EV3 WITH PYTHON

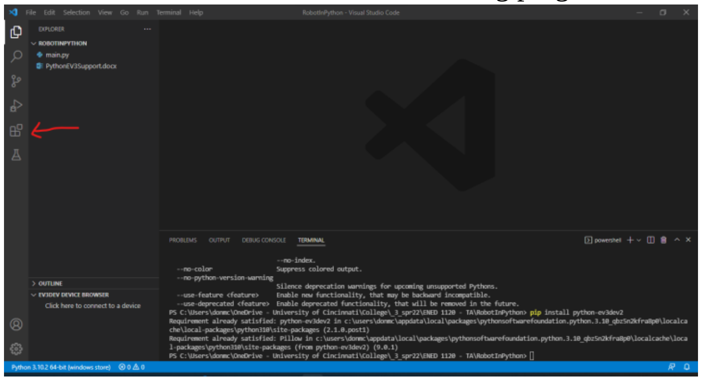
ABSTRACT
In this article, you’ll learn how to install the necessary components to begin coding your EV3 robot in python. As well as some necessary commands to get you started as you experiment with different codes.

Mcfarland, Donald

Contents

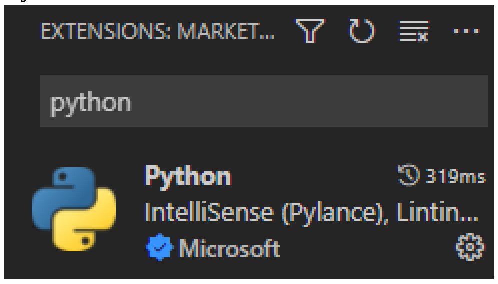
Visual Studio Code Installation and Set Up:

1. Download Visual Studio Code from https://code.visualstudio.com/
2. Run the downloaded .exe file and follow the prompts
3. Go to the "Extensions" page in Visual Studio Code by clicking on the extensions button or hitting "Ctrl + Shift + X" and install the following plugins.

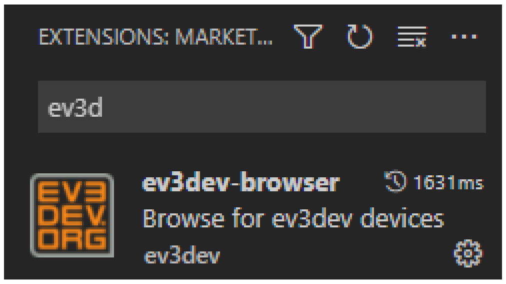


```
                            --no-index.
  --no-color                Suppress colored output.
  --no-python-version-warning
                            Silence deprecation warnings for upcoming unsupported Pythons.
  --use-feature <feature>   Enable new functionality, that may be backward incompatible.
  --use-deprecated <feature>  Enable deprecated functionality, that will be removed in the future.
PS C:\Users\donmc\OneDrive - University of Cincinnati\College\_3_spr22\ENED 1120 - TA\RobotInPython> pip install python-ev3dev2
Requirement already satisfied: python-ev3dev2 in c:\users\donmc\appdata\local\packages\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localcache\local-packages\python310\site-packages (2.1.0.post1)
Requirement already satisfied: Pillow in c:\users\donmc\appdata\local\packages\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localcache\local-packages\python310\site-packages (from python-ev3dev2) (9.0.1)
PS C:\Users\donmc\OneDrive - University of Cincinnati\College\_3_spr22\ENED 1120 - TA\RobotInPython>
```

   a. Python

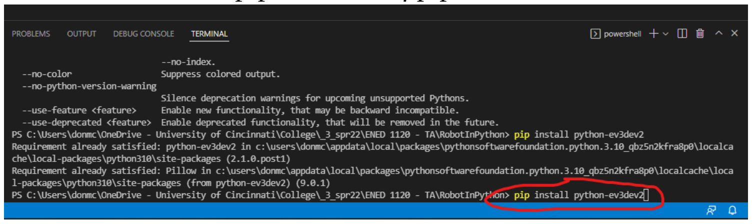


   b. ev3dev-browser



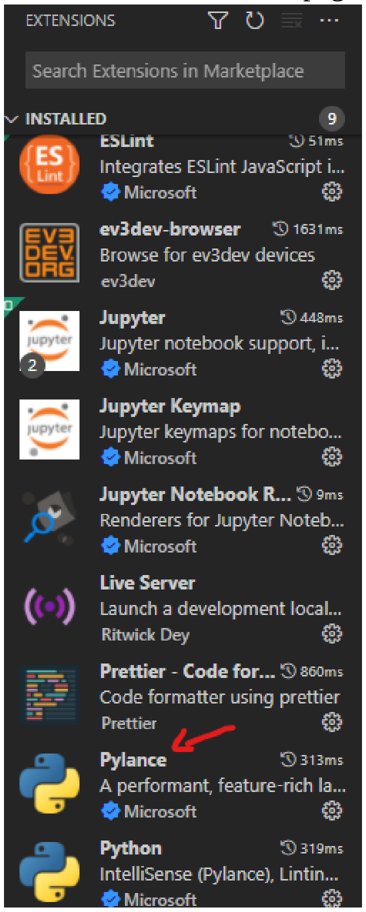
4. With those two packages installed, open a terminal window by hitting "Ctrl + tilde (`)"
5. In the terminal install the ev3dev2 package with the following command:

a. pip install python-ev3dev2
Note: On Macs use pip3 instead of pip

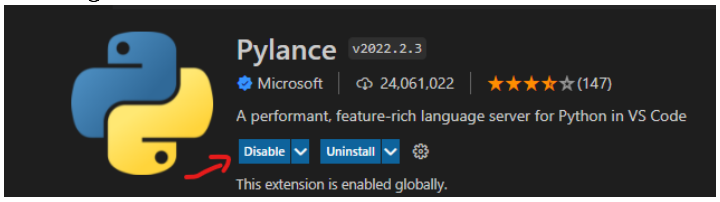


```
                            --no-index.
  --no-color                Suppress colored output.
  --no-python-version-warning
                            Silence deprecation warnings for upcoming unsupported Pythons.
  --use-feature <feature>   Enable new functionality, that may be backward incompatible.
  --use-deprecated <feature>  Enable deprecated functionality, that will be removed in the future.
PS C:\Users\donmc\OneDrive - University of Cincinnati\College\_3_spr22\ENED 1120 - TA\RobotInPython> pip install python-ev3dev2
Requirement already satisfied: python-ev3dev2 in c:\users\donmc\appdata\local\packages\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localca
che\local-packages\python310\site-packages (2.1.0.post1)
Requirement already satisfied: Pillow in c:\users\donmc\appdata\local\packages\pythonsoftwarefoundation.python.3.10_qbz5n2kfra8p0\localcache\loca
l-packages\python310\site-packages (from python-ev3dev2) (9.0.1)
PS C:\Users\donmc\OneDrive - University of Cincinnati\College\_3_spr22\ENED 1120 - TA\RobotInPython> pip install python-ev3dev2
```

6. If the terminal does not install the package and says pip is not a recognized function, see the section [*Pip Installation Guide*]() and retry the previous step
7. Go back to the extension page and find the plugin labeled Pylance

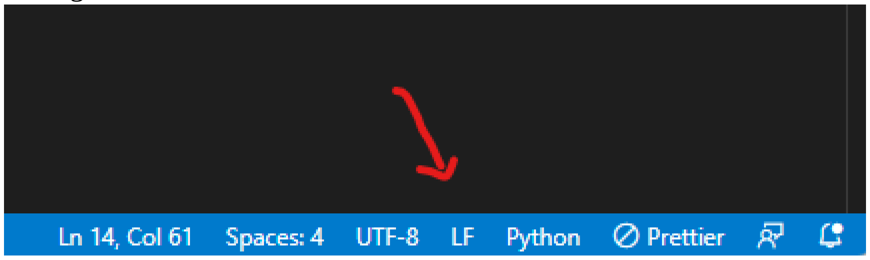

EXTENSIONS
Search Extensions in Marketplace
INSTALLED 9
ESLint 51ms
Integrates ESLint JavaScript i...
Microsoft
ev3dev-browser 1631ms
Browse for ev3dev devices
ev3dev
Jupyter 448ms
Jupyter notebook support, i...
Microsoft
Jupyter Keymap
Jupyter keymaps for notebo...
Microsoft
Jupyter Notebook R... 9ms
Renderers for Jupyter Noteb...
Microsoft
Live Server
Launch a development local...
Ritwick Dey
Prettier - Code for... 860ms
Code formatter using prettier
Prettier
Pylance 313ms
A performant, feature-rich la...
Microsoft
Python 319ms
IntelliSense (Pylance), Lintin...
Microsoft

8. Disable the plugin, reload Visual Studio Code, reenable the plugin, and reload Visual Studio Code again


Pylance v2022.2.3
Microsoft
24,061,022
★★★★☆(147)
A performant, feature-rich language server for Python in VS Code
Disable
Uninstall
This extension is enabled globally.

a. *Pylance* is your intellisense. What this means is it can read simple errors in your code before the code executes while at the same time help with importing packages such as the ev3dev2 package you just imported in step 5.

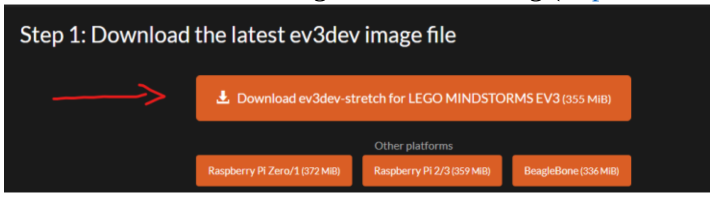
9. In order to be able to create new files and upload them to the EV3 brick, you must change the line ending ins VSC from CRLF to LF



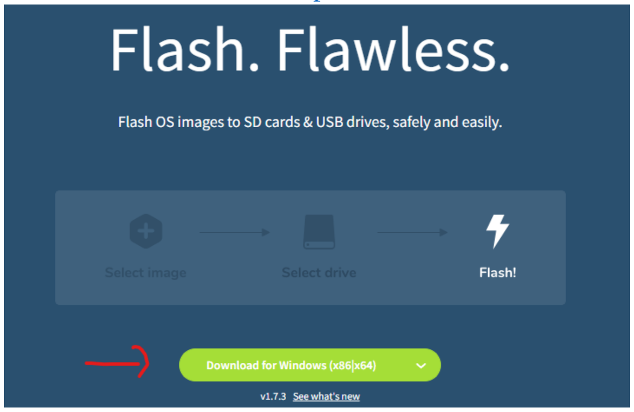
10. When creating a new you must also begin each file with this comment #!/usr/bin/env python3

Brickman Installation Guide:

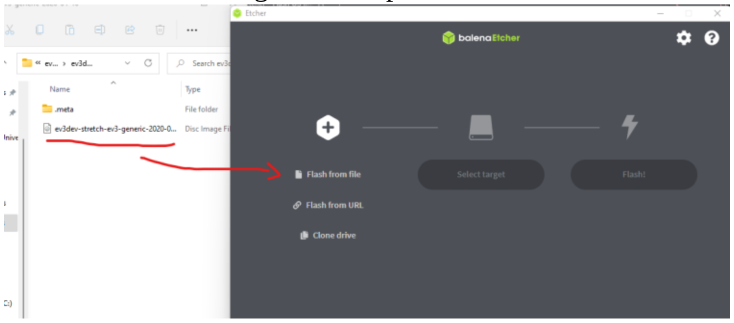
1. Download the ev3dev image from ev3dev.org (https://www.ev3dev.org/docs/getting-started/)


Step 1: Download the latest ev3dev image file
Download ev3dev-stretch for LEGO MINDSTORMS EV3 (355 MiB)
Other platforms
Raspberry Pi Zero/1 (372 MiB)
Raspberry Pi 2/3 (359 MiB)
BeagleBone (336 MiB)

2. Download Etcher from https://www.balena.io/etcher/

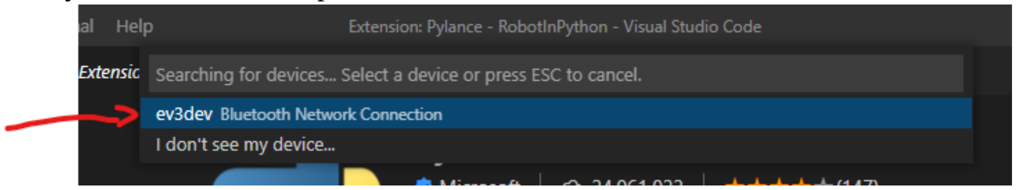

Flash. Flawless.
Flash OS images to SD cards & USB drives, safely and easily.
Select image
Select drive
Flash!
Download for Windows (x86|x64)
v1.7.3 See what's new

3. Flash the ev3dev image from step one onto a microSD card using Etcher



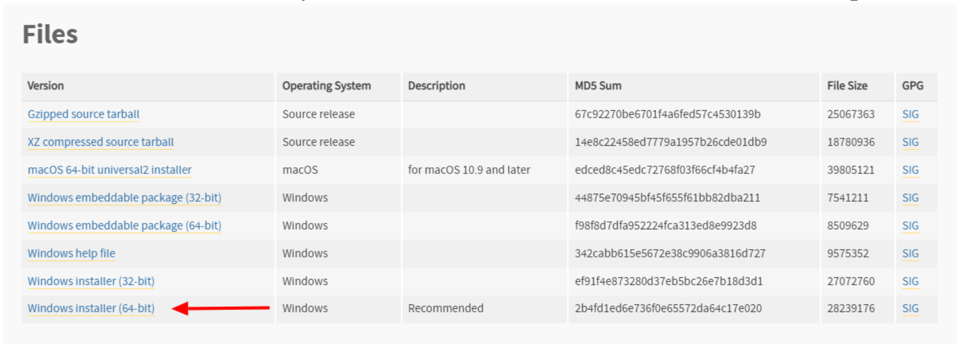
4. Insert the microSD card into the EV3 brick and boot up the brick
Note: If Brickman does not boot then the EV3 brick must be updated to the latest version. See the Updating the EV3 Brick section for more information
5. After booting up the brick, wait for the screen to load in until you see "File Browser" at the top of your screen.
6. Scroll down to "Wireless and Networks" and hit the center button on the EV3 brick

7. Select “Bluetooth”
8. Enable “Powered” and “Visible” and the select “Start Scan”
9. Make sure your computer’s Bluetooth is enabled and find the computer on the EV3 Brick
10. Pair the brick with the computer by selecting “Pair”
11. After pairing with the computer, on the brick select “Network Connection”
12. Select “Connect”
13. On your computer, open Visual Studio and Select “Connect to a device”
14. Find your Brick on the drop-down menu and connect


al Help
Extension: Pylance - RobotInPython - Visual Studio Code
Extensic
Searching for devices... Select a device or press ESC to cancel.
ev3dev Bluetooth Network Connection
I don't see my device...

Pip Installation Guide:

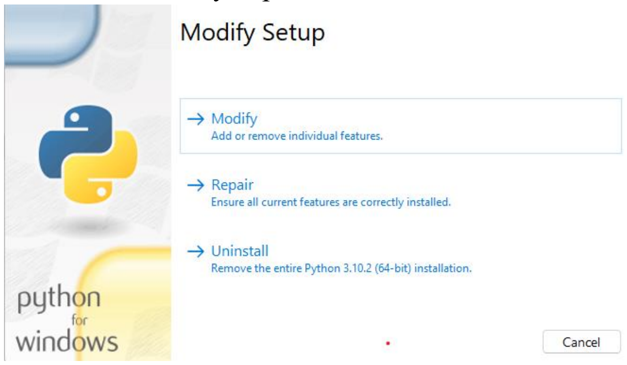
1. Find your Python installation executable or download it from https://www.python.org/downloads/release/python-3102/
   Note: Selected version is for Window’s OS. For Mac select the macOS option.



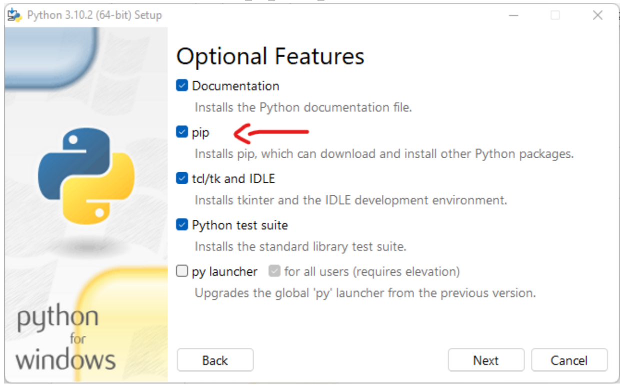
Files

Version	Operating System	Description	MD5 Sum	File Size	GPG
Gzipped source tarball	Source release		67c92270be6701f4a6fed57c4530139b	25067363	SIG
XZ compressed source tarball	Source release		14e8c22458ed7779a1957b26cde01db9	18780936	SIG
macOS 64-bit universal2 installer	macOS	for macOS 10.9 and later	edced8c45edc72768f03f66cf4b4fa27	39805121	SIG
Windows embeddable package (32-bit)	Windows		44875e70945bf45f655f61bb82dba211	7541211	SIG
Windows embeddable package (64-bit)	Windows		f98f8d7dfa952224fca313ed8e9923d8	8509629	SIG
Windows help file	Windows		342cabb615e5672e38c9906a3816d727	9575352	SIG
Windows installer (32-bit)	Windows		ef91f4e873280d37eb5bc26e7b18d3d1	27072760	SIG
Windows installer (64-bit)	Windows	Recommended	2b4fd1ed6e736f0e65572da64c17e020	28239176	SIG

2. Select the “Modify” option


Modify Setup
Modify
Add or remove individual features.
Repair
Ensure all current features are correctly installed.
Uninstall
Remove the entire Python 3.10.2 (64-bit) installation.
Cancel
python
for
windows

3. And make sure the “pip” option is enabled

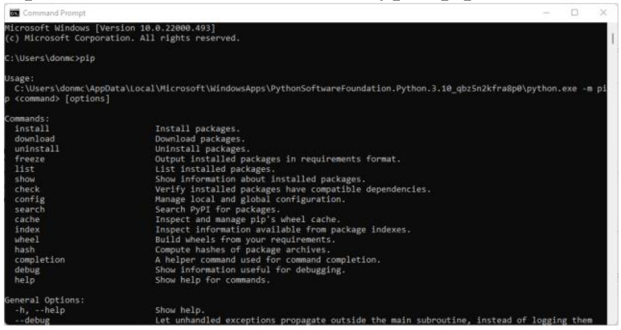


Python 3.10.2 (64-bit) Setup

Optional Features

- [✓] Documentation
  Installs the Python documentation file.
- [✓] pip
  Installs pip, which can download and install other Python packages.
- [✓] tcl/tk and IDLE
  Installs tkinter and the IDLE development environment.
- [✓] Python test suite
  Installs the standard library test suite.
- [ ] py launcher [✓] for all users (requires elevation)
  Upgrades the global 'py' launcher from the previous version.

4. Open a command window and type “pip” and make sure the following is displayed:

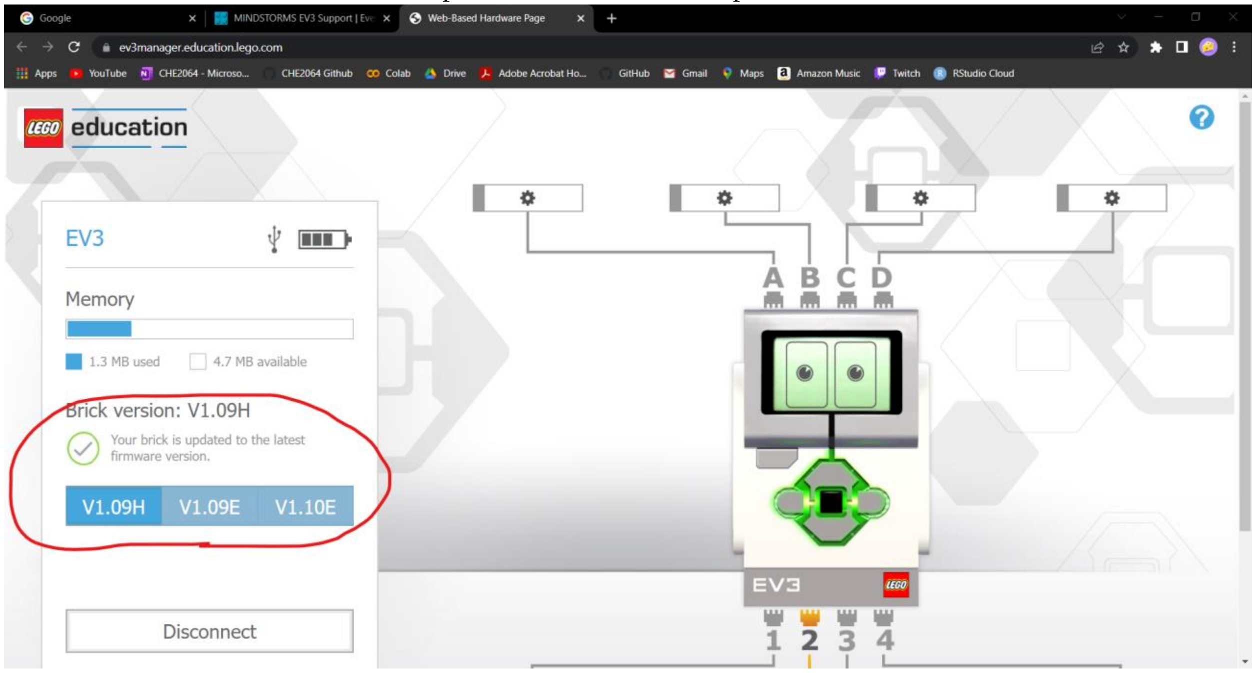


Command Prompt

```
Microsoft Windows [Version 10.0.22000.493]
(c) Microsoft Corporation. All rights reserved.

C:\Users\donmc>pip

Usage:
  C:\Users\donmc\AppData\Local\Microsoft\WindowsApps\PythonSoftwareFoundation.Python.3.10_qbz5n2kfra8p0\python.exe -m pi
p <command> [options]

Commands:
  install                     Install packages.
  download                    Download packages.
  uninstall                   Uninstall packages.
  freeze                      Output installed packages in requirements format.
  list                        List installed packages.
  show                        Show information about installed packages.
  check                       Verify installed packages have compatible dependencies.
  config                      Manage local and global configuration.
  search                      Search PyPI for packages.
  cache                       Inspect and manage pip's wheel cache.
  index                       Inspect information available from package indexes.
  wheel                       Build wheels from your requirements.
  hash                        Compute hashes of package archives.
  completion                  A helper command used for command completion.
  debug                       Show information useful for debugging.
  help                        Show help for commands.

General Options:
  -h, --help                  Show help.
  --debug                     Let unhandled exceptions propagate outside the main subroutine, instead of logging them
```

Updating the EV3 Brick

1. Connect the EV3 Brick with no SD card inserted
2. Go to the EV3 Device Manager located here https://ev3manager.education.lego.com/#
3. Make sure the EV3 Brick is at least up to version 1.09H and update if needed



EV3

Memory

1.3 MB used 4.7 MB available

Brick version: V1.09H

Your brick is updated to the latest firmware version.

ev3dev2 Syntax Guide

Retrieved from: https://ev3dev-lang.readthedocs.io/projects/python-ev3dev/en/stable/index.html

ev3dev2.motor:

Objects and functions located in the ev3dev2.motor module

- SpeedPercent(percent) [SpeedValue]
  sets speed to the inputted percent of the motor's max speed
- SpeedRPS(rps) [SpeedValue]
  sets speed in rotations per second
- SpeedRPM(rpm) [SpeedValue]
  sets speed in rotations per minute
- SpeedDPS(dps) [SpeedValue]
  sets speed in degrees per second
- SpeedDPM(dpm) [SpeedValue]
  sets speed in degrees per minute
- OUTPUT_A (for A-D)
  Addresses for the motor ports on the EV3 Brick
- Motor(address)
  Assigns motor based on OUTPUT Objects:
    - on_for_rotations(speed, rotations)
      Turns on the motor at the inputted speed for the inputted number of rotations.
      Speed must be a SpeedValue object
    - on_for_degrees(speed, degrees)
      Turns on the motor at the inputted speed for the inputted amount of degrees
    - on_to_position(speed, position)
      Turns on the motor at the inputted speed until it reaches a specific position
    - on_for_seconds(speed, seconds)
      Turns on the motor at the inputted speed for the inputted amount of time
    - on(speed)
      Turns on the motor at speed indefinitely
    - stop(stop_action=”brake”)
      Forces motor to stop all commands by executing stop_action.
      stop_action can be “brake” or “coast”
- MoveTank(Address1,Address2):
  Allows two motors to be run at the same time. Same methods as Motor but add a second speed input for the second Motor

ev3dev2.sensor.lego:

Objects and functions located in the sensor.lego module

- INPUT_1 (1-4)
  Each input object corresponds to one of the sensor ports on the ev3 brick
- TouchSensor(address)
  Address is the port the sensor is connected to

    - is_pressed
      returns a bool based on if the sensor is touched (True) or not (False)
    - wait_for_pressed(timeout_ms=None, sleep_ms=10)
      waits for touch sensor to be pressed and returns True, if it is not pressed down within in timeout_ms then it will return False
    - wait_for_released(timeout_ms=None,sleep_ms=10)
      same logic as wait_for_pressed but depends on when the touch sensor is released instead of pressed
    - wait_for_bump(timeout_ms=None,sleep_ms=10)
      waits for sensor to be pressed then released otherwise returns False
- ColorSensor(address)
  Address is the port the sensor is connected to
    - reflected_light_intensity
      gives light intensity as a percent (0-100) sensor will be red
    - ambient_light_intensity
      gives light intensity as a percent (0-100) sensor will be a dim blue
    - color
      returns number value associated with the color detected
        - 0 – No color
        - 1 – Black
        - 2 – Blue
        - 3 – Green
        - 4 – Yellow
        - 5 – Red
        - 6 – White
        - 7 – Brown
    - color_name
      returns name of color detected
- UltrasonicSensor(address)
  Address is the port the sensor is connected to
    - distance_centimeters
      take continuous measurements in cm
    - distance_centimeters_ping
      take one measurement in cm
    - distance_inches
      same as cm, but in inches
    - distance_inches_ping
      same as cm, but in inches
- GyroSensor(address)
  Address is the port the sensor is connected to
    - angle
      number of degrees the sensor has been rotated
    - rate
      the rate of rotation in degrees per second
    - calibrate()
      calibrate the gyro sensor when it is perfectly still

- reset()
  reset the angle count to 0
- wait_until_angle_changed_by(delta, direction_sensitive=False)
  waits until sensor changes by the inputted amount. Direction sensitive denotes whether the rotation must take place in a certain direction
- circle_angle()
  converts angle to be within 0-360 range

ev3dev2.sound
Objects and Functions located in the sound module

- Sound
  - beep()
    The EV3 brick will make a beep sound
  - play_file(wav_file)
    The EV3 brick will play the specified .wav file if it is loaded onto the brick
  - speak(text)
    The EV3 brick will speak the message you inputted
  - set_volume(val)
    sets the volume of the EV3 brick
  - get_volume
    gets the volume of the EV3 brick

ev3dev2.display
Objects and Functions located in the display module

- Display
  - clear()
    clears the screen on the EV3 brick
  - update()
    updates the screen of the EV3 brick with incoming changes
    MUST CALL UPDATE OTHERWISE CHANGES WILL NOT OCCUR
  - line(clear_screen=True, x1=10, y1=10, x2=50, y2=50, line_color='black', width=1)
    draws a line from (x1,y1) to (x2,y2)
  - circle(clear_screen=True, x=50, y=50, radius=40, fill_color='black', outline_color='black')
    draws a circle centered at (x,y)
  - rectangle(clear_screen=True, x1=10, y1=10, x2=80, y2=40, fill_color='black', outline_color='black')
    draws a rectangle with top left corner at (x1,y1) and bottom left corner at (x2,y2)
  - text_pixels(text, clear_screen=True, x=0, y=0, text_color='black', font=None)
    writes message on EV3 brick screen at (x,y)