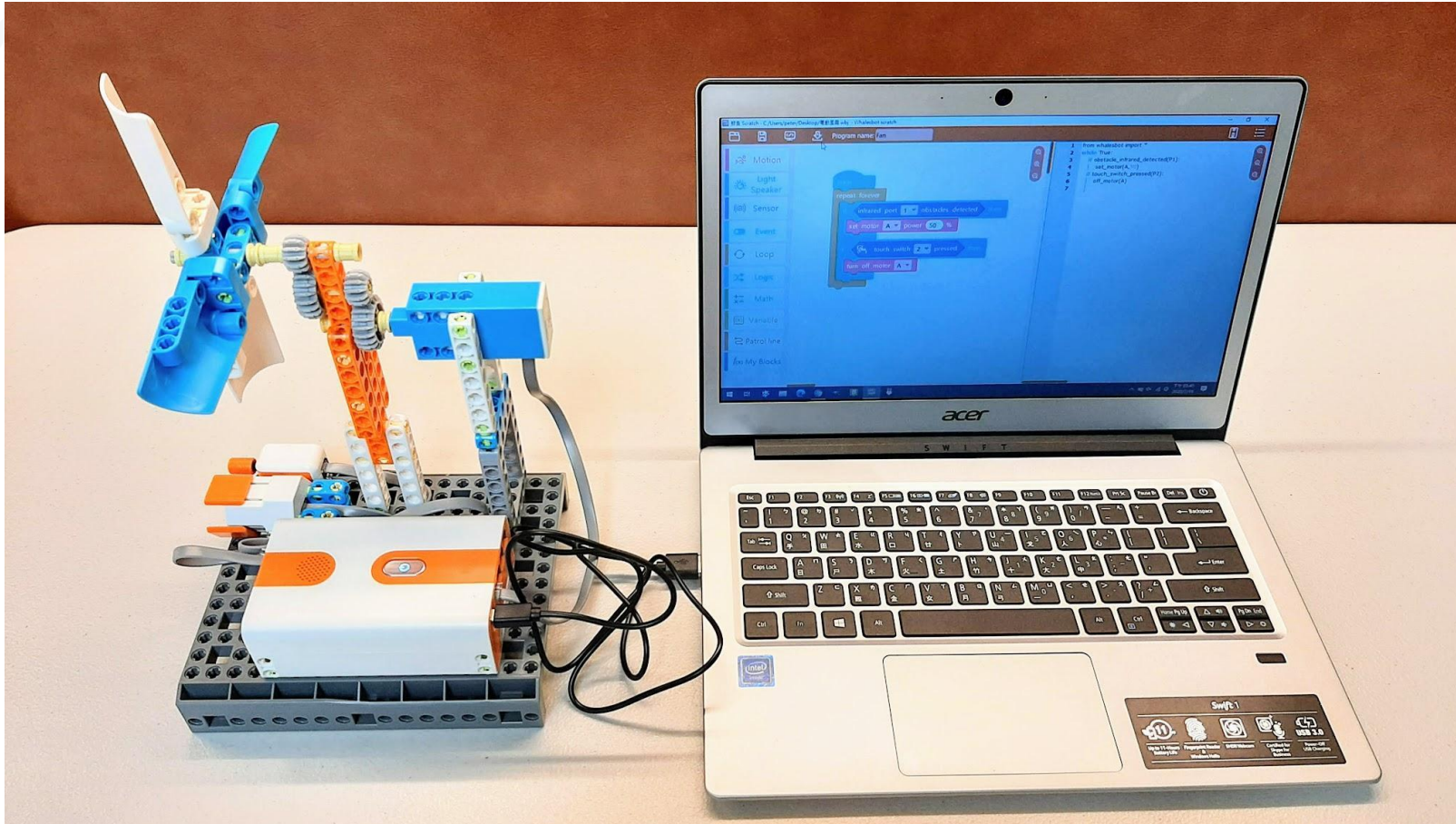


The speed of the sensor-triggered fan is fixed, the electrical fan at home normally have 3 speed modes:

1. slow
2. medium
3. fast

How can we change our program to make our fan able to change speed?

Sensor-triggered Fan and PC WhalesBot Scratch Coding





Live Demo:

Tour on PC WhalesBot Scratch Coding



Live Demo:

How many times we pressed touch switch?

By PC WhalesBot Scratch Coding



Live Demo:

Speed-changing Fan

By PC WhalesBot Scratch Coding



Question 5

Please complete in Corelab

WhalesBot scratch programming software is capable of converting graphical programming language into C-coding or Python by clicking one button on the tool bar. Please select the correct button on the tool bar to make this code conversion.

A. a

B. b

C. c

The screenshot shows the WhalesBot programming environment. On the left, a Scratch script is visible with a 'main' block containing a 'repeat forever' loop. Inside the loop, there is an 'if touch switch 1 pressed' block with a 'repeat' sub-block containing 'set left motor A right motor B Forward power 40 %' and 'set motor A power 20 %'. On the right, a Python code block is shown with the following code:

```

1 from whalesbot import *
2 while True:
3     while touch_switch_pressed(P1):
4         move(move_forward,40)
5         set_motor(A,20)
6

```

Three red arrows point to buttons in the top toolbar: 'a' (Export to Python), 'b' (Export to C), and 'c' (AI).

Question 5 - Reference Answer

WhalesBot scratch programming software is capable of converting graphical programming language into C-coding or Python by clicking one button on the tool bar. Please select the correct button on the tool bar to make this code conversion.

A. a

B. b

C. c

The screenshot shows the WhalesBot Scratch programming environment. The top toolbar contains several icons, with a red arrow labeled 'a' pointing to the 'Export' icon. The central workspace displays a Scratch script with a 'main' block, a 'repeat forever' loop, an 'if touch switch 1 pressed' condition, and two 'set motor' blocks. The right side of the interface shows a Python code editor with the following code:

```

1 from whalesbot import *
2 while True:
3     while touch_switch_pressed(P1):
4         move(move_forward,40)
5         set_motor(A,20)
6

```

A red arrow labeled 'b' points to the 'Python' button in the top toolbar. On the left, the block palette has an 'AI' button with a red arrow labeled 'c' pointing to it.



Thank You !

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