Scratch 2.0 Wireless Programming Guide for Vortex

—DF4Scratch Service Launching Tutorial

Vortex is a programmable robot developed by DFRobot. Based on the Arduino developing platform, Vortex is equipped with Atmega328 Arduino UNO compatible computing unit, motors, an LED matrix, proximity sensors and several other interactive electric components.

Figure (1-1) Vortex robot

With its built-in Bluetooth 4.0 module, Vortex is capable of communicating with various developing tools wirelessly. Among these tools is Scratch 2.0, a user friendly graphical programming development environment developed by Lifelong Kindergarten Group (part of MIT Media Lab).

Using Scratch 2.0, programs can be written by dragging and dropping code blocks in to place, which makes it a perfect learning tool for beginners to programming.
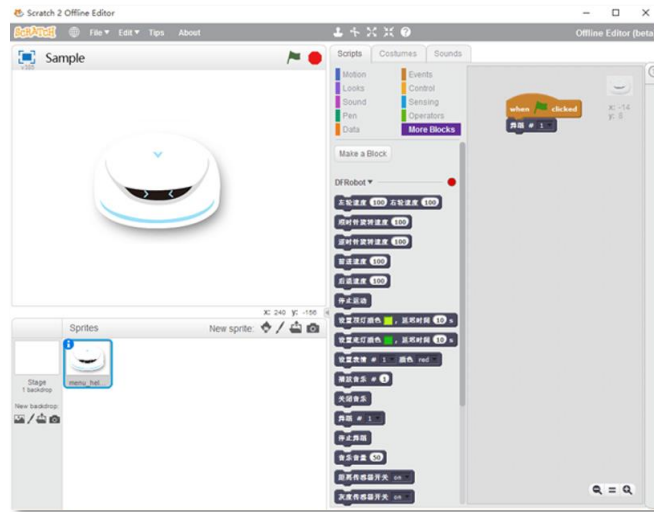
Figure (1-2) Scratch 2.0 programming interface

To add Scratch 2.0 support for Vortex, DFRobot developed "DF4Scratch", a plug-in service that enables wireless communication between Arduino compatible kits and Scratch 2.0.

Figure (1-3) Use Scratch2.0 to program Vortex via DF4Scratch

Preparation

First we need to install software and drivers on to our PC. This step only needs to be done once.

Install Arduino IDE

Arduino IDE (Integrated Development Environment) is used to write programs for Arduino supported hardware. To use Scratch 2.0 as programming tool for Arduino platform, we need to install Arduino IDE first.

Arduino IDE is compatible with Windows, Linux and Mac. However, as DF4Scratch is only currently supported by Windows, this tutorial will walk through the setup for DF4Scratch on Windows 7 or later.

Installation Guide

1. Download the installation package:

Download the latest version of Arduino IDE software from the link below.
Download link: http://arduino.cc/en/Main/Software

Windows Installer
Windows ZIP file for non admin install

Mac OS X 10.7 Lion or newer

Linux 32 bits
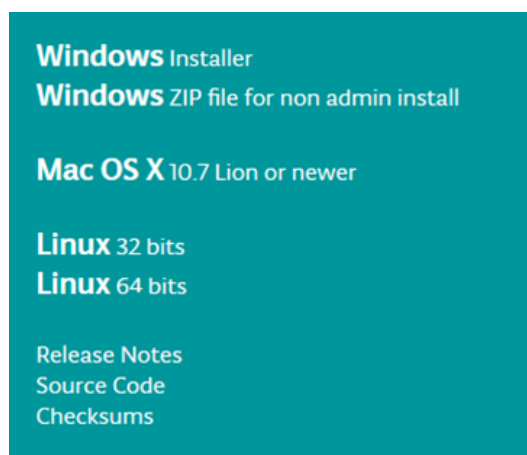**Linux** 64 bits

Release Notes
Source Code
Checksums

Figure (2-1) Arduino IDE download page

You can either download a Windows executable installer (requires installation) or a .ZIP file (no installation required).

2. **Install Arduino IDE:**

For the Windows Installer, run the installer and follow the wizard to finish installation.

For the Windows ZIP file, unzip the file to a directory of your choice and follow the instructions below to manually install drivers.

3. **Install drivers (for Windows ZIP file only):**

Once files are unzipped, open the "drivers" folder in the main directory of Arduino software to install drivers for the Arduino microcontroller. For 32-bit systems, run "dpinst-x86.exe"; for 64-bit systems, run "dpinst-amd64.exe".
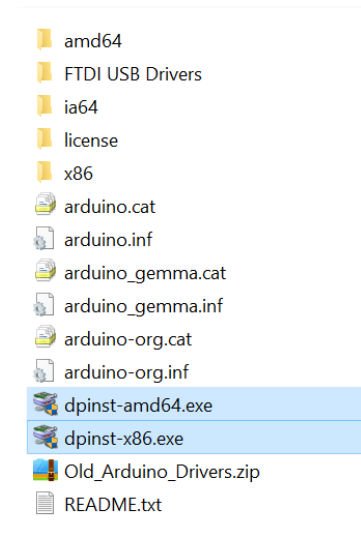

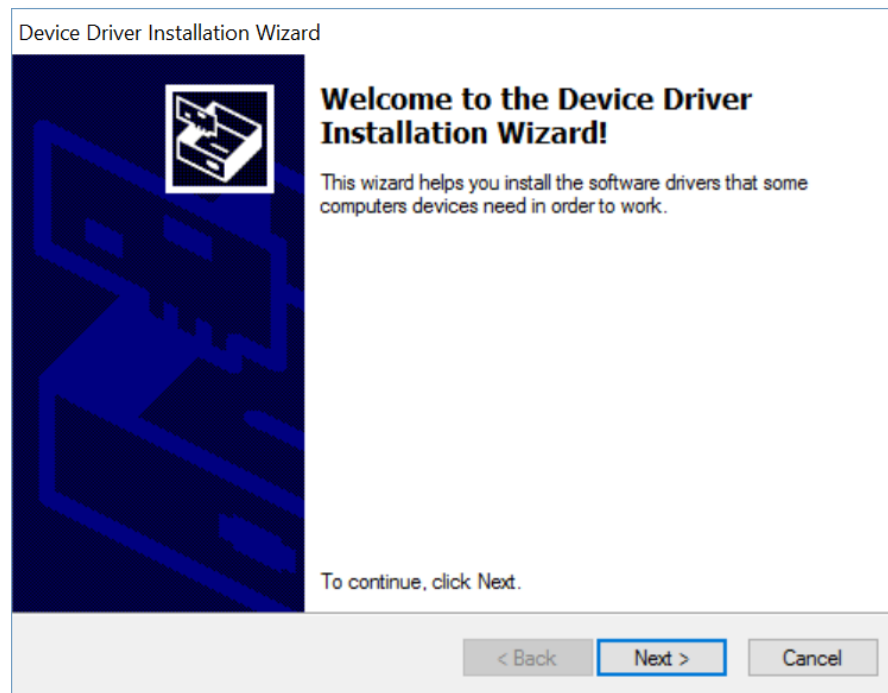*Figure (2-2) Driver installers under the "drivers" directory*

Figure (2-3) Click "Next" to start installation

Figure (2-4) Installation complete

Once the driver is successfully installed, Arduino compatible hardware can be recognized by PC.

Install Scratch 2.0 Editor and DF4Scratch Plugin

Installation Guide

1. **Download the installation package:**

   Download the Scratch 2.0 installer and the DF4Scratch plugin from the link below.
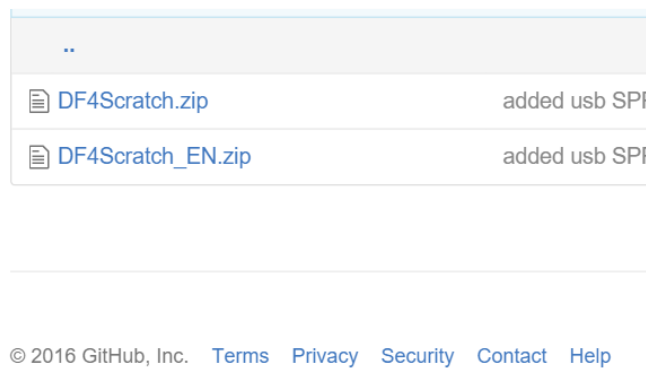
   Scratch 2.0 download link: https://scratch.mit.edu/scratch2download/

   DF4Scratch download link:
   https://github.com/DFRobot/DFResources/tree/master/Vortex4Scratch

   Figure (2-5) DF4Scratch download page

2. **Install Scratch 2.0 :**

   Run file "Scratch 2.0.air. Follow the wizard to finish installation.

    "Scratch2.0.air" needs the "Adobe Air" environment. Follow the link below to install "Adobe Air" .

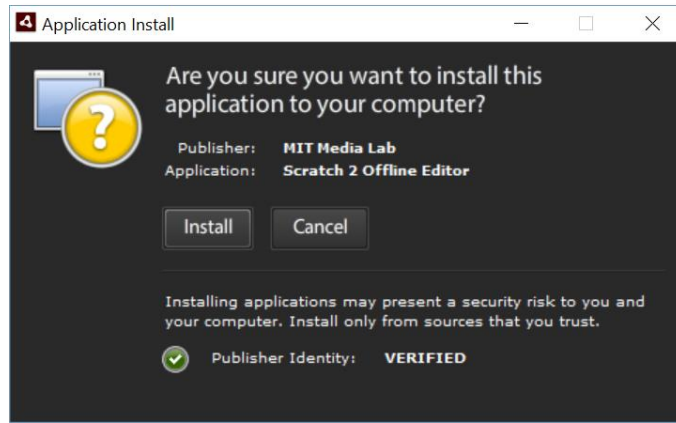   Adobe Air download page：https://get.adobe.com/air/

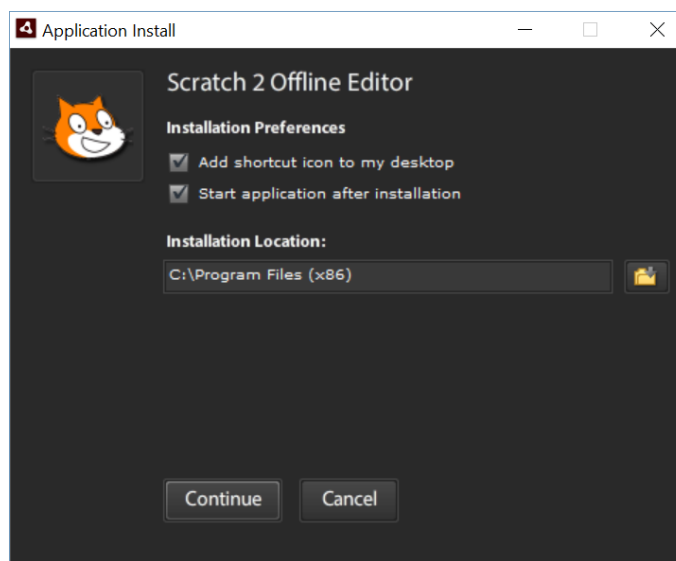*Figure (2-6) Select "Install" to continue*

Figure (2-7) Select installation location (C:\Program Files (x86) by default)
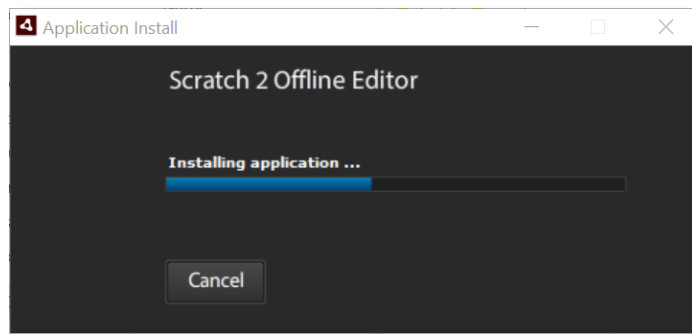
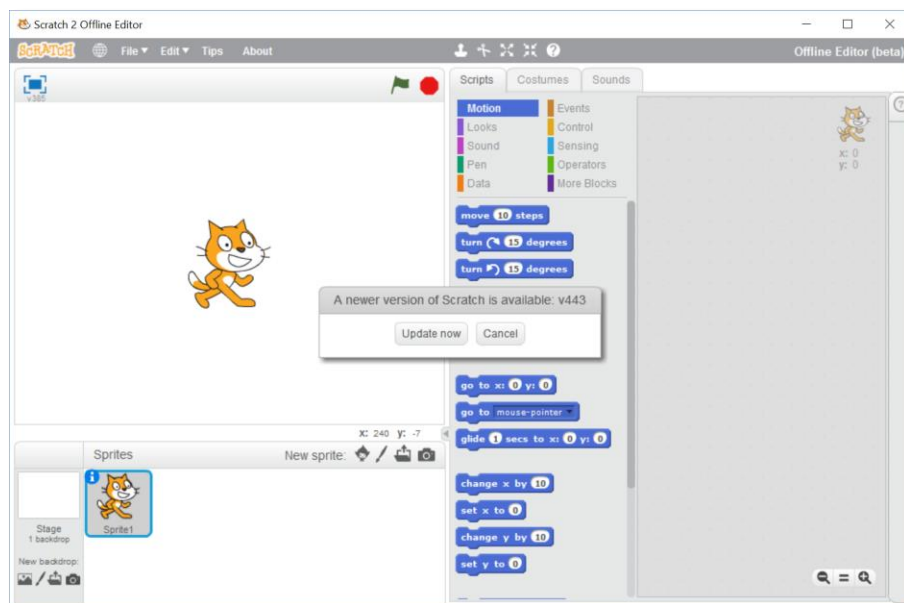*Figure (2-8) Installation in progress*

Figure (2-9) Scratch 2.0 editor will pop out when Installation is complete. You may select "Cancel" to skip the update if prompted.

Once installation is complete, you can close the Scratch 2.0 editor and move to the next steps.

3. Install DF4Scratch Plugin：

Unzip "DF4Scratch_EN.zip" to a folder of your choice. You will need to visit this folder in the "Launch DF4Scratch Service" step.

contents
examples
Arduino Example.sb2
DF4scratch Manual.html
Launch Arduino Communication Service.lnk
Launch Vortex Communication Service.lnk
Stop Communication Services.lnk
Vortex Example.sb2

Figure (2-11) Files under "DF4Scratch" directory

Pair Your Devices

DF4Scratch supports both Bluetooth 4.0 and USB communication between Vortex and PC.

Connect Vortex to PC via Bluetooth (Option A)

Using a Bluetooth connection significantly increases the quality of the user experience as you no longer have to keep Vortex hooked up to a PC to transfer data.

We recommend using the "USB BLE-Link" Bluetooth 4.0 adaptor developed by DFRobot, exclusively designed for wireless programming, so as to avoid a complicated Bluetooth setup procedure.

Figure (3-1) "USB BLE-Link" Bluetooth adaptor (SKU: TEL0087)

"USB BLE-Link" Purchase Link:

http://www.dfrobot.com/index.php?route=product/product&product_id=1220#.Vt6WPPkrLWI

USB BLE-Link needs Arduino hardware driver support. As we have already installed driver in previous step, for Windows 7 or later, USB BLE-Link is ready to use when plugged in to the USB port.

Vortex should be upgraded to its latest firmware through the "VortexBot" iPhone app before pairing with PC.

Firmware Upgrade：

A firmware upgrade will automatically start when Vortex is paired with the "VortexBot" app.
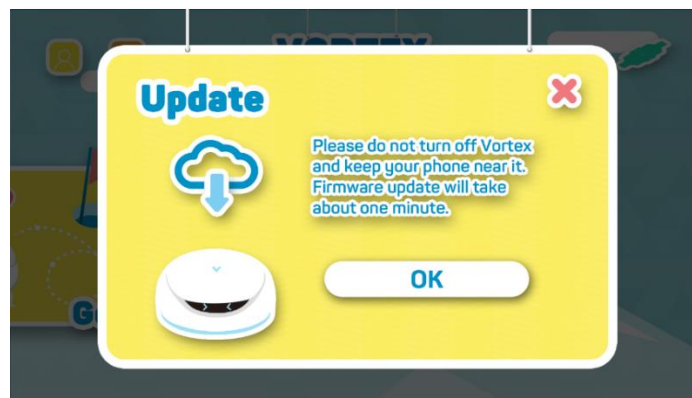
Figure (3-2) An update notification will pop up automatically when Vortex is connected to the VortexBot app
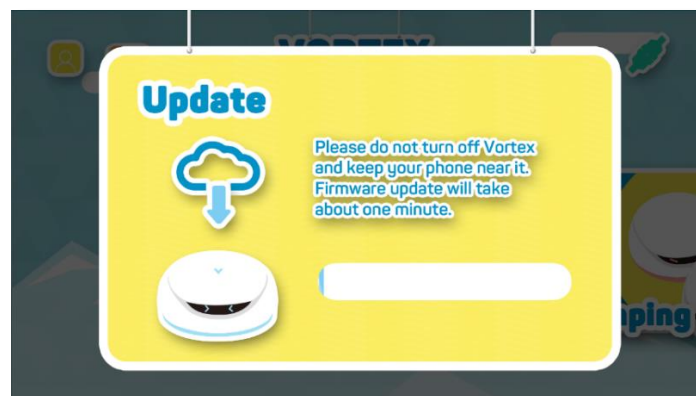
Figure (3-3) Tap "OK" to start update
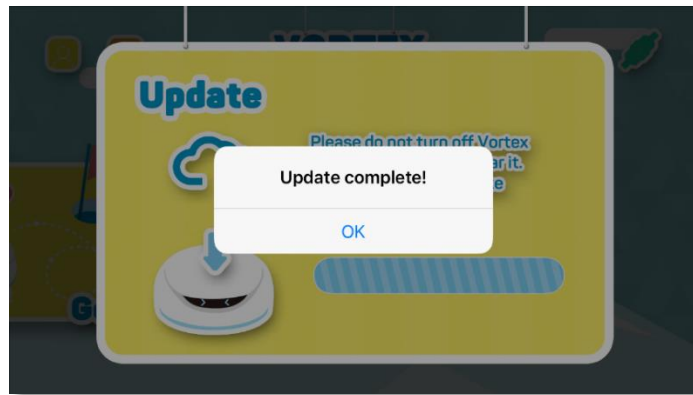
Figure (3-4) Update complete

Setup Bluetooth Connection:

Plug the USB BLE-Link Bluetooth adaptor into your PC's USB port.

Figure (3-5) Plug in USB Bluetooth adaptor

Turn off all other unpaired Bluetooth devices within range to ensure connection, then switch Vortex on.

Figure (3-6) Switch on Vortex

When Vortex is not paired, its LED lights will brighten up then fade repeatedly.

To pair, simply place Vortex next to the Bluetooth adaptor and it will pair automatically.

Figure (3-7) Pair Vortex to Bluetooth adaptor

Once Vortex is paired, its LEDs will stay at a constant brightness. The blue LED indicator on the Bluetooth adaptor will also light up.
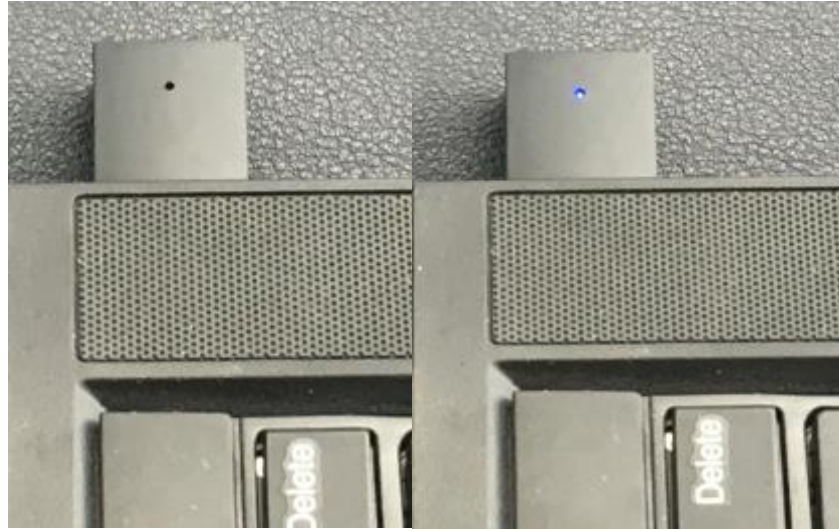
Figure (3-8) Pairing complete

If pairing fails, unplug and re-plug the adaptor to the USB port and restart Vortex, then go through the above steps again.

Connect Vortex to PC via USB Cable (Option B)

Alternatively, Vortex can communicate to PC through the on-board Micro USB port.

Setup Wired Communication:

Open Vortex's top magnetic cover.

Figure (3-9) Open top magnetic cover.

Remove the screw and then remove the back cover.

Figure (3-10) Take off the back cover
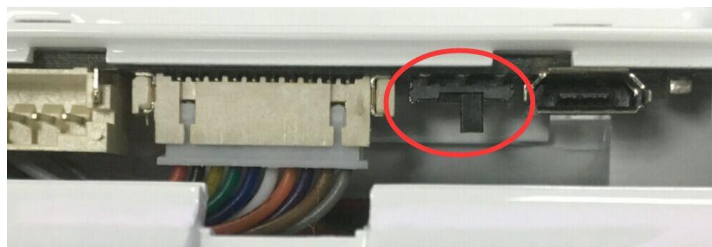
Figure (3-11) serial communication is enabled

Find the micro USB port at the right side of the slot, make sure the switch is set to the USB port side so that serial communication is enabled, then connect it to your PC with a micro USB cable.

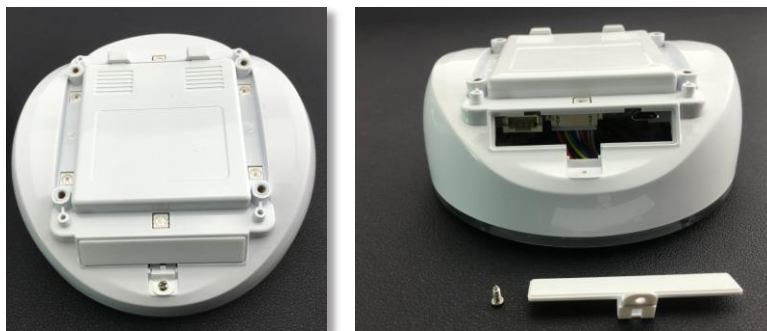*Figure (3-12) Plug in USB cable*

Once connected, Vortex will show up as "Arduino Uno" in Windows Device Manager.

Launch DF4Scratch Service

Once Vortex has been successfully connected to your PC, we are ready to launch the DF4Scratch service and control Vortex through Scratch 2.0.

Service Launching Guide

Start DF4Scratch Service:

Double click the "Launch Vortex Communication Service" shortcut file in the "DF4Scratch" folder (unzipped in previous step) to start the service.

Once the service is initiated, a black window will then pop up. The service may ask for authority of making changes to the computer, click "Allow" to continue launching. The black window will soon vanish automatically.

Figure (4-2) Service initiating in progress

Running the initializer more than once may cause problem to the service. When this happens, follow the instructions below to terminate the DF4Scratch service and reinitiate the launching service.

Terminate the DF4Scratch Service (if necessary):

Double click the short cut file "Stop Communication Service" in the folder "DF4Scratch" to terminate the service.
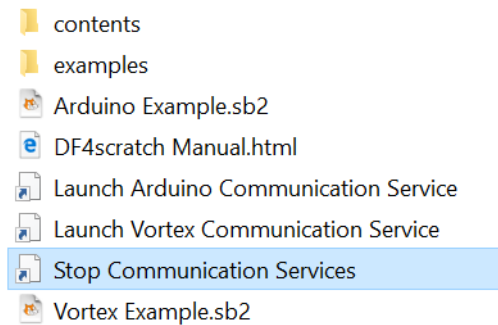
Figure (4-3) "Stop Communication Service" shortcut under "DF4Scratch" directory

Once the termination process is initiated, a black window will pop up. The service may ask for authority to make changes to the computer, click "Yes" to continue termination. The black window will soon vanish automatically.
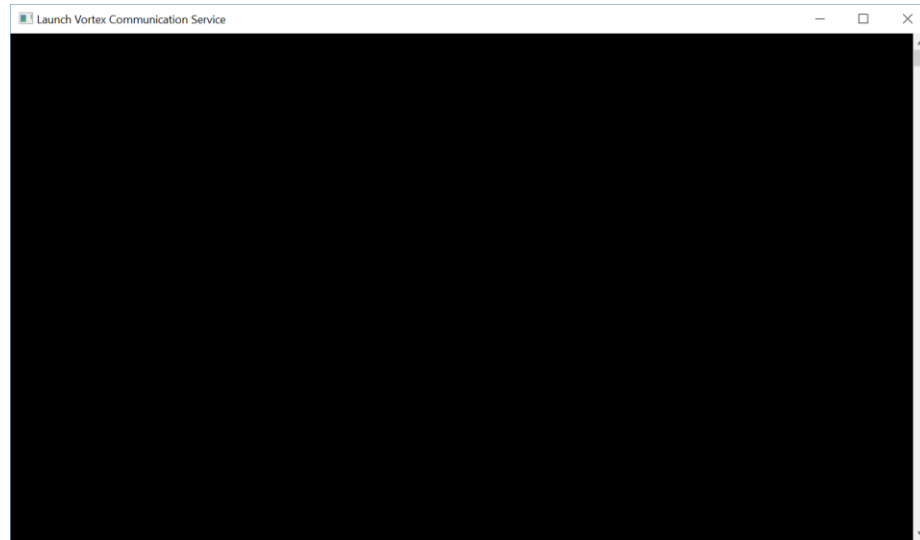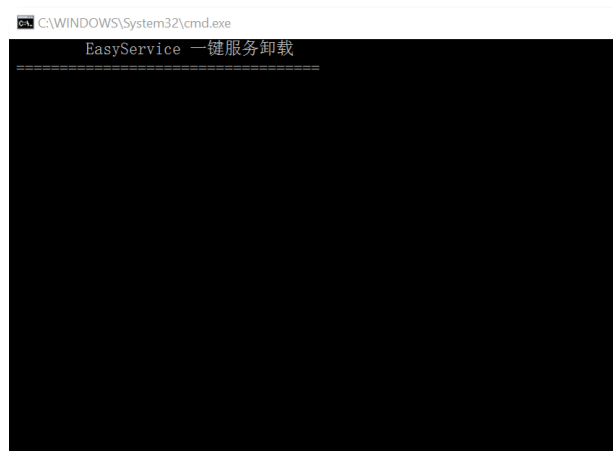

Figure (4-4) Service terminating in process

We can start to program Vortex using Scratch 2.0 after the service is launched.
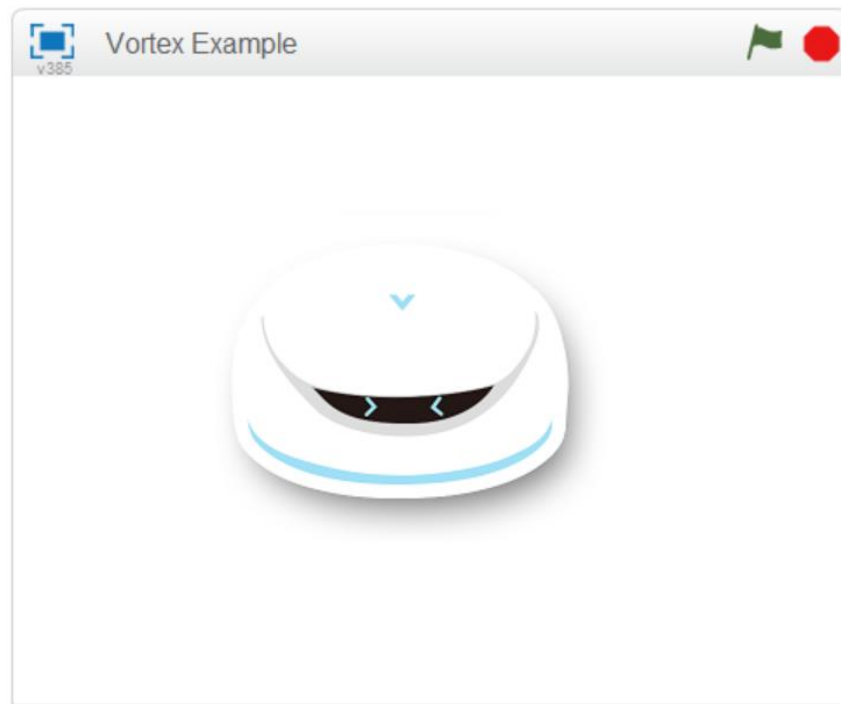
Figure (4-5) Run simple test

You can also open the Scratch 2.0 script file "Vortex Example.sb2" under the directory "DF4Scratch" to run a simple test. Once the green flag is clicked, Vortex will start dancing.

Start Programing

It's time for us to program Vortex with Scratch 2.0. As this tutorial only aims to help users setup Scratch 2.0 programming environment, we will not go deep into the programming details.

Instructions below provide basic operations for Scratch 2.0, you can also skip to the "Sample Program chapter" and use the sample script to control Vortex with your keyboard.

Visit the Vortex forum for more information about Scratch 2.0 programming.

Link to Vortex Forum: http://www.dfrobot.com/forum/viewforum.php?f=19

Scratch 2.0 Programming Interface

Basic Vortex code blocks are preloaded in the script file "Simple Vortex Example" under the directory "DF4Scratch". For beginners, you can edit the file and use preloaded code blocks to program Vortex.
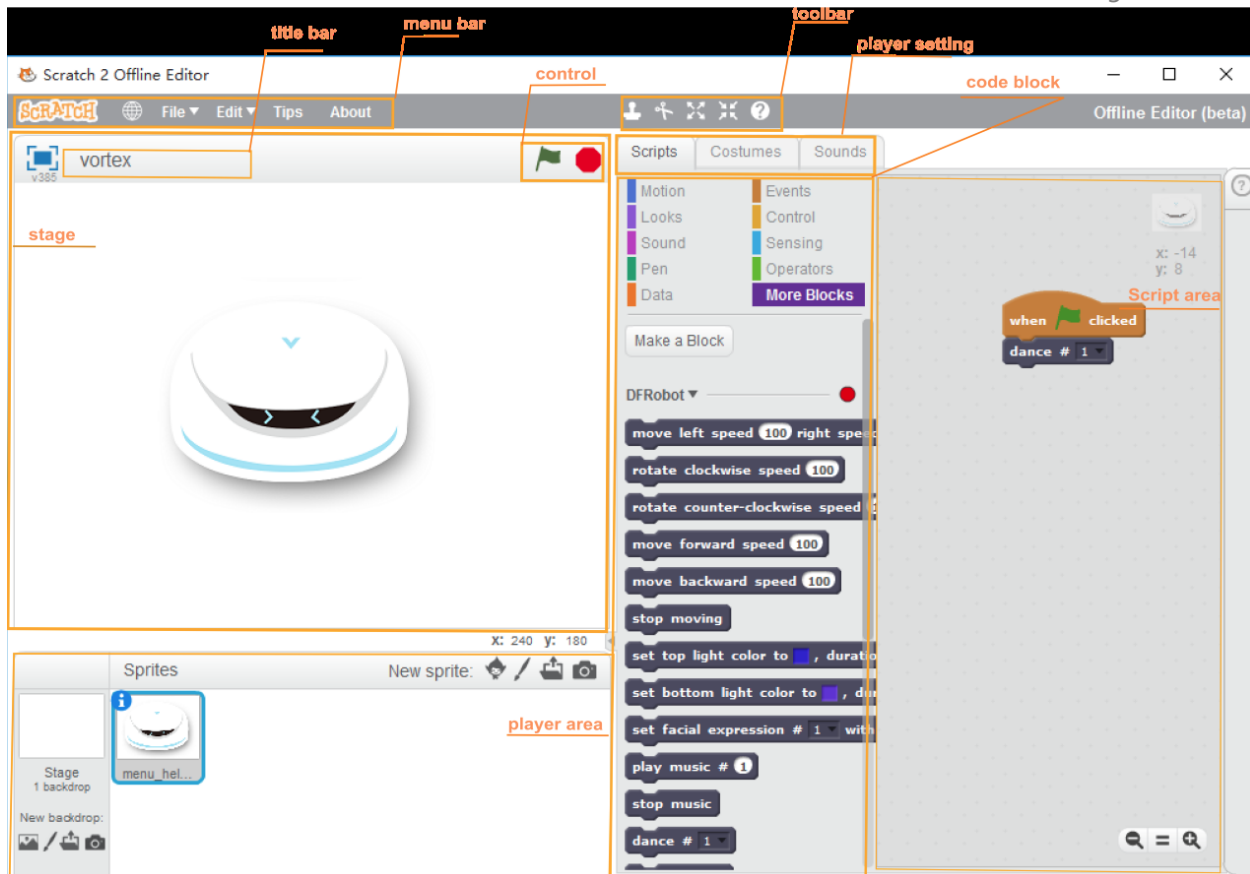
Figure (5-1) Scratch 2.0 Programming Interface

Title Bar: Shows the file name

Menu Bar: Lists software functions

Toolbar: Edits character's appearance

Code Block Area: Lists code blocks for programming

Player Area: Lists characters

Script Area: Program editing area

Control Buttons: Program control area

Display Window: Shows character actions

In Scratch 2.0, programs can be written by simply dragging and dropping code blocks

Use Vortex Code Blocks

Preloaded Vortex code control blocks can be found under "More Blocks" in the code block area.

Vortex Code Block Descriptions

Code Block	Function	Parameters
move left speed 100 right speed 100	Set speeds of the two wheels	speed: 0-255
rotate clockwise speed 100	Make Vortex rotate clockwise	rotation speed: 0-255
rotate counter-clockwise speed 100	Make Vortex rotate counter-clockwise	rotation speed: 0-255
move forward speed 100	Make Vortex move forward	speed: 0-255
move backward speed 100	Make Vortex move backward	speed: 0-255
stop moving	Set speed to 0	none
set top light color to ▪, duration 10 s	Set top light color	duration: 0-∞ (s)
set bottom light No. 10 color to ▪, duration 10 s	Set bottom light color	duration : 0-∞ (s)
set facial expression # 1 with color red	Set facial expression of Vortex	expression: 1-30 ; 7 colors
play music # 1	Let Vortex play music	music: 0-32
stop music	Let Vortex stop music	none
dance # 1	Let Vortex dance	dances: 0-3
stop dancing	Let Vortex stop dancing	none
music volume 50	Set music volume	volume: 0-255
turn proximity check on	Turn on/off the distance sensor	states: on/off
turn greyscale check on	Turn on/off the greyscale sensor	states: on/off
greyscale threshold 50	Set greyscale threshold	threshold: 0-255
proximity	Detected obstacle	return true or false
greyscale	Choose a greyscale sensor	sensor: 1-6
version	Return version number of Vortex	none
query vortex version	Query version number of Vortex	none
set top light No. 10 color to ▪, duration 10 s	Set color of a top light	top light: 1-6, duration: 0-∞
set bottom light color to ▪, duration 10 s	Set color of bottom light	duration: 0-∞

After Vortex has been recognized by Scratch 2.0, the indicator at the bottom right corner of the code block area will turn from red to green, indicating that a program can be uploaded.
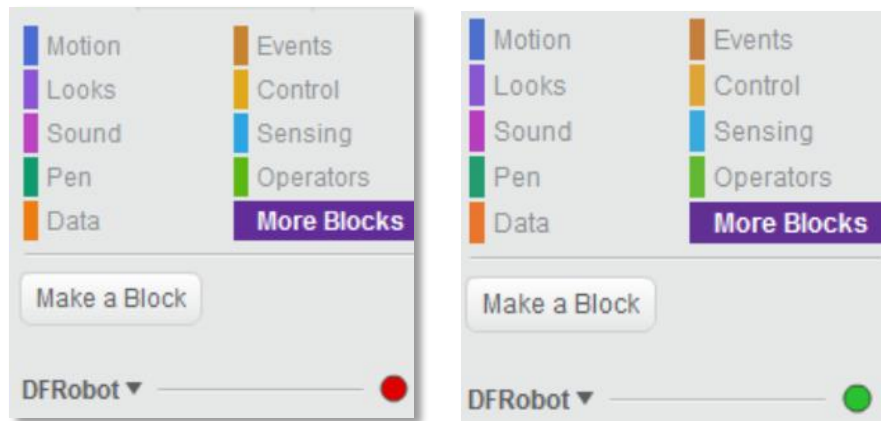

Figure (5-2) Vortex can be programmed after the indicator turns to green

Sample Program

With the sample program, you can use your keyboard to set Vortex to move, play music or change LED color.

Start a Sample Program

Double click to open the "Keyboard Controlling Vortex Example.sb2" Vortex 2.0 script file under directory "DF4Scratch\examples".
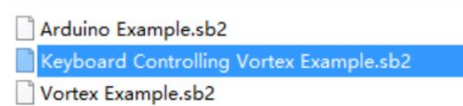

Figure (5-3) "Keyboard Controlling Vortex Example.sb2" sample script file

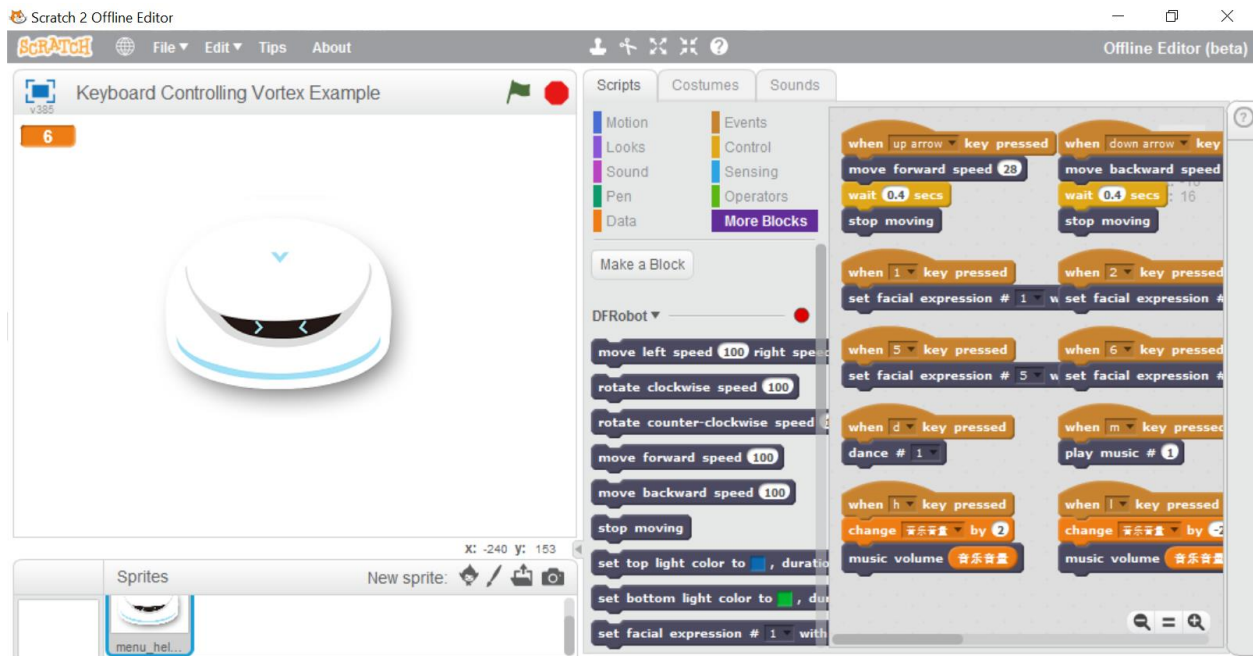In the script editing interface, click the green flag to start keyboard control.

Figure (5-4) "Keyboard Controlling Vortex Example" script editing interface

Key Commands

Arrow Keys: Tells Vortex to go forward, backward, left and right.

Number keys 1-7: Activates expression 1-7 for Vortex

D : Tells Vortex to dance

M : Tells Vortex to play music

S : Stops dancing and music

H : Increases volume

I : Decreases volume