DFROBOT
DRIVE THE FUTURE

The Adventures of Vortex: Return to the Planet DF

WhenDo ProgramingTutorial for Vortex

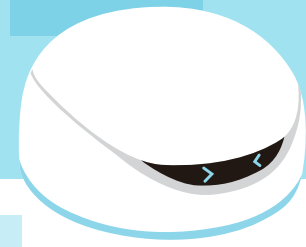
Foreword

“

We believe that parents are the best teachers.

The aim of this tutorial is to introduce you to WhenDo’s visual programming interface. We hope that parents will join in with their kids on this tutorial. We have designed it as a story about Vortex’s adventures in order to introduce WhenDo to kids in an entertaining, engaging way.

We hope that by using WhenDo, your kids will be able to experiment and have fun as they program the actions of Vortex.



Meet Vortex

Profile

Name:	Vortex
Planet of Birth:	Planet DF
Date of Birth:	November 2015
Height:	2.5 Inches
Weight:	0.57lbs
Favorite Color:	Orange
Favorite Sport:	Soccer and Sumo Wrestling

What is WhenDo?

Using WhenDo makes it easier than ever to get creative with code and develop your programming abilities! WhenDo is an intuitive visual programming app that uses building blocks of code to make programs. WhenDo uploads to Vortex wirelessly and is also compatible with other DFRobot kits. Uploading your own programs to Vortex will make him truly unique!

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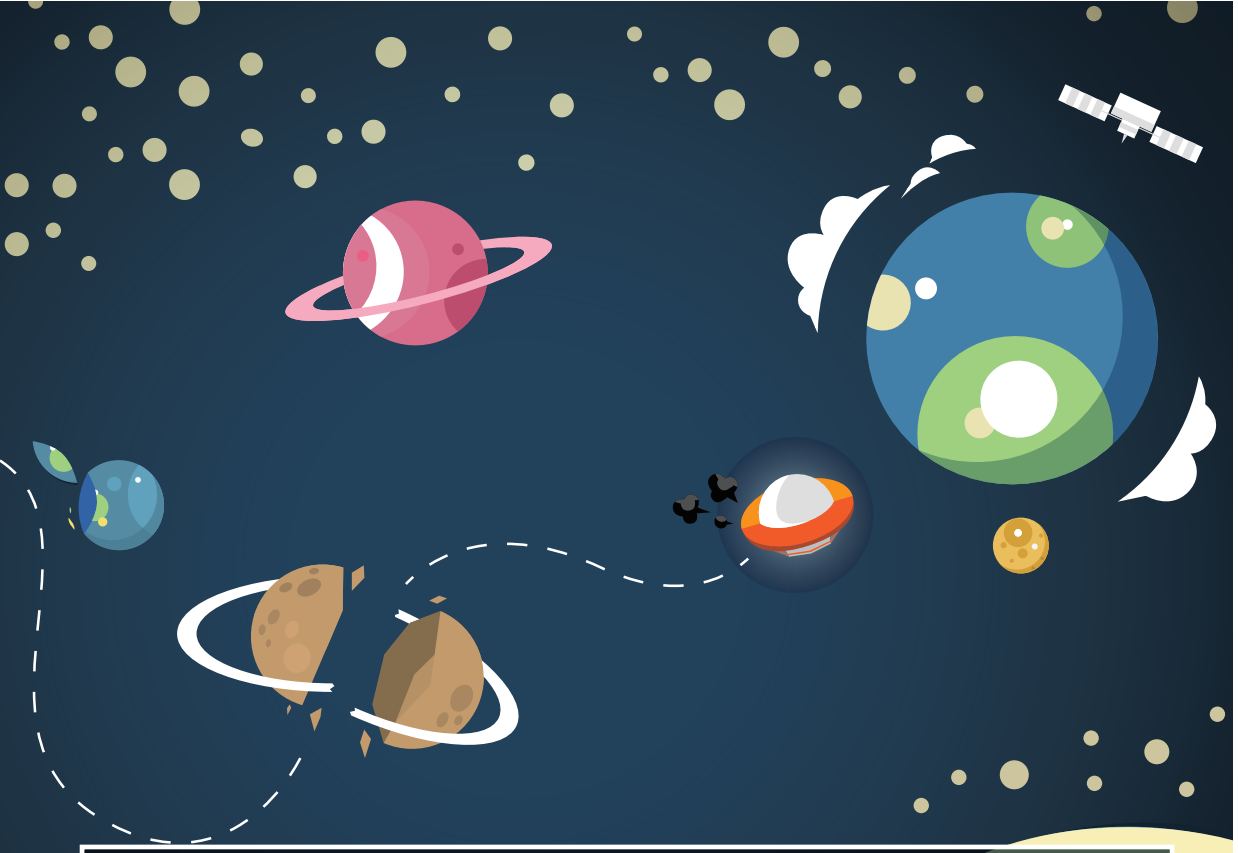

1. Adventures in Space

Vortex lives on the Planet DF. He likes travelling through space very much. One day, as he approaches the solar system, something goes very wrong with his spaceship!

Please Note

Using the WhenDo app to upload new programs to Vortex will overwrite his default settings, which will prevent him from running the VortexBot games.

To re-enable the VortexBot control, simply restore him to factory settings.

Read Page-41 for more details about restoring factory settings.

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Download WhenDo from the App Store

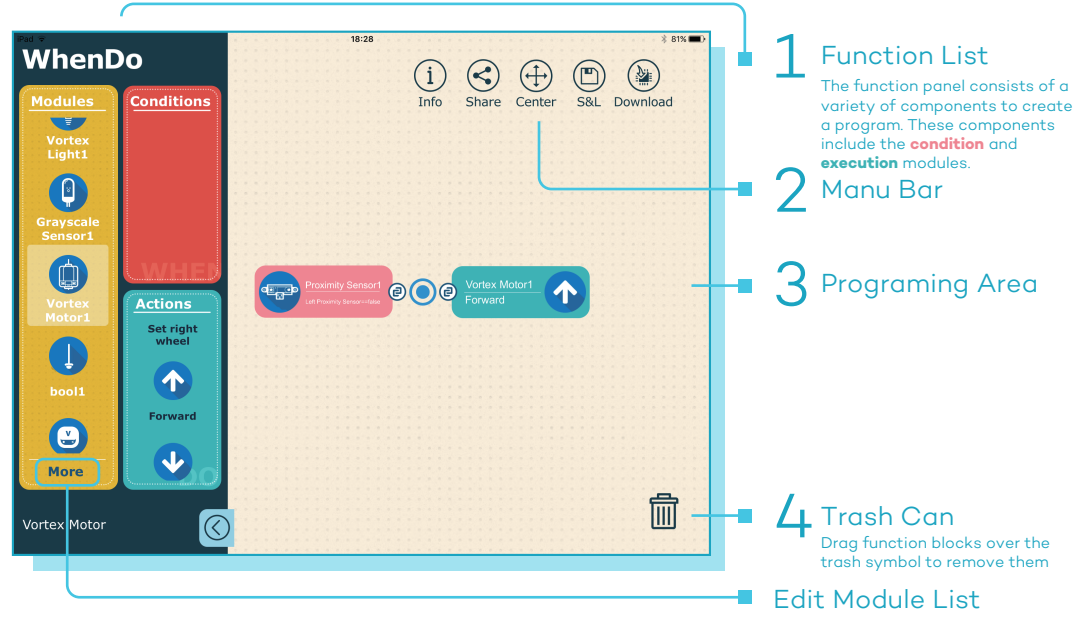
iOS users can go to the App Store, search “WhenDo” app and download.

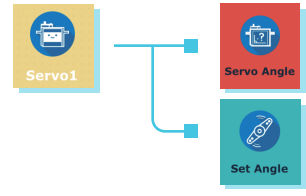
Available on the App Store

The following devices are available:
iPad 3, iPad mini2, iPad Pro

To enter the programing interface for Vortex, open WhenDo and select “Vortex”.

WhenDo’s Interface





The function list includes a Module list, a Condition list and an Action list.Users can drag function blocks from the function list and build programs. Each module may correspond to multiple conditions or actions. Make sure the right type of function is used when building a program.

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2. Emergency Landing

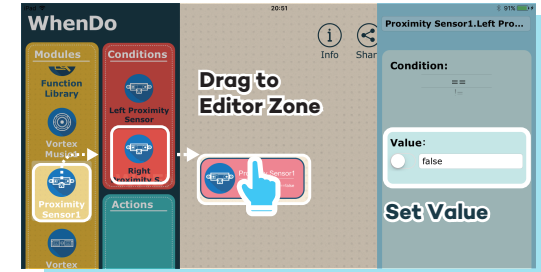
Vortex decides to make an emergency landing. He crashes on the surface of a strange planet, leaving his ship badly damaged and knocking him out!

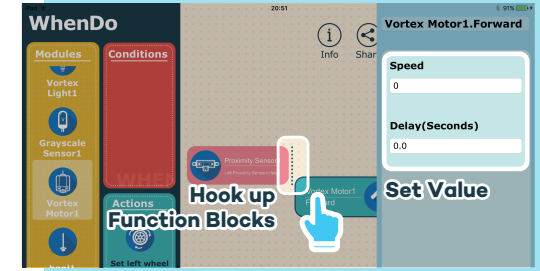
Build a WhenDo Program

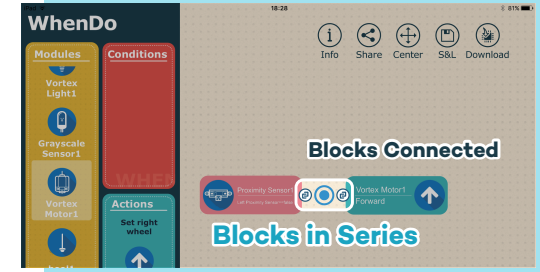
Select a module from the Module list, depends on its function, drag out Condition or Action blocks to the programming area. A pop-out window will appear where you can set the parameters for each function. You can also activate the pop-out window by double tapping a function block.

You can hook different function blocks together. A blue dot will appear connected function blocks.

Read Page 36 for more details about building a WhenDo program.







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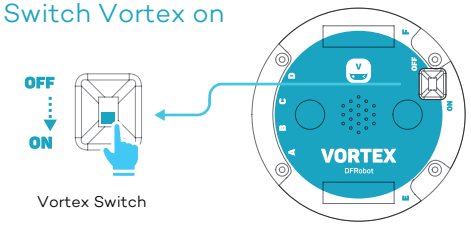
Upload a WhenDo Program to Vortex

To run programs, we need to upload them to Vortex.

1. Preparation

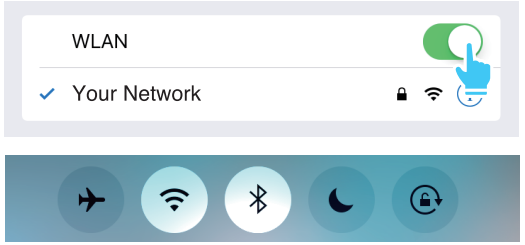
WhenDo uploads programs to Vortex via Bluetooth. Uploading also requires an internet connection.

1. Switch Vortex on



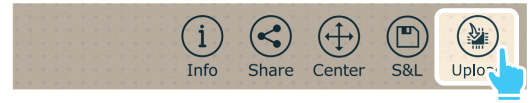
2. Enable Bluetooth

3. Attach iPad to Internet

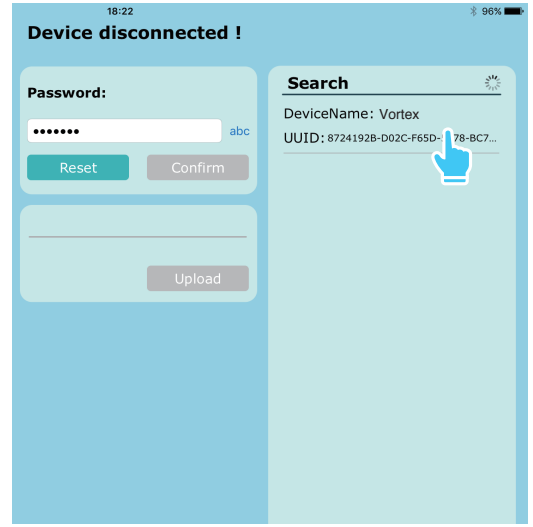


2. Pair up Vortex with iPad

Tap the "Upload" icon in the Menu bar



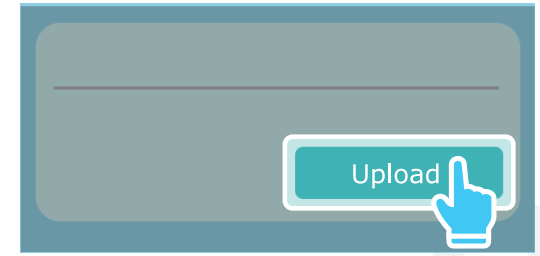
Your device will scan for available connections. When you see "Vortex" select it and they will pair.



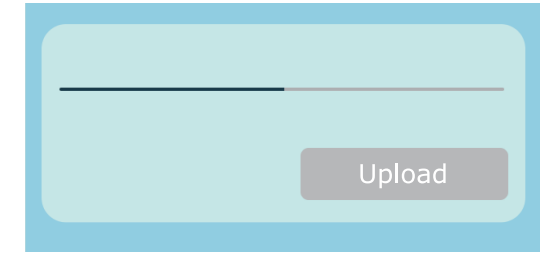
3. Upload a Program to Vortex

When Vortex is connected to your device, tap "Confirm"

Tap "Upload" to start uploading

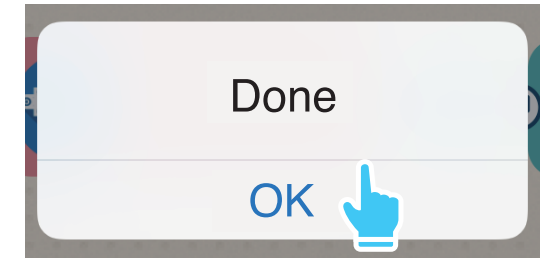


The "Upload" button will be greyed out during an upload.



4. Done Uploading

After the program has been successfully uploaded, a confirm window will pop up



Note:
Do not make any change to the program during uploading.

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3. Revival

After some time, Vortex wakes up battered and bruised. He checks the controls of his spaceship and finds that it can't take off. What will he do?

We are going to use Action blocks to program Vortex to wake up.

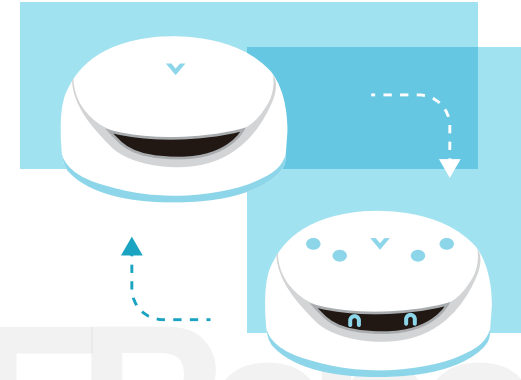
Action Blocks

Green colored blocks are Action blocks. Action blocks perform an action, such as turn a light on or off, activate a motor, or even perform calculations.

Tips:
Know more about WhenDo, pleaser refer to: Page 35-WhenDo programming interface.

Goals

Program Vortex to keep his top lights turning on , make him open his blue smiling eyes for 2 seconds, then close them for 1 second. This sequence repeats over and over again.



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Example Program

Here is an example program which will wake Vortex up. Try adjusting the parameters for each block to see what will happen.

Settings	Description
Vortex Eyes 1 — Set Expression Mix Red: False Expression Number: 11 Mix Green: False Delay(seconds) : 2.0 Mix Blue: True Vortex Eyes 1 — Close Expression Duration(seconds): 1.0	The first Action block displays the Expression 11 on vortex's front LED panel. 2 seconds later, the second Action block turns off the display and delays 1 second till the program runs into the next loop.
Vortex Light 1 — Set Top Light-Blue Duration(seconds): 2.0	This Action block turns on Vortex's top blue lights*.

Tips:
Know more about WhenDo, pleaser refer to: P38-Uploading to Vortex

* You may notice that Vortex's top lights will not turn off after 2 seconds. Here is the explanation. Once the program runs through an Action block, it first changes the status of the module then delays for a certain time till the program hits the next function block. The status of the first module will not be changed again unless a following Action block does so. Therefore, to set the duration, always remember to add a turn off Action block. this mechanism is critically important in understanding programing.

Modules

Module	Sample Function Block	Settings	
Vortex Eyes	Vortex Eyes 1 — Expression On Expressions On Displays an eye expression and then delays for a set duration.	Mix Red / Mix Green / Mix Blue / Result	Sets the color of Vortex's eyes
		False / False / True	A color palette is a combination of red, green, blue, it produces colors.
		False / True / False	
		True / True / False	
		True / False / True	
		Expression Number	Vortex's expression is set by choosing a number between 0–32.
		Duration (seconds)	Sets delay after Vortex's expression is turned on.
	Vortex Eyes 1 — Expression Off Turns off Vortex's eye expressions and then delays for a set duration.	Duration (seconds)	Sets delay after Vortex's expression is turned off.
Vortex Light	Vortex Light 1 — Top Blue Lights on Turns on Vortex's blue top lights and then delays for a set duration.	Duration (seconds)	Sets delay after Vortex's top lights are turned on.

Extra Activities

1. Vortex has a total of 32 different expressions he can show with his eyes. Try using different expression numbers to find out what expressions he can make!
2. Can you make Vortex's top lights flash on and off? Try to make Vortex's top lights flash in a sequence of different colors.

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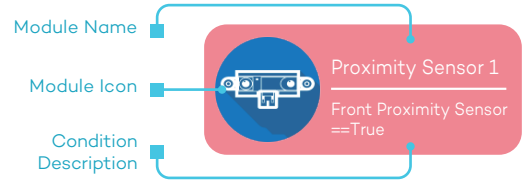
4. Stranded on a Strange Planet

After looking around, Vortex decides to climb to the very top of moutain so that he can send an SOS signal to his friends back home.

In this chapter, we will use Condition blocks to program Vortex to make him react to hand gestures.

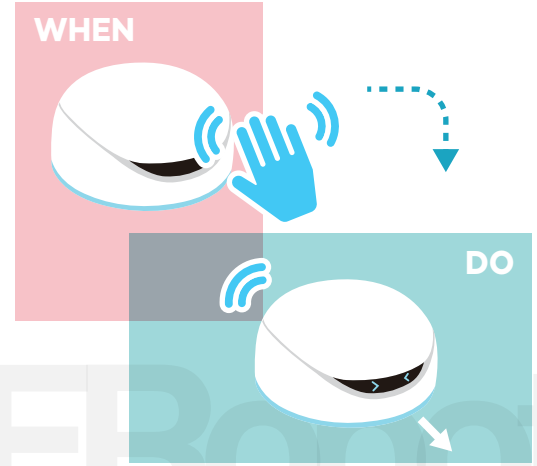
Condition Block

In WhenDo app, red blocks are Condition blocks. They read values from modules and make decisions for Vortex.



Goals

In this program we want Vortex to detect objects in front of him. When he detects an object, he will open his eyes and move forward.



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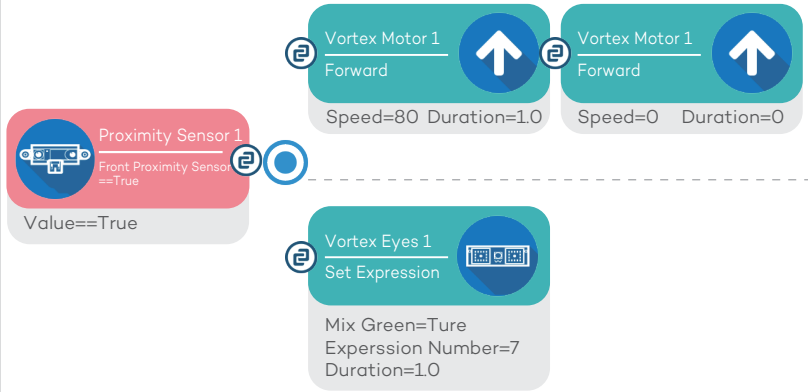
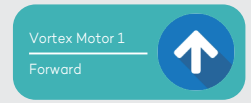
Example Program

This is an example program with detailed parameters for waking up vortex through hand gestures.

Settings	Description
	When an object is detected ahead, Vortex moves forward at speed 80 for 1 second and then stops. When an object is detected ahead, Vortex displays eye expression 7.

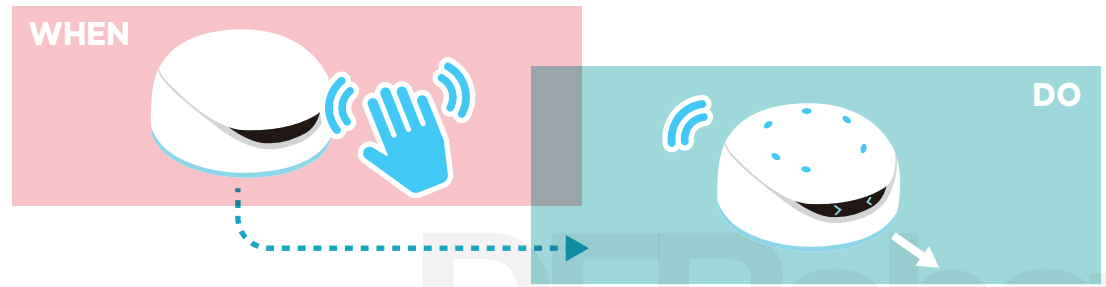
Note:
Parameters provided in the example program can be adjusted to meet specific needs.

Modules

Module	Sample Function Block	Settings		
 Vortex Proximity Sensor	 Makes a decision out of two possibilities: true or false.	Return Value (true / false)	If an object is detected, the module returns "True". If no object is detected, the module returns "False".	
 Vortex Motor	 Activates a motor for a set duration and then delays for a set duration.	Speed (0-255)	Sets the speed of the motor. Motor speeds range from 0 (off) to 255 (fastest).	
		Duration (seconds)	Sets delay after the motor has activated.	

Extra Activities

Can you program Vortex to turn on his top lights when he detects an object in front of him? You can use the example as a guide.



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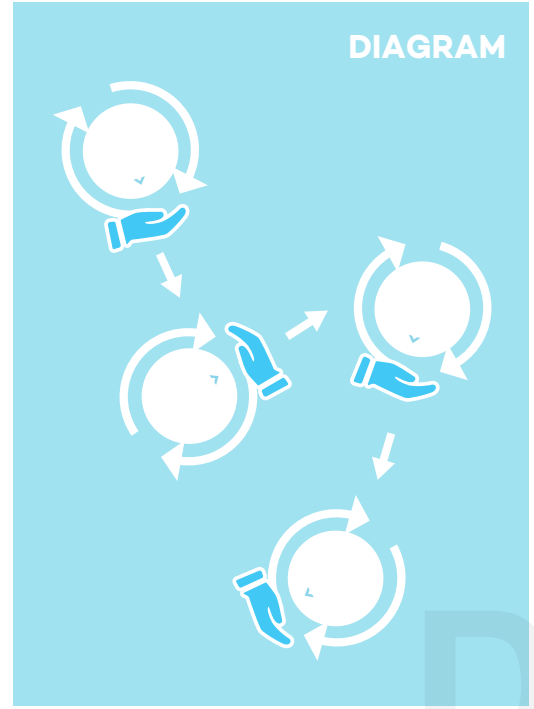
5. Vortex Meets The Fox Family

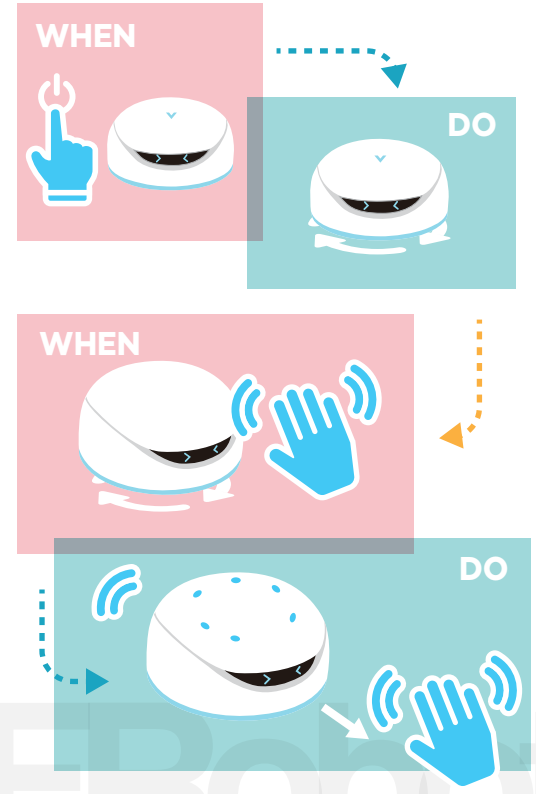
As Vortex climbs the winding paths of the mountain, he feels very tired and lost. He feels like he will never reach the top! Suddenly, he hears rustling in some nearby bushes. A red furry head pops out. It's a fox! " Hello! We are the Fox Family. We live on this mountain. Are you lost? We can help you find your way!" Vortex smiles with relief as he follows his new friends up the mountain.

In this chapter we will program Vortex to follow an object.

Goals

1. Vortex will spin around on the spot until he detects an object.
2. If he detects an object, he will move towards it and turn on his top lights.





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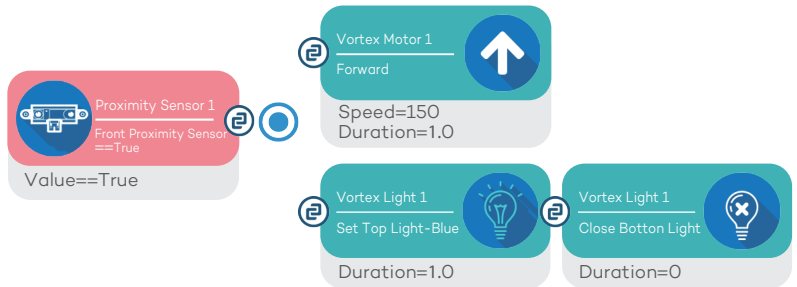
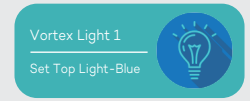
Example Program

This is an example program with detailed parameters for guiding vortex through hand gestures

Setting	Description
	When nothing is detected, Vortex spins counter-clockwise at speed 60.
	When an object is detected Vortex will turn on his top lights and move forward at speed 150 for 1 second, and then turn off his top lights.

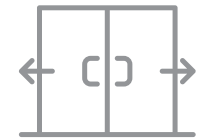
Tips: Because very routine will be executed repeatedly, set the Duration of Turn Left to 0.1 will remove the delay of motor action and increase the sensitivity of proximity sensor.

Modules

Module	Sample Function Block	Settings	
Vortex Light	 Turns on Vortex's blue bottom lights and then delays for a set duration	Duration (seconds)	Sets delay after Vortex's bottom lights are turned on.
	Turns off Vortex's blue bottom lights and then delays for a set duration.	Duration (seconds)	Sets delay after Vortex's bottom lights are turned off.

Extra Activities

Do you find this similar to automatic doors
When no one goes by, the door stays closed.
When someone goes by, the door opens.
Now, try to list other applications in daily life which apply the same mechanism.



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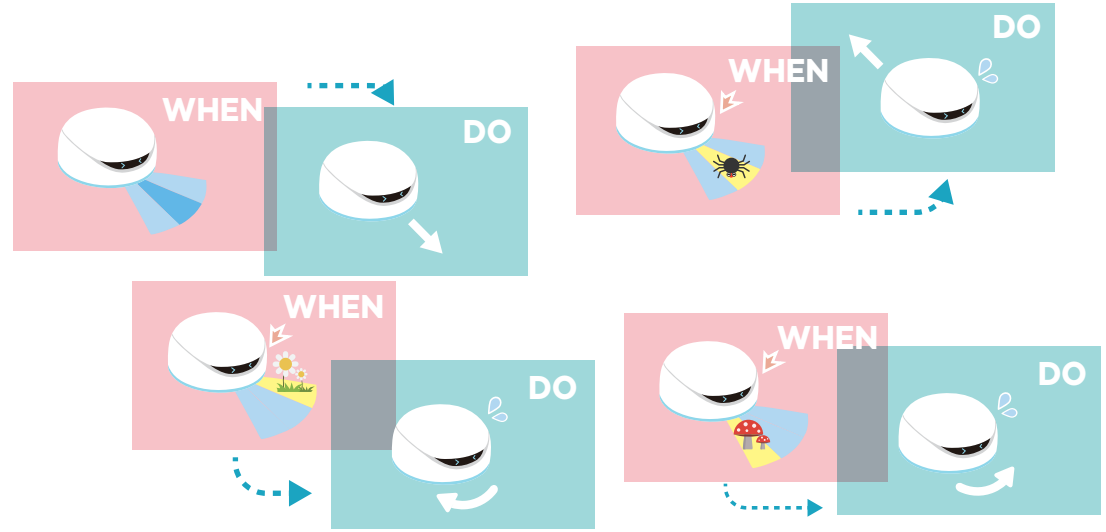
6. Sneaking Through The Forest!

The Fox family leads Vortex to a big green forest full of sleeping animals. Vortex must be very quiet, or he might wake them! Vortex remembers his obstacle avoidance mode. He activates it and begins carefully moving through the sleeping forest.

In this chapter we will program Vortex to avoid obstacles so that he can move through the forest without waking any animals.

Goals

When Vortex senses an object in his path he will avoid it by changing direction.



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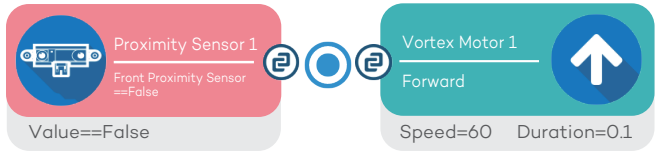
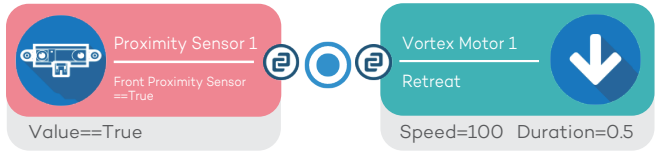
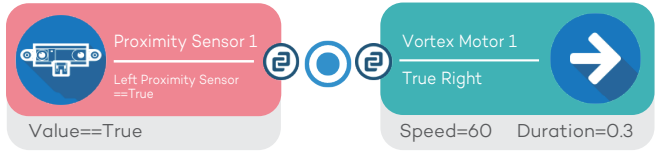
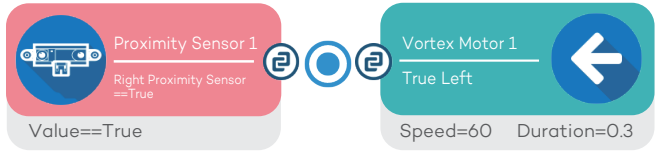
Example Program

Setting	Description
	Vortex will keep moving when nothing is detected.
	Vortex will move backward when objects are detected in front of him.
	Vortex will turn right when objects are detected ahead of him to the left.
	Vortex will turn left when objects are detected ahead of him to the right.

Extra Activities

1. After programming, Children are advised to repeat their programming process to their parents. Please write it below.

2. Explain why vortex can avoid obstacles.

3. In previous chapters we have introduced the Vortex Eyes module and the Vortex Light module.
Try to adjust the obstacle avoidance program so that:
a. Vortex shows an eye expression when he moves forward
b. Vortex's bottom lights turn on when he avoids objects

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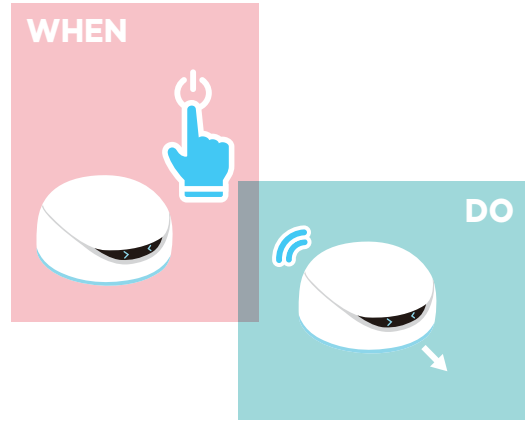
7. Land of the Moles

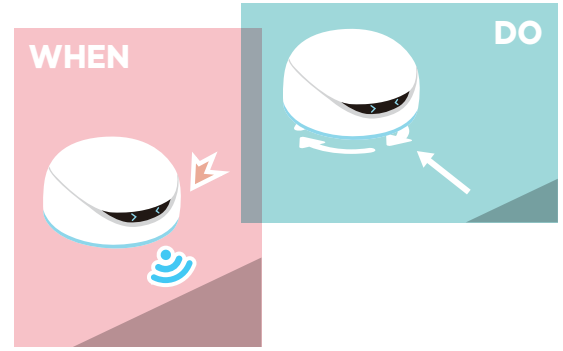
Vortex continues his adventure to the top of the mountain. He finds a big field full of holes in the ground. Suddenly, a head pops out of one of the holes. It's a mole! "Be careful!" says the mole "You might fall in to one of our holes!" Vortex turns on his grayscale sensors and moves slowly and carefully so that he doesn't fall in to any mole-holes.

In this chapter we will program Vortex to avoid gaps.

Goals

If Vortex finds a gap in the surface he is moving on, he will reverse and change direction.





Note:
1. The sample program is designed base on **white color** surface.
2. Falling from a high surface may cause damage to Vortex. Adult supervision is recommended for this activity.

Tips:
The gap avoidance function requires the Bool module.
Read page 40 to find out how to add modules to the module list.

Bool Module

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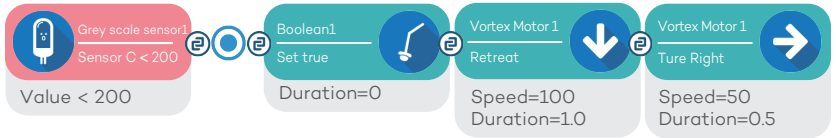
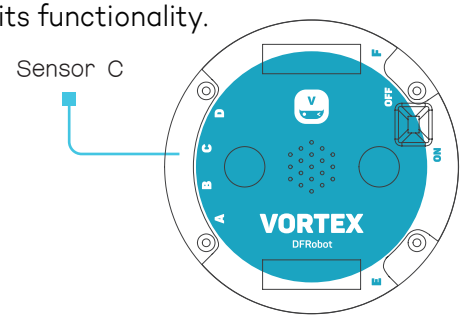
Example Program

Settings	Description
	When there is no gap detected (return value of grayscale sensor C bigger than 400), Vortex keeps moving forward at speed 70.
	When gaps are detected (return value of the grayscale sensor C less than 200), Vortex moves backward at speed 100 for 1 second , then spins to the right.

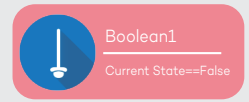
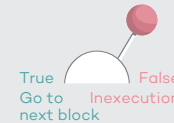
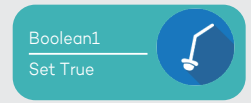
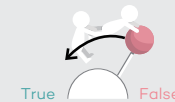
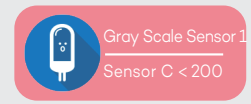
The function of Bool module is to switch between 2 action status.

Note:

Sensitivity of the grayscale sensor may various due to environment.
Further calibrations may be needed to optimize its functionality.



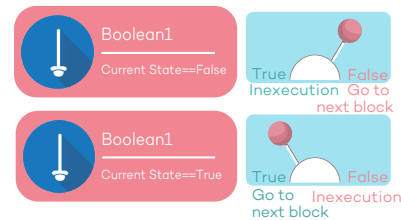
Modules

Module	Sample Function Block	Settings		
Bool	 A bool condition block checks a variable and then makes a decision based on the result.	Current State	Example: Value==true If the position of the switch is True, Go to next Block.	
	 Sets the value of a Boolean variable as true.	Duration (seconds)	Sets delay after the bool variable is set.	
Grayscale Sensor	 Reads value from the gap sensor underneath Vortex.	Logical Statement == != >= >= < <= Value (0-255)	Sets logical statement with threshold return value.	

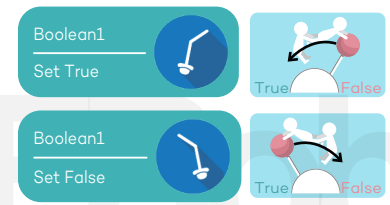
More Details about Bool Module

More Details about Bool ModuleA Bool variable only has 2 status, which are “true” and “false”. its function can be understood as an electric switch which switches the program between 2 tracks.

Bool Condition block reads the position of the switch and makes decisions.



Bool Action block simply sets the position of the switch.



8.Returning Home

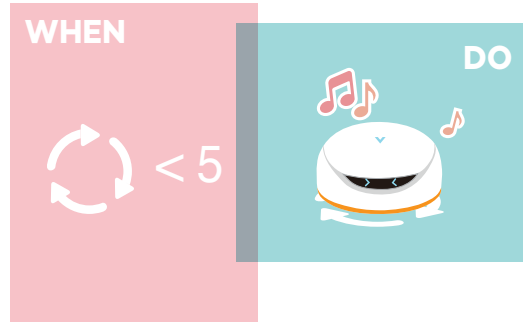
Vortex arrives at the top at the mountain late at night. He is very tired after his long journey, but grateful for all the friends that helped him along the way.
He dances and sings with joy. Then he turns on his bottom light to send an SOS signal to his friends on the Planet DF.
Soon, a big orange spaceship flies in to view. It's Vortex's friends! They beam him up in to the spaceship and then fly off in to the distance.
Vortex is on his way home!

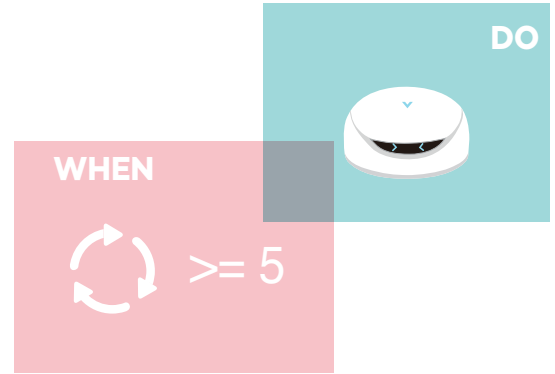
To help Vortex on the final step of his journey, we need to use math modules to build a counter. He needs to send five messages to his friends before they respond.

Goals

We need Vortex to complete the following sequence of actions five times:

Spin on the spot
Turn on his orange bottom light
Play SOS music





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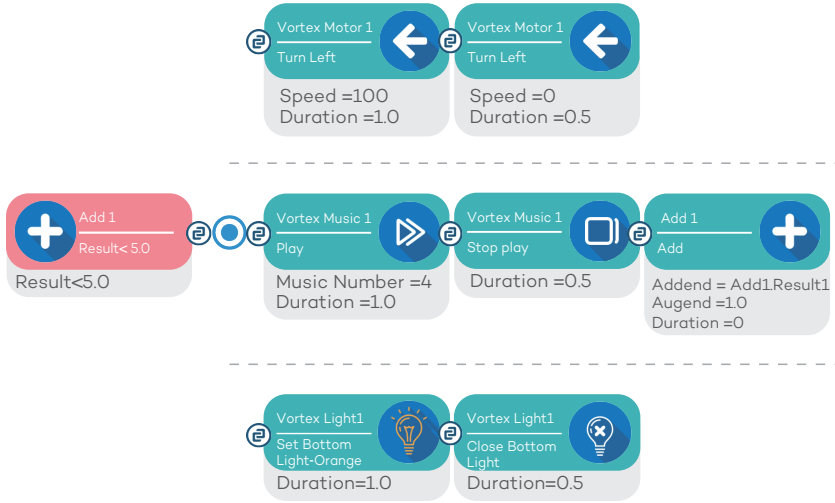
Example Program

Settings	Tips
	When the value of Add1 is less than 5, Vortex spins to the left at a speed of 100 for 1 second. Add1 starts from its default value of 0. At the beginning of each program loop, 1 is added to the counter. After this is added, Vortex plays Music 4 for 1 seconds. When Add1 is less than 5, Vortex turns on his orange bottom light for 1 second.

Modules

Module	Sample Function Block	Settings	
Add	Add1 Add This module will add two values together. You can also insert function blocks in to a value to add the outcome of that function block.	Addend Augend Duration (seconds)	Sets another module value as a value to be added. Sets delay after the operation completes. Link: Vortex Motor2 → Add1 (Result)
	Add1 Result < 5.0 This module makes a decision based on the value that an addition module outputs. Default Value: 0	Logical Statement Value	If the result of the add module meets the set value, the module returns "true". If the result of the add module does not meet the set value, the module returns "false".
Vorte Music Player	Vortex Music1 Play Starts playing music and then delays for a set duration.	Music Number Duration (seconds)	Sets music number (each track corresponds to a number between 0-31). Sets delay after music starts playing.
	Vortex Music1 Stop play Stops playing music for a set duration.	Duration (seconds)	Sets delay after the music stops playing.

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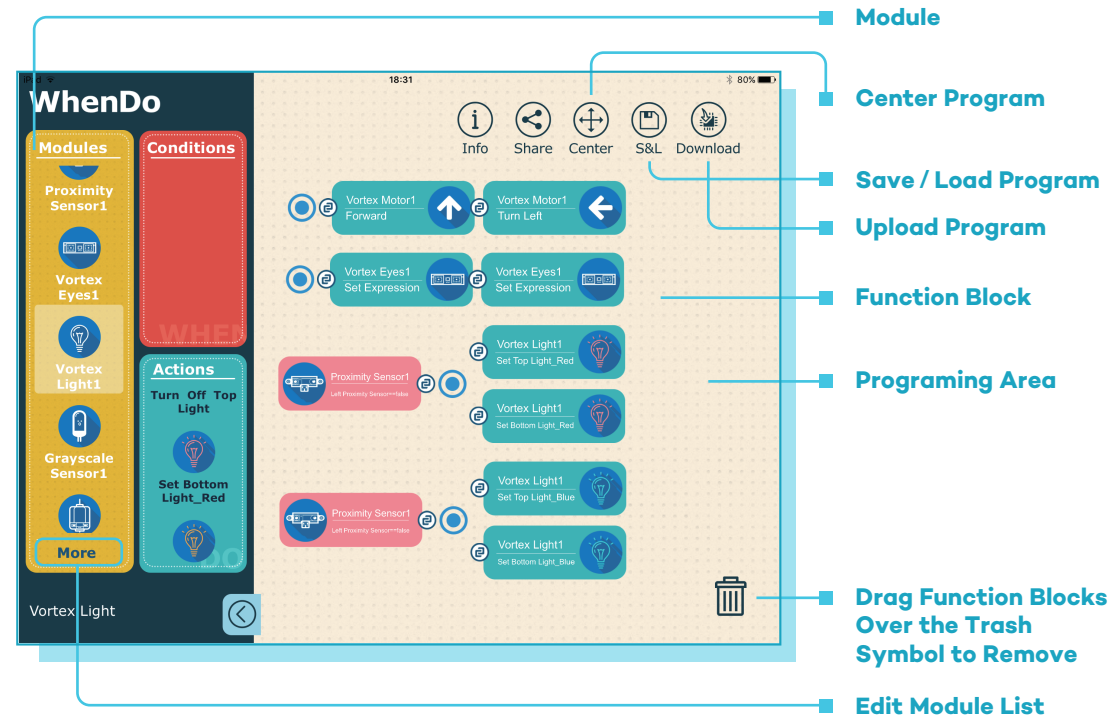
WhenDo

Quick Start Manual

1. WhenDo Programming Interface



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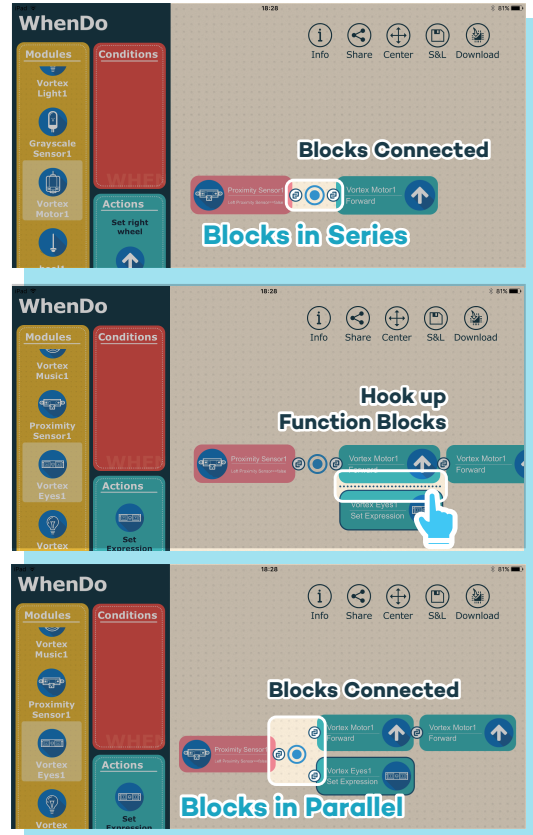
2. Build A WhenDo Program

Basic Program Patterns

Tap to select a module from the module list. Depending on its function, you can drag a function block from either the Condition List or the Action List.



Basic Program Patterns

Blocks in Series

When-Do Pattern

When Condition1 is met, do Action1

Do-ThenDo Pattern

Do Action1 then do Action2

Blocks in Parallel

DoAndDo Pattern

Do Action1 and Action2 simultaneously

When-Do AndDo Pattern

When Condition1 is met, do Action1 and Action2 simultaneously

Note: Functions blocks of the same module connected in parallel may not be logically legitimate.
Example: You cannot set the motor to be moving both forward and backward at the same time.

Combination Patterns

When-Do Pattern

Program will run in a loop

When-Do AndDo Pattern

You may combine both of these patterns and build a program for advanced functions. Likewise, action series connected in parallel will be executed simultaneously

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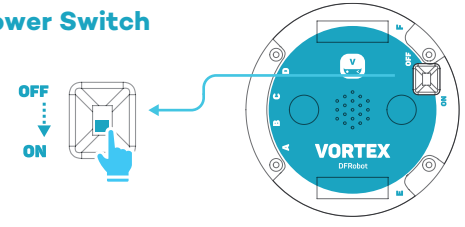
3. Uploading to Vortex

WhenDo uploads programs to Vortex via Bluetooth. You will also need an active WiFi connection to be able to upload.

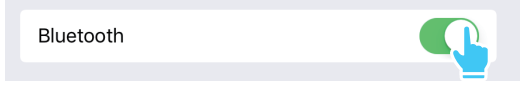
1. Setup Hardware

Switch on Vortex, enable the Bluetooth connection on your device(iPad/iPhone) and make sure it is attached to the Internet.

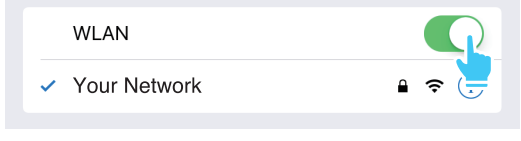
Power Switch



Enable Bluetooth Connection

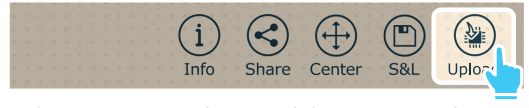


Upload Program

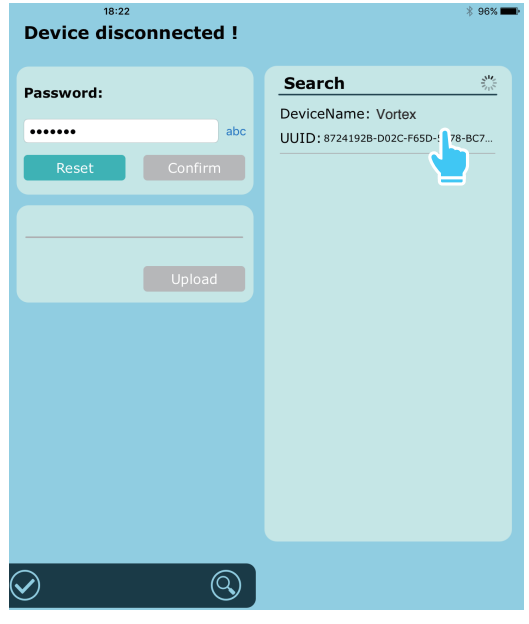


2. Enable Bluetooth

Tap the Upload icon at the top right corner

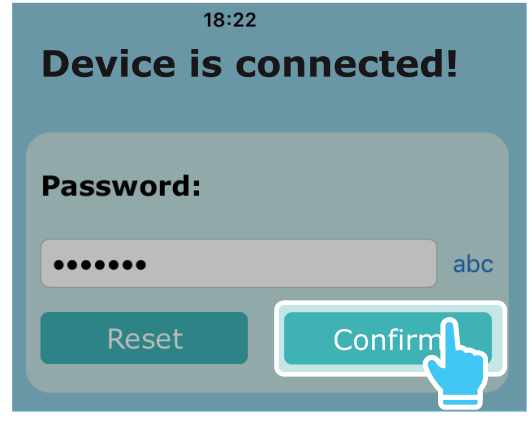


Select "Vortex" in the search list to pair with your device.

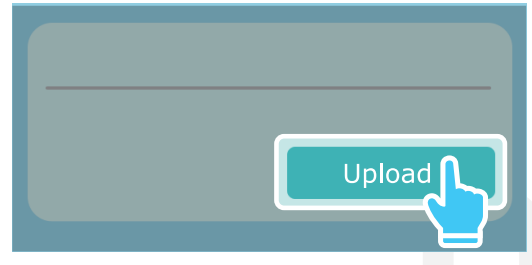


3. Upload Program

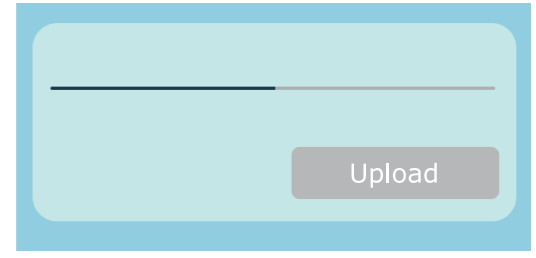
When Vortex is connected to your device, tap "Confirm"



Tap "Upload" to start uploading

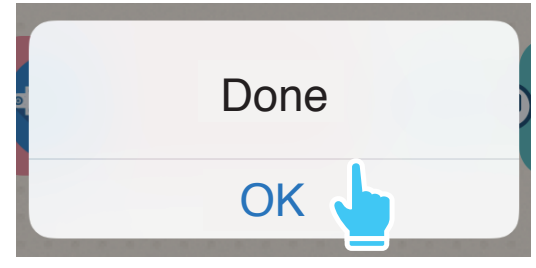


During uploading, the "Upload" button will be marked grayed.



4. Done Uploading

The program has been successfully uploaded.



Restore Password: Click Reset button to restore to default password, if password is forgotton or deleted.

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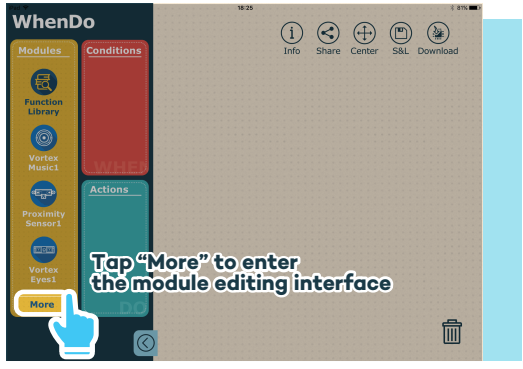
4. Add / Remove Modules

WhenDo has a large module bank which supports a vast amount of functions for different DFRobot kits.The module bank is divided into several categories.To enable different functions, we need to select modules from the module list.

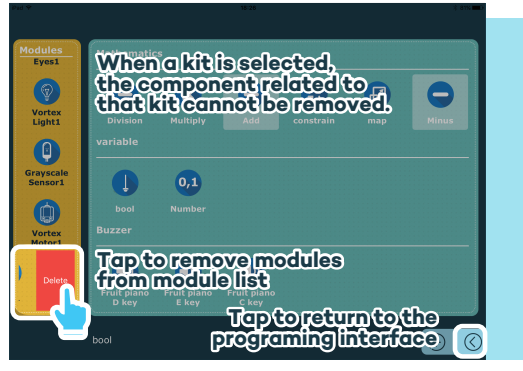
Enter Editing Interface



Add a Single Module

Add Multiple Modules

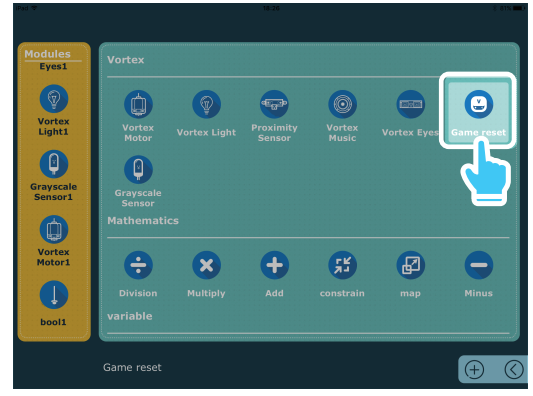
Remove Modules



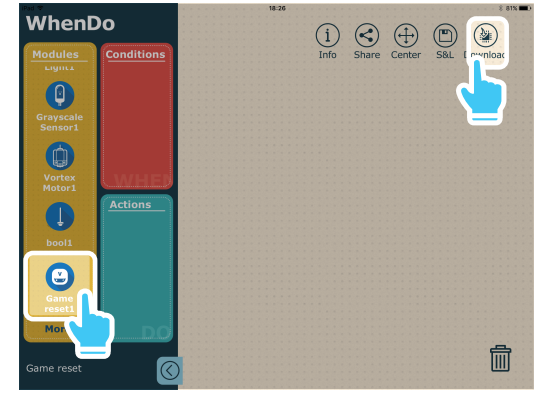
5. Restore Factory Settings

Using WhenDo to program Vortex will overwrite his default program which will disable VortexBot app functionality. To re-enable it, follow these steps:

1. Add "Restore Factory Settings" module to the module list.



2. When the module is on the list, upload any program to restore factory settings (you may leave the programing area blank).



3. After Vortex is successfully restored to factory settings, remove the module to switch the WhenDo app back to programing mode.

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Appendix

WhenDo allows modules to be added to the module list multiple times.If a module has the same function but a different number, it will still function in the same way.

Module	Sample Function Block	Settings				
Vortex Eyes	Vortex Eyes 1 Expression On Expressions On Displays an eye expression and then delays for a set duration.	Mix Red	Mix Green	Mix Blue	Result	Sets the color of Vortex's eyes
		False	False	True		A color palette is a combination of red, green, blue, it produces colors.
		False	True	False		
		True	True	False		
		True	False	True		
		Expression Number		Vortex's expression is set by choosing a number between 0–32.		
		Duration (seconds)		Sets delay after Vortex's expression is turned on.		
	Vortex Eyes 1 Expression Off Turns off Vortex's eye expressions and then delays for a set duration.	Duration (seconds)		Sets delay after Vortex's expression is turned off.		
Vortex Motor	Vortex Motor 1 Forward Activates a motor for a set duration and then delays for a set duration.	Speed (0-255)		Sets the speed of the motor. Motor speeds range from 0 (off) to 255 (fastest).		
		Duration (seconds)		Sets delay after the motor has activated.		

Module	Sample Function Block	Settings	
Vortex Light	Vortex Light 1 Top Blue Lights on Turns on Vortex's blue top lights and then delays for a set duration.	Duration (seconds)	Sets delay after Vortex's top lights are turned on.
	Vortex Light 1 Set Bottom Light-Blue Turns on Vortex's blue bottom lights and then delays for a set duration	Duration (seconds)	Sets delay after Vortex's bottom lights are turned on.
	Vortex Light 1 Close Bottom Light Turns off Vortex's blue bottom lights and then delays for a set duration.	Duration (seconds)	Sets delay after Vortex's bottom lights are turned off.
Vortex Music Player	Vortex Music1 Play Starts playing music and then delays for a set duration.	Music Number Duration (seconds)	Sets music number (each track corresponds to a number between 0-31). Sets delay after music starts playing.
	Vortex Music1 Stop play Stops playing music for a set duration.	Duration(seconds)	Sets delay after the music stops playing.

Module	Sample Function Block	Settings		
Vortex Proximity Sensor	Proximity Sensor 1 Front Proximity Sensor ==True Makes a decision out of two possibilities: true or false.	Return Value (true / false)	If an object is detected, the module returns "True". If no object is detected, the module returns "False".	
Vortex Grayscale Sensor	Gray Scale Sensor 1 Sensor C < 200 Reads value from the gap sensor underneath Vortex.	Logical Statement != >= <= Value (0-255)	Sets logical statement with threshold return value.	
Add	Add1 Add This module will add two values together. You can also insert function blocks in to a value to add the outcome of that function block.	Addend Augend Duration (seconds)	Sets another module value as a value to be added. Sets delay after the operation completes.	**Link** Vortex Motor2 Add1 Result
	Add1 Result < 5.0 This module makes a decision based on the value that an addition module outputs. Default Value: 0	Logical Statement Value	If the result of the add module meets the set value, the module returns "true". If the result of the add module does not meet the set value, the module returns "false".	

Module	Sample Function Block	Settings		
Bool	Boolean1 Current State==False A bool condition block checks a variable and then makes a decision based on the result.	Current State	Example: Value==true If the position of the switch is True, Go to next Block.	True False Go to next block Inexecution
	Boolean1 Set True Sets the value of a Boolean variable as true.	Duration (seconds)	Sets delay after the bool variable is set.	True False

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Vortex User Guide
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