STMicroelectronics IoT Platform Tutorial: Introduction to STMicroelectronics Development Environment and Project Example For Apple Mac Systems

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1. Introduction

The IoT Platform is a new Internet of Things (IoT) system provided by STMicroelectronics integrating state-of-the-art processor, wireless interfaces, and sensor systems. The IoT Platform can form the foundation for wearable consumer devices, wearable medical devices, residential IoT systems and vehicle IoT systems.

The IoT Platform system provides an exceptionally powerful and well-supported platform for introduction to IoT technology. The IoT Platform is remarkably compact as shown in Figure 1.

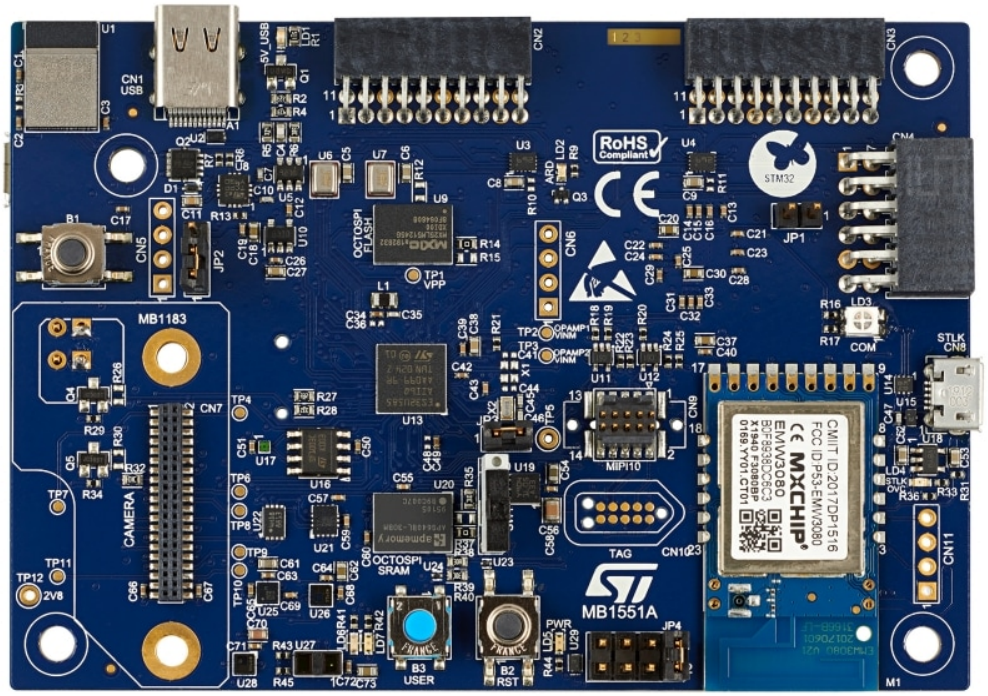


Figure 1. The STMicroelectonics IoT Platform - B-U585I-IOT02A

The IoT Platform includes these components:

1) The IoT Platform Processor System is an STM32L4 microprocessor based on the ARM Cortex M33 system. This provides introduction to the ARM processor architecture that is deployed on nearly every smartphone on earth.
2) The IoT Platform Sensors includes:

a) The ISM330DHCX combining microaccelerometer and microgyroscope.
b) The IIS2MDCTR magnetometer for compass heading
a) The LPS22HH barometric pressure sensor for determination of altitude and atmospheric pressure.
b) Two MP23DB01HPTR microphones

2) The IoT Platform also includes a Bluetooth Low Energy (Bluetooth Smart) wireless interface the BlueNRG-MS system.
3) The IoT Platform also includes non-volatile flash storage that stores the executable code that enables IoT system operation.
4) The IoT Platform also includes a cradle accessory with additional features including:
   a) SD Card Flash Storage System
   b) STC3115 Battery Monitor providing detailed energy monitoring for the IoT Platform
   c) HTS221 Humidity and Temperature environmental sensors

2. Introduction to This Tutorial

This Tutorial introduces the development environment for the IoT Platform system.

Development environments are essential to development of software for IoT systems and other products. These provide support to developers for both creation of systems, testing, debugging, and installation of software systems on platforms.

This development environment is referred to as an Integrated Development Environment (IDE). This includes all of the software tools required to create a software distribution for the IoT Platform, compile this software system into the processor instruction set using a Build capability, execute this system using a Debug capability, and also create an "image" file that can be installed in the IoT Platform non-volatile storage.

The Tutorial steps include:

1. Installing an Integrated Development Environment (IDE) on Mac.
2. Obtaining reference design example project software. This will specifically include a sensor Data Logging system.
3. Usage of the IDE to Import, Build, Run, Debug and Flash the IoT Platform board to run the example Data Logging project.

For more information regarding the IoT Platform board, please open the following link on a web-browser on your Mac.

https://www.st.com/en/evaluation-tools/b-u585i-iot02a.html#

2.1. List of Required Equipment and Materials

You will receive a kit on the first Lab session day. You must always bring this to each Lab session along with your laptop computer and its power supply.

1) STMicroelectronics IoT Platform B-U585I-IOT02A
2) Plastic enclosure bag for protection of IoT platform from electronic damage
3) USB 2.0 A-Male to Micro-B Cable (micro USB cable). This must be the new data cable supplied to you..
4) USB-C to USB-A Adapter
5) Network access to the Internet.

Please ensure that the USB cables are data cables supplied with this kit. Many USB cables provide only charging and do not include essential data lines.

Also, a contaminated data cable will irreparably damage the kit.

3. Integrated Development Environment Installation

This portion of the document will guide users through the STM32CubeIDE Development Environment (IDE) installation process.

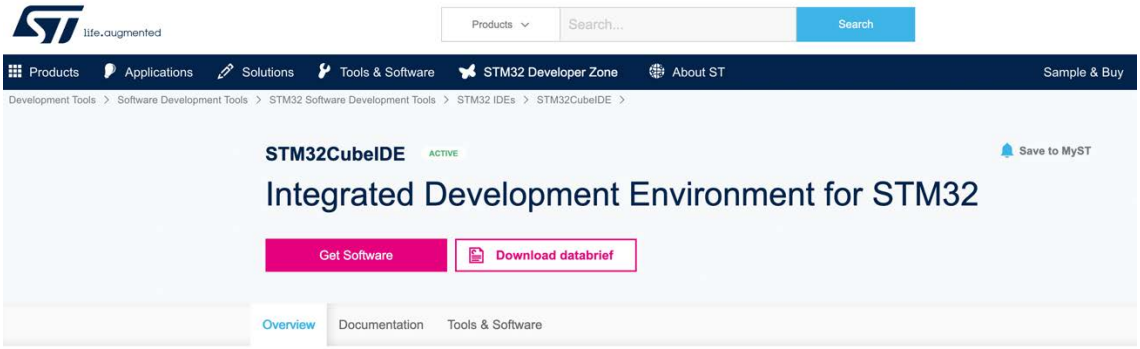
3.1. Prerequisite Steps

1. First, check your operating system version at Apple > About This Mac

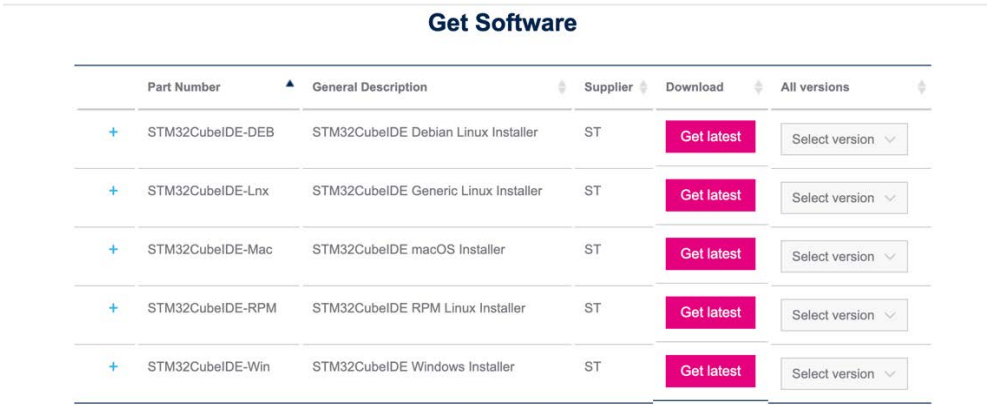
2. Update your Mac's operating system (OS) to at least OS X 10.15 Catalina.

3. If your version is equal or greater than 10.15, this is sufficient and no additional action is required.

4. Navigate to this Web site:
   https://www.st.com/en/development-tools/stm32cubeide.html



5. Select Get Software



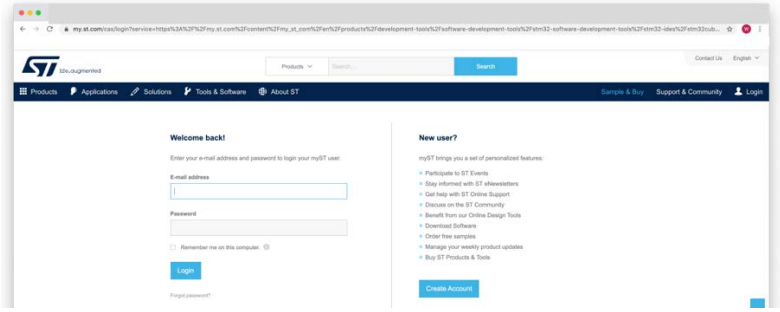
6. Select

   STM32CubeIDE-Mac STM32CubeIDE macOS Installer

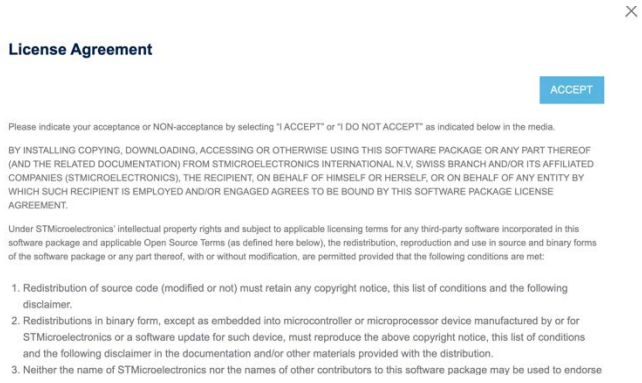
8. This Web page will appear. Enter registration information.

    1. Please use a gmail email account if possible.

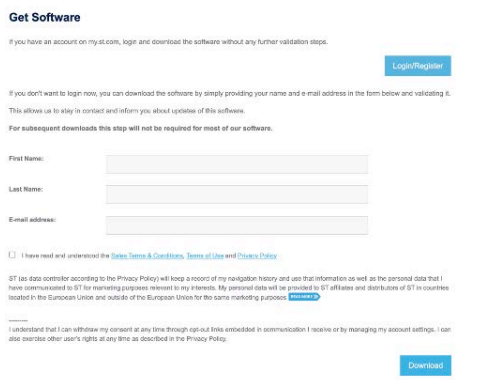
    2. Please note that the confirmation email from STMicroelectronics may be directed to the Spam folder. Please check for this.



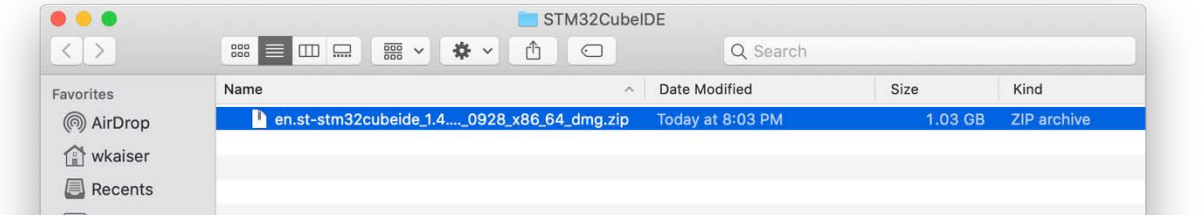
9. Open the email from STMicroelectronics and follow the link provided. This license agreement will appear. Click Accept



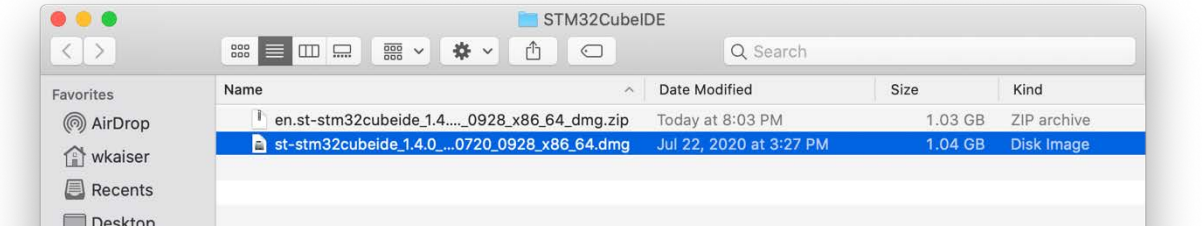
10. A request for a login may appear. Proceed to log in.



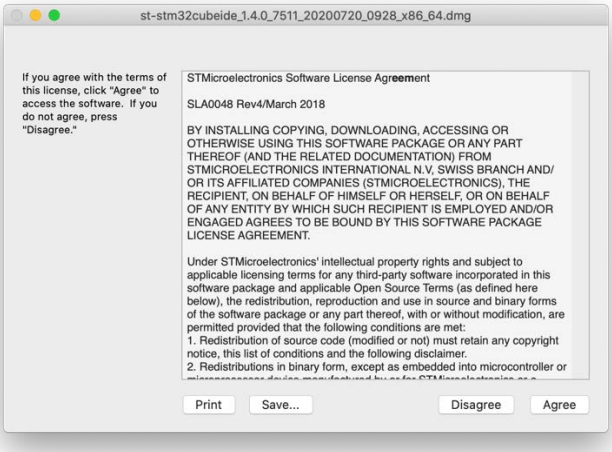
11. Download will start



12. Double click on the downloaded file to unzip

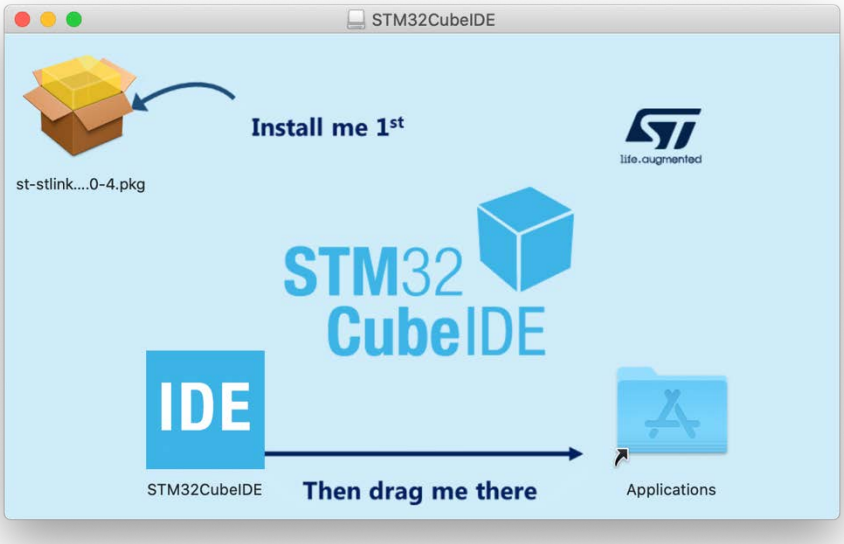


13. Double click on the .dmg file – installation will start. Select Agree

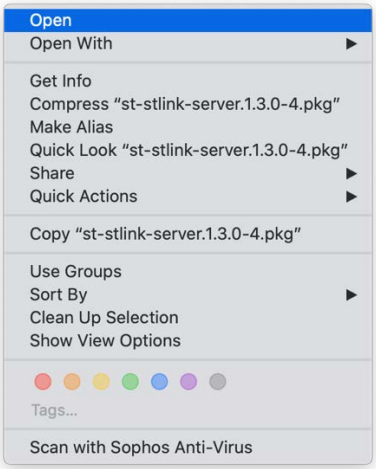


14. This screen will appear.

15. Right click on the .pkg file at upper left.

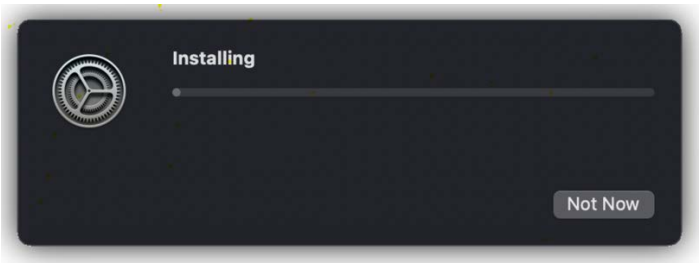


16. This screen will appear. Click on Open



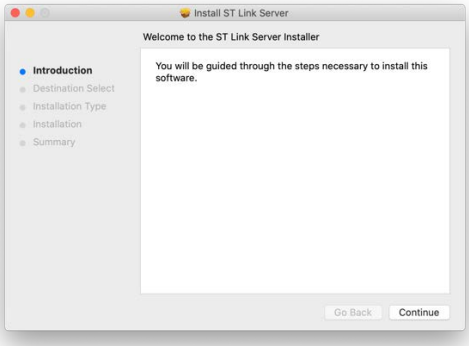
17. If your Macbook is an Apple M1 machine, you will receive a prompt to install the Rosetta application supplied by Apple. This screen will appear

18. Select Install Software. This screen will appear

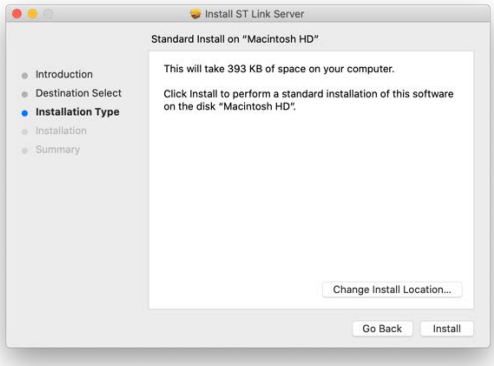


19. This screen will appear. Click on Open

20. This screen will appear. Click on Continue

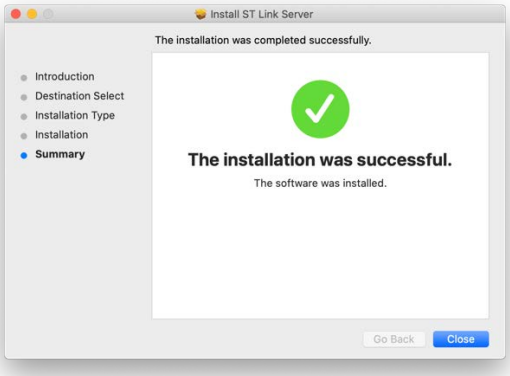


21. This screen will appear. Click on Install

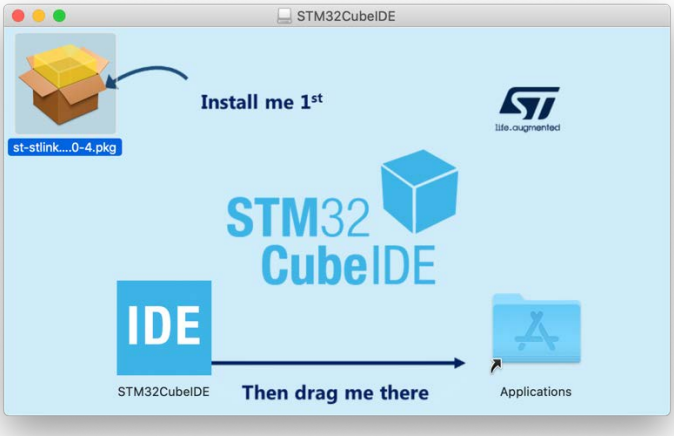


22. This screen will appear. Enter system administrator password and click on Install

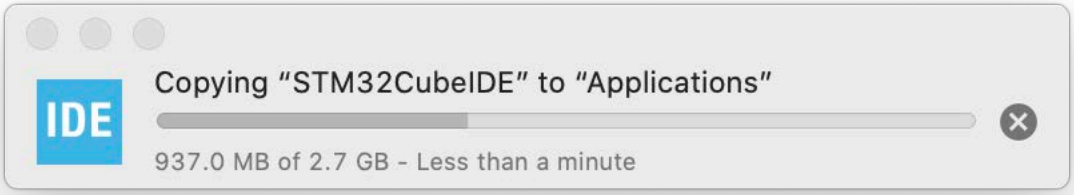
23. This screen will appear.



24. Return to the previous screen and drag IDE into Applications



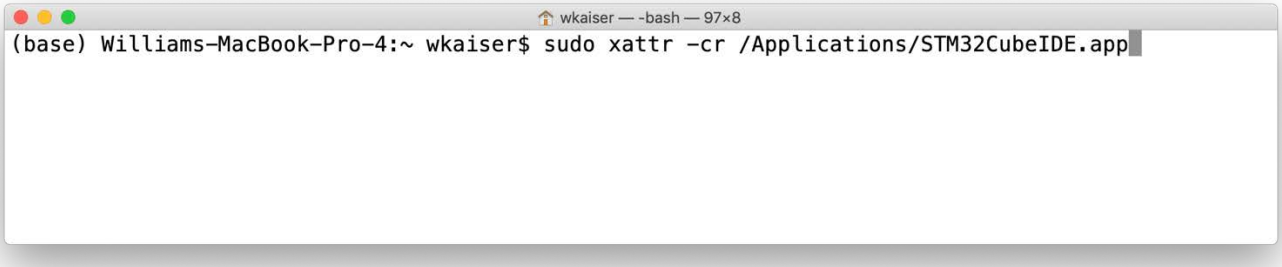
25. Wait for completion



26. Open the Mac OSx Terminal. Enter this command

```
sudo xattr -cr /Applications/STM32CubeIDE.app
```

Please enter this string directly. Do not use copy and paste into Terminal since the hyphen above will not be entered correctly.

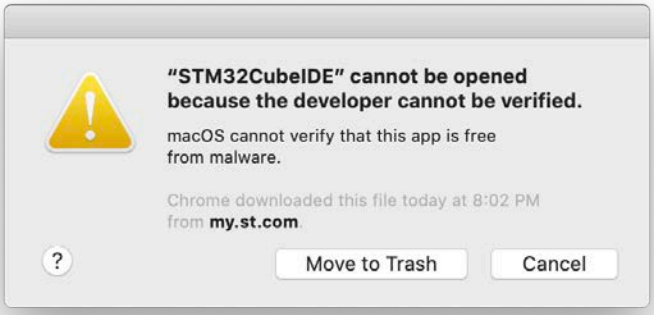


27. Then, enter the system administrator password at the prompt

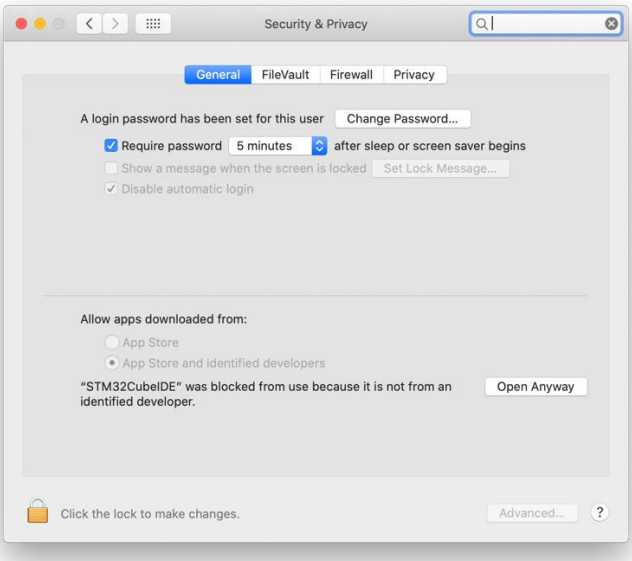
28. Find the STM32CubeIDE App. Enter STM32CubeIDE in the Apple Spotlight Search

29. Right click on the STM32CubeIDE App. This screen will appear

30. Select CANCEL – Do Not Select Move to Trash

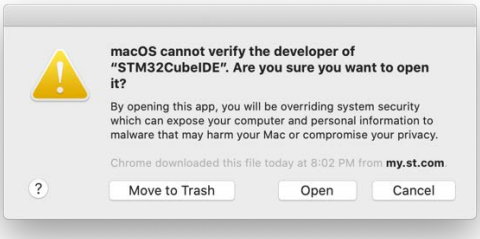


31. Then navigate to System Preferences > Security & Privacy > General



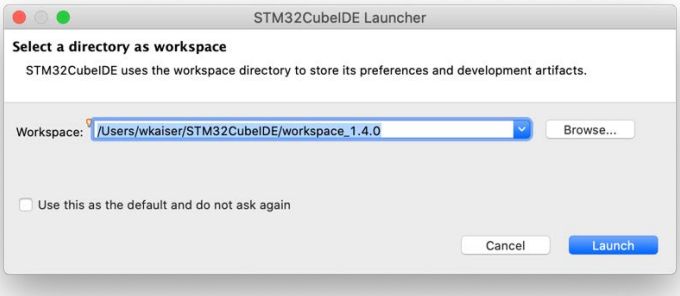
32. Find the message regarding STM32CubeIDE and select Open Anyway

33. Again, right click on the STM32CubeIDE App. This screen will appear. Select Open

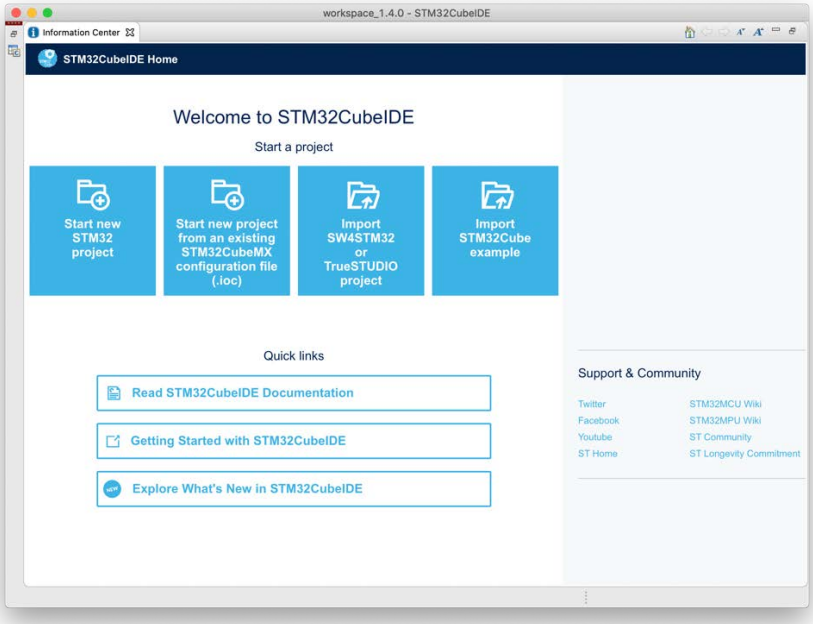


34. STM32CubeIDE will start. Select the Default Workspace and select Launch.

35. Please note that the Default Workspace should not include spaces in its pathnames



36. This screen will appear. This can be closed by selecting the X in the upper left corner tab.



4. The IoT Platform Kit

4.1. IoT Platform Hardware Platform Kit

1. The IoT platform is shown below in Figure 2.

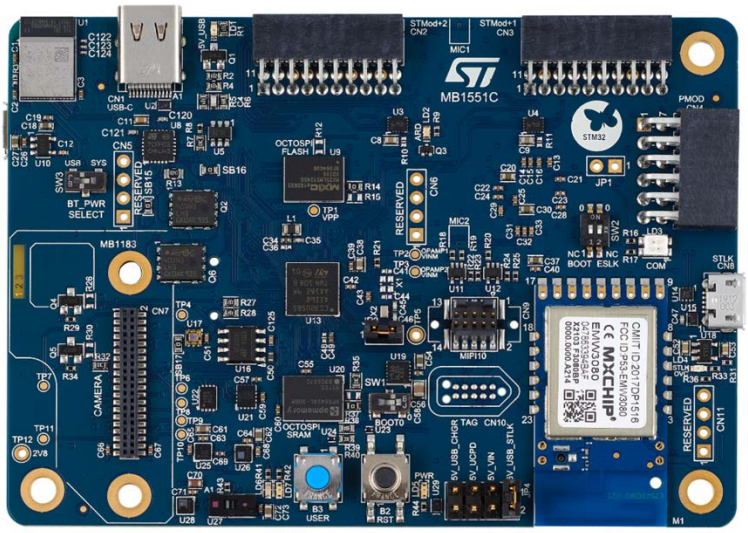


Figure 2. The STMicroelectonics IoT Platform - B-U585I-IOT02A. ***Note the Micro-USB port at the right side.***

2. The IoT platform User and Reset Buttons are shown below in Figure 3.

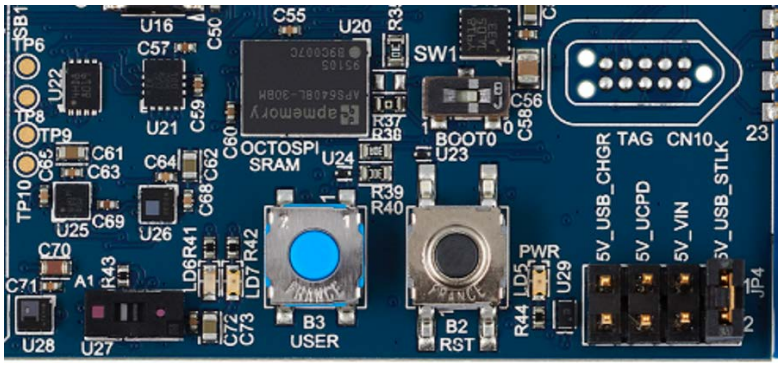


Figure 3. Close Up image of the IoT Platform. This shows the ***Lower Side*** *of the board.* ***Note that Blue Button. This is the User Button that will be applied in all projects. The smaller Black Button is the Reset button and this will be rarely used.***

4.2. IoT Platform Hardware Platform Kit Enclosure

1. The IoT platform in its enclosure is shown in Figure 4.

Figure 4. The IoT Platform in its enclosure. ***The IoT platform must remain in this enclosure to protect it against electronic contact with other objects or surfaces.***

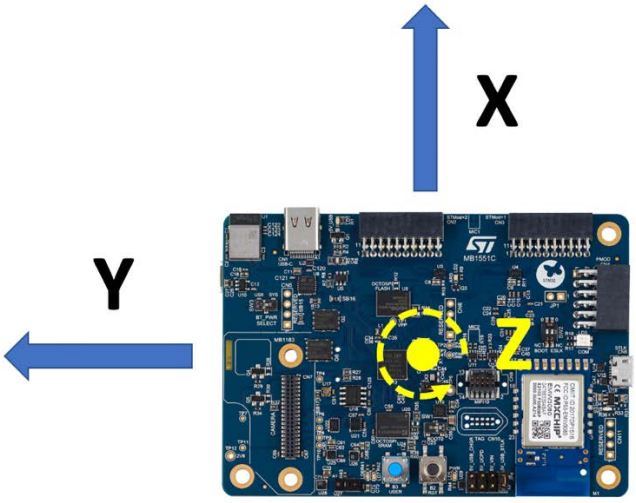


Figure 5. The Orientation of Accelerometer and Gyroscope Sensor Axes of the IoT Platform.

5. Connecting the IoT Platform System to the Apple Mac Platform

5.1. USB Connectors

1. First, determine the connector type on the Apple Mac platform

    1. **Apple Mac with Two USB-A Ports with one at left side and one at right side**

2. **Apple Mac with One USB-A Port**

3. **Apple Mac with Two USB-C Ports**

4. **Apple Mac with One USB-C Port**

2. **Cables, Connectors and Connections**
    1. **Apple Mac with One or Two USB-A Ports with one at left side and one at right side**
        A. **One USB-A to Micro-USB Cable**

    2. **Apple Mac with One or Two USB-C Ports**
        A. **One USB-A to Micro-USB Cable**
        B. **One USB-C to USB-A Adapters**

6. Import the Tutorial 1 Project

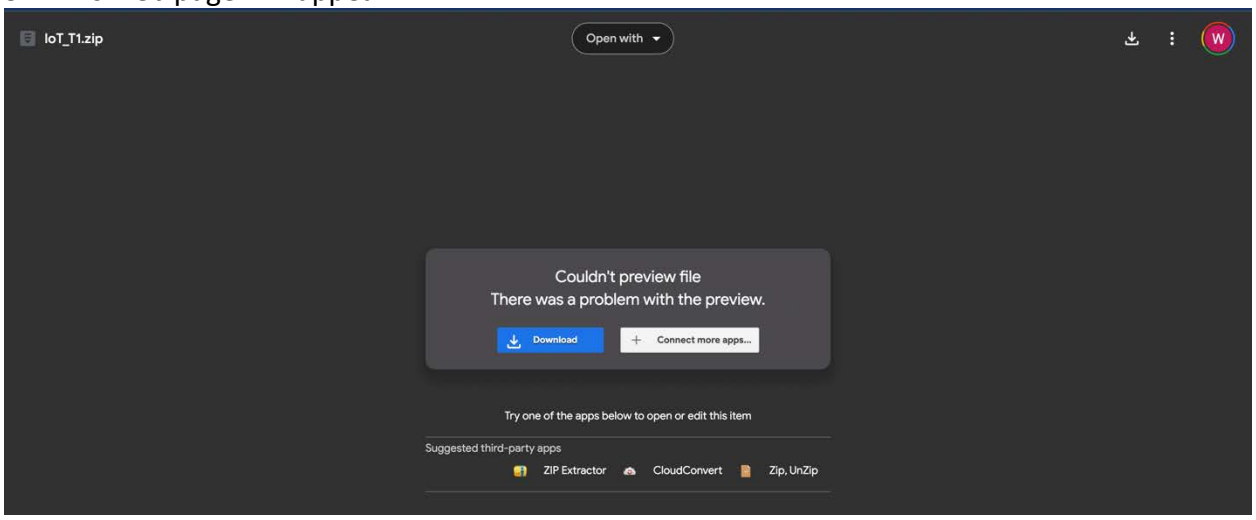
1. Create a directory named Tutorial_1 (without spaces in directory names) in your file system

6.1. Download the DataLog Project

2. Open the following link on a web-browser.

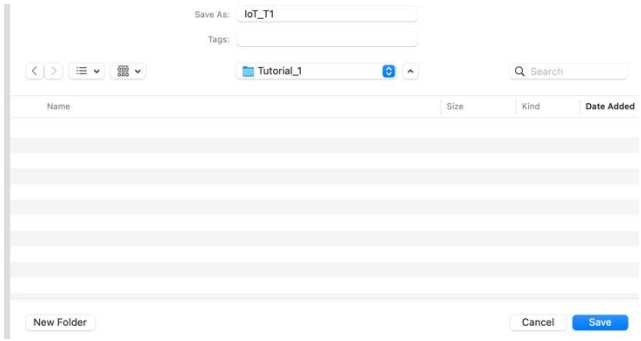
   https://drive.google.com/file/d/19C6Fl4jnbr0IO6DbMq43D51iZxEEsgis/view?usp=sharing

3. This web page will appear

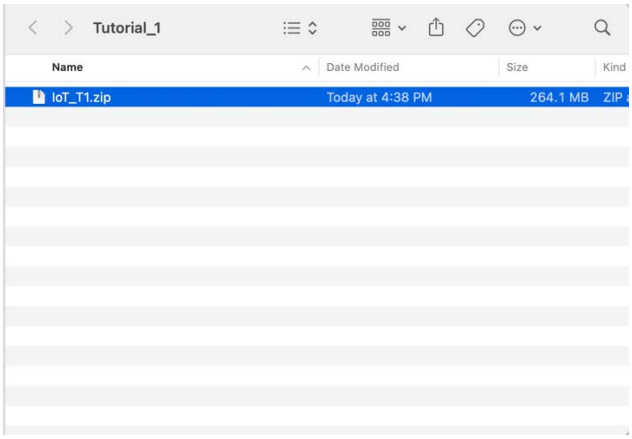


4. Select Download

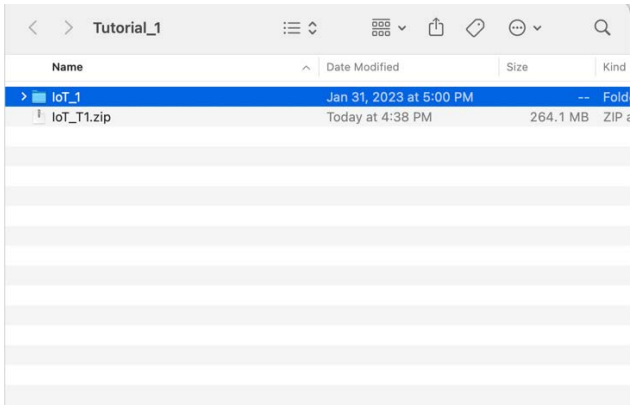
5. Then select the Tutorial_1 directory you had created for the download destination



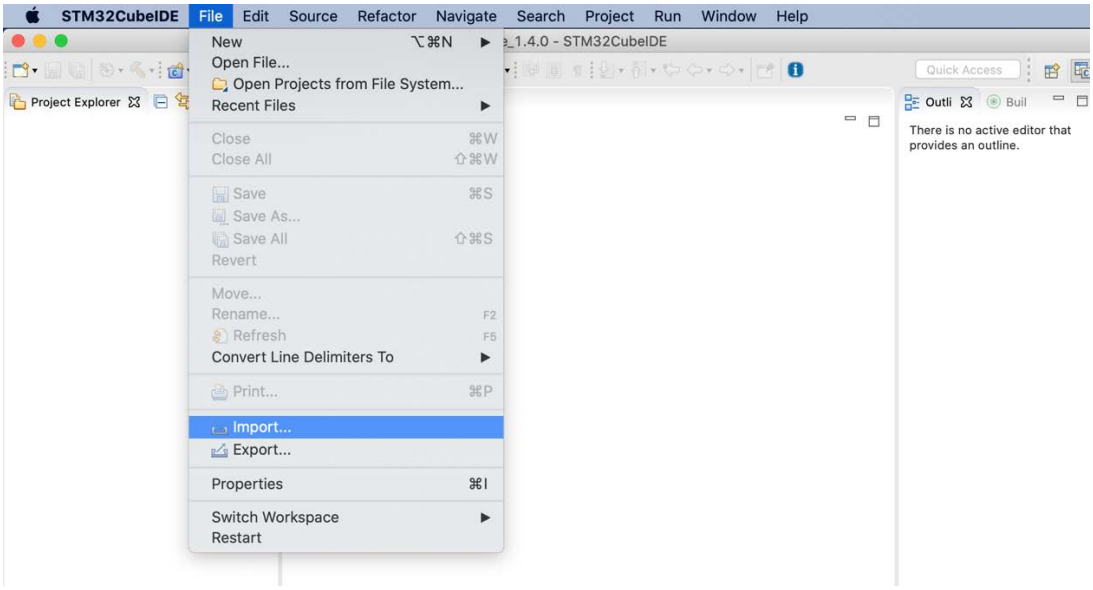
6. Then open the folder in Finder and double click on the downloaded archive to unzip.



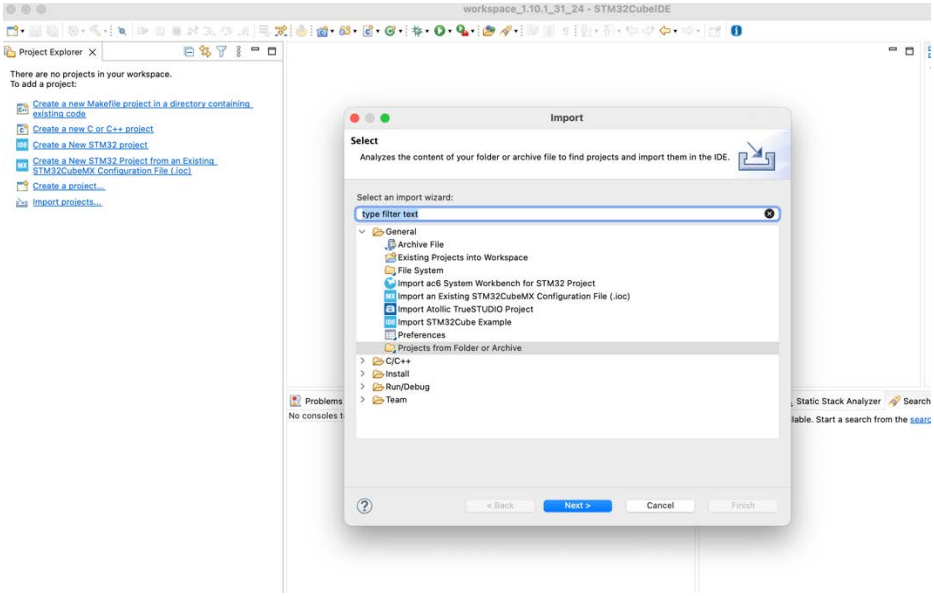
7. The directory will appear



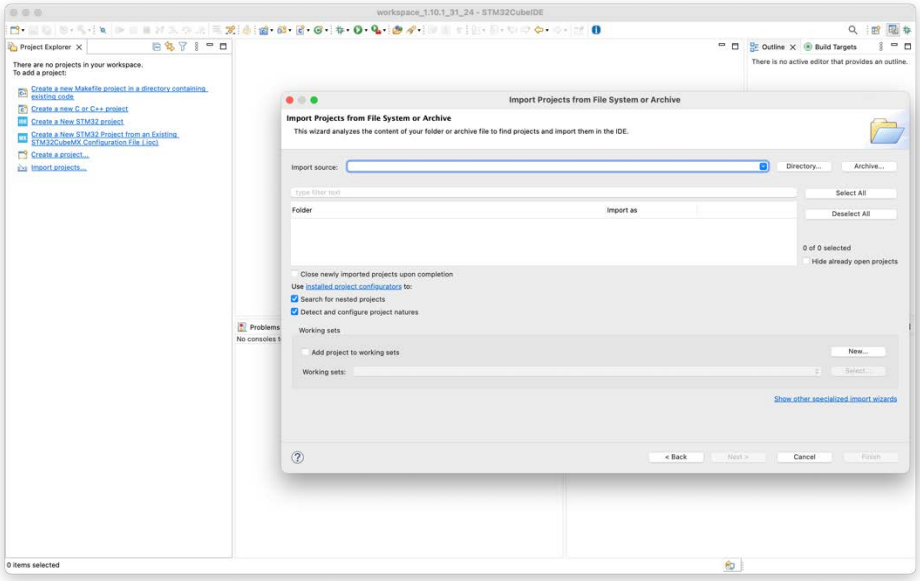
8. Now, start the STM32CubeIDE Application. Select File > Import



9. Then, Select Projects from Folder or Archive. Click Next

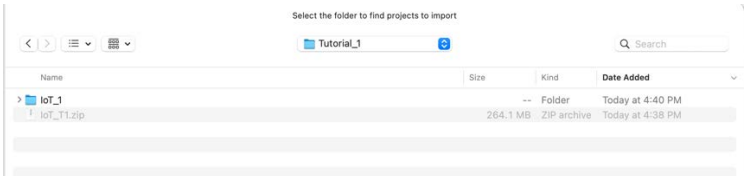


10. Then, Select Projects from Folder or Archive. Click Next



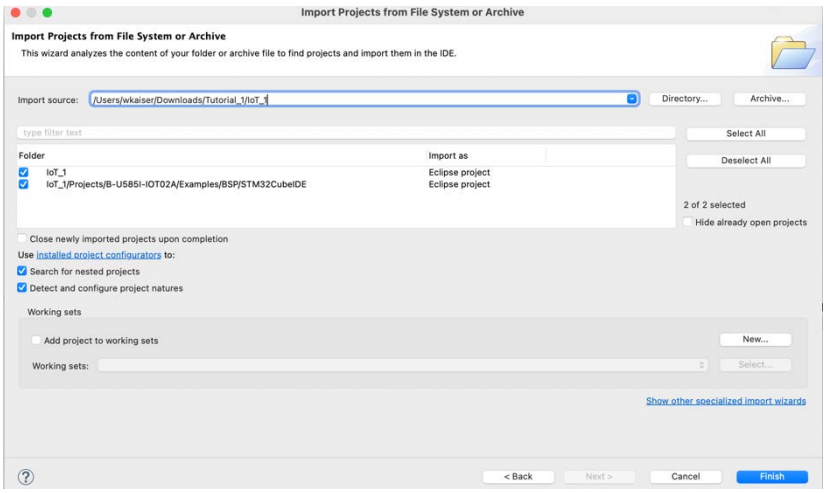
11. Then, Navigate to the Tutorial_1 directory you have created

12. The input options should appear as below.



13. Highlight IoT_1

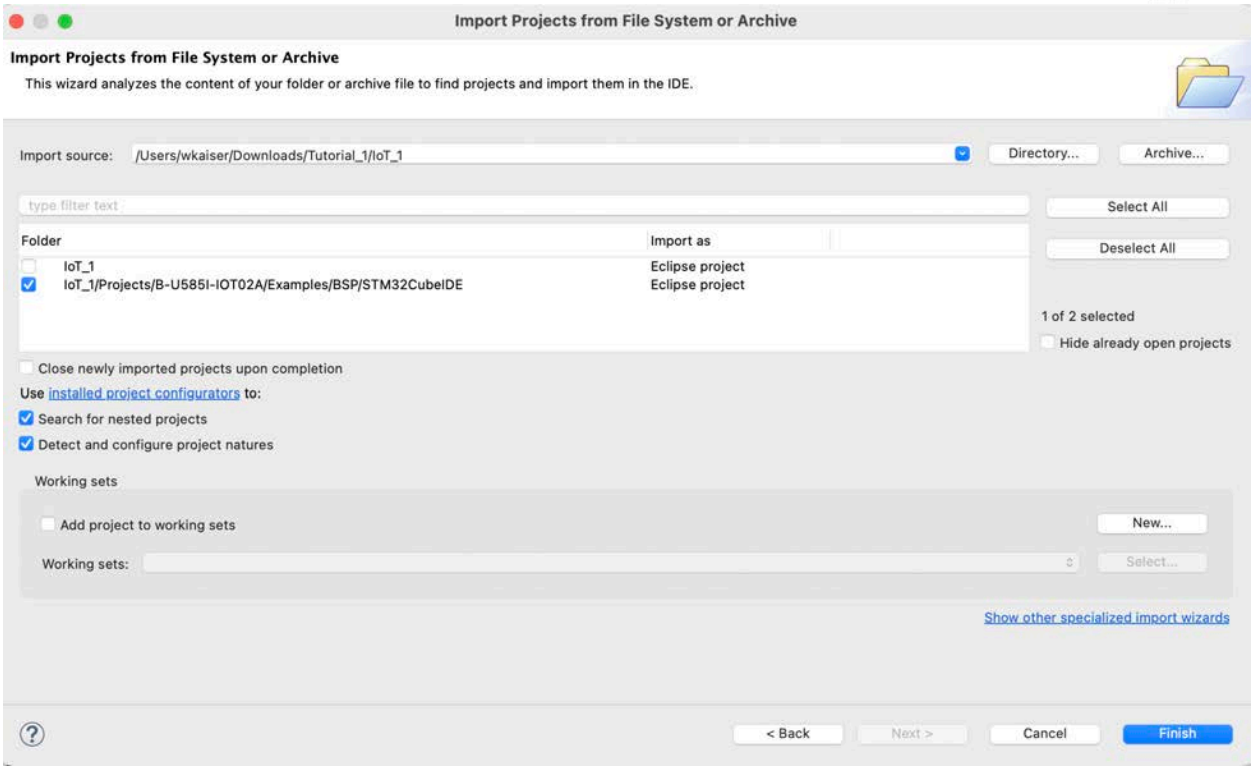
14. Select Open



15. Deselect the first directory.

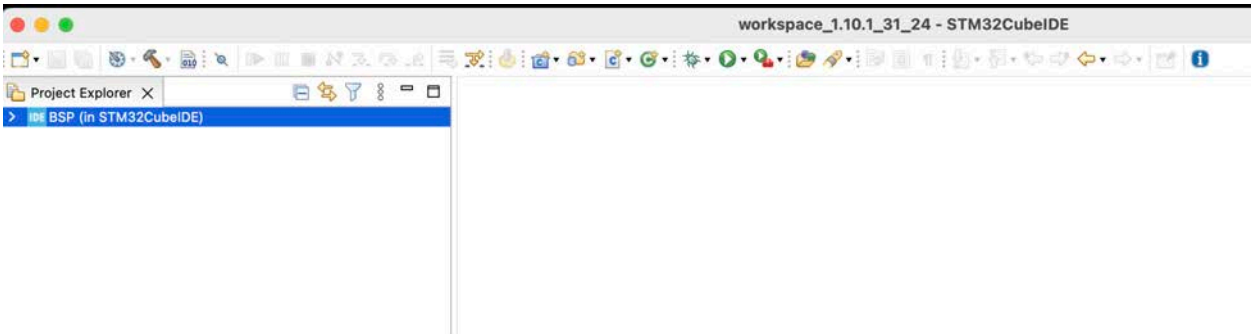
16. Only the second project should be selected as below.

17. Also, the default selection of other options must appear as below.

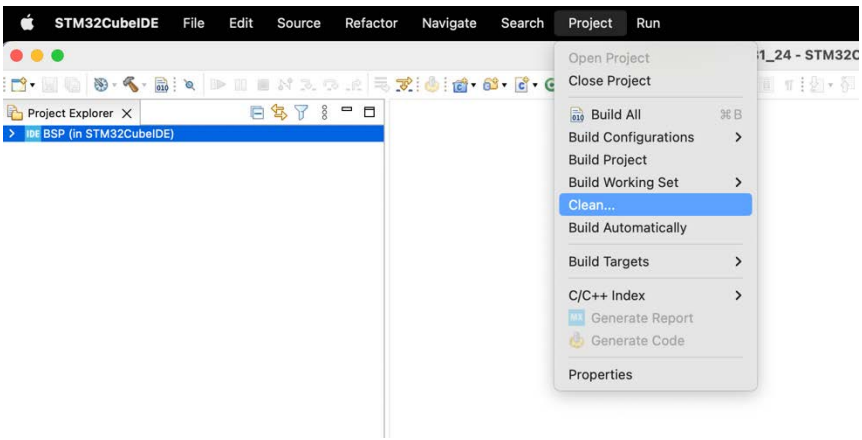


18. Select Finish

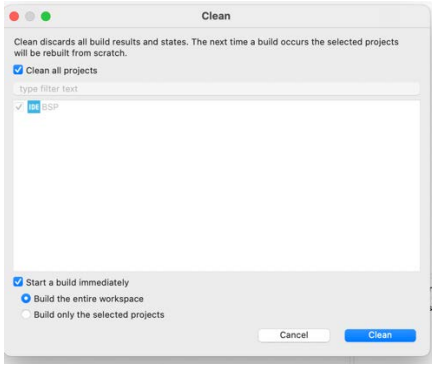
19. Now STM32CubeIDE will appear as below



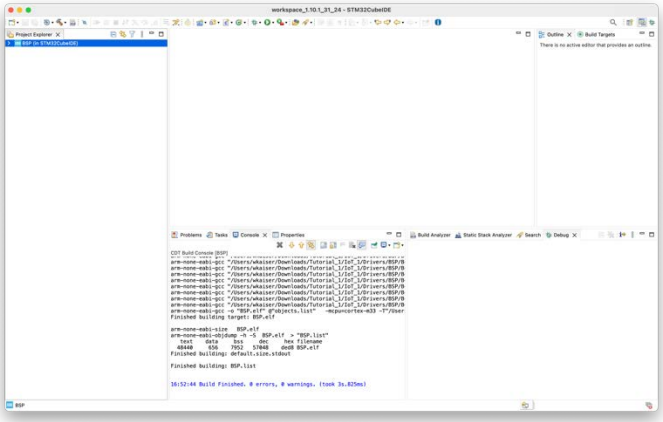
20. Highlight the BSP Project and select Project > Clean



21. Select Clean



22. The BSP Project will build and successful compilation will be shown as below.

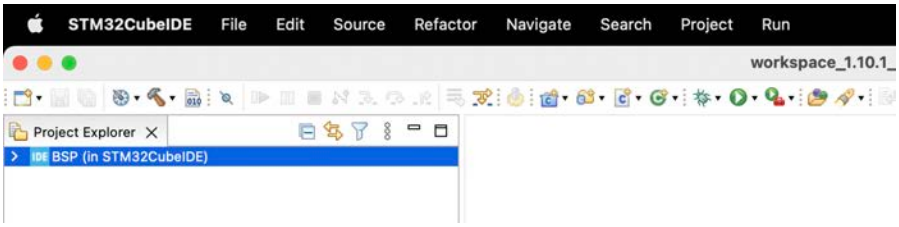


23. Now this Project will be executed.

24. First, attach the IoT Platform USB Cable to the computer USB port with the appropriate adapter as required for USB-C computer ports.

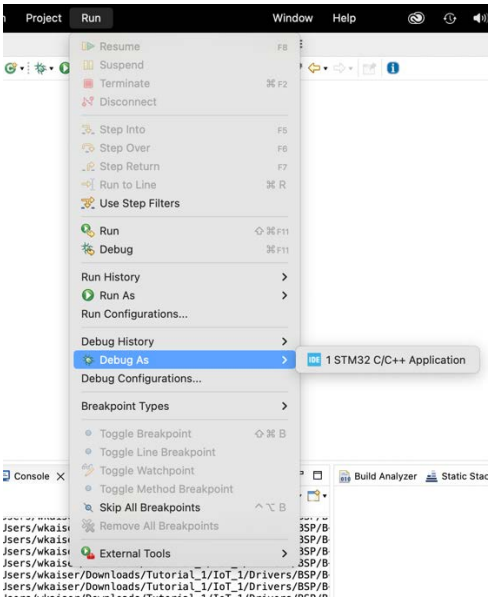
25. Then, return to STM32CubeIDE

26. Ensure that the project directory is highlighted as below. If not, simply mouse over the Project name and present a single mouse click (not double click)



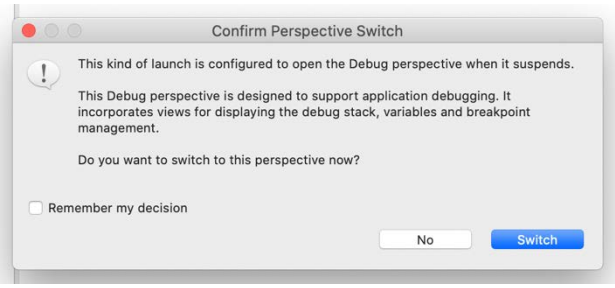
27. Ensure that the project directory is highlighted as below. If not, simply mouse over the Project name and present a single mouse click (not double click)

28. Now, select Run > Debug As > STM32 C/C++

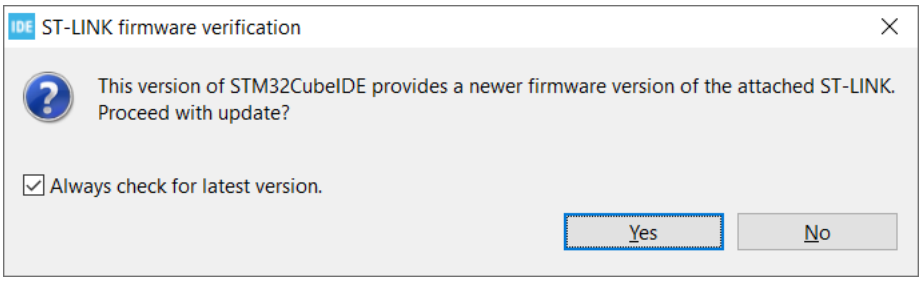


29. Now, select Run > Debug As > STM32 C/C++

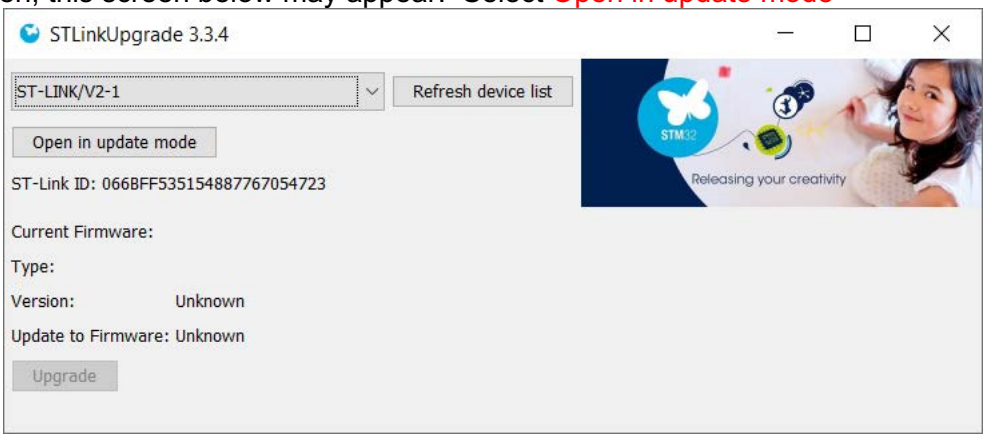
30. This screen will appear. Select Switch. Do not check the checkbox. This screen is useful in the future.



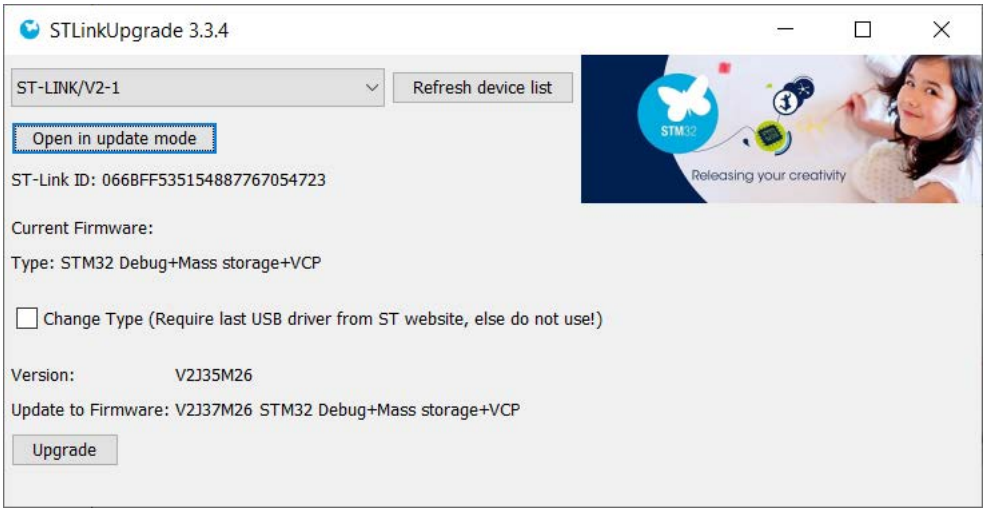
31. During the first operation, this window below will appear. Select Yes.



32. Then, this screen below may appear. Select Open in update mode

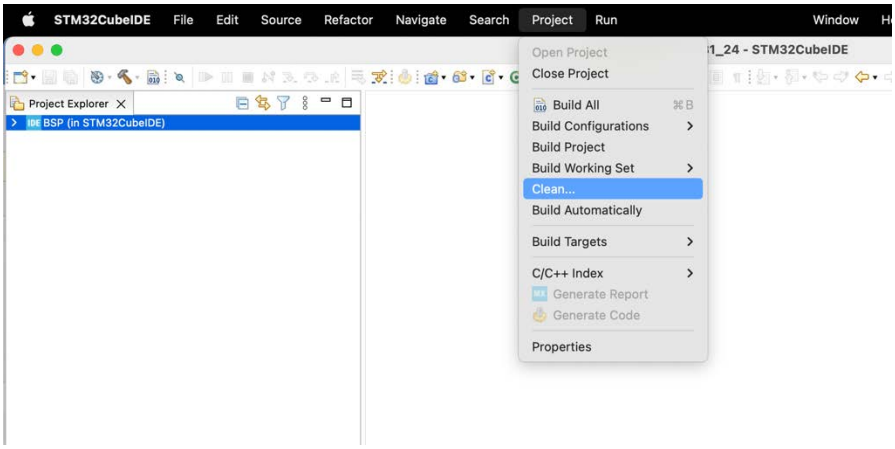


33. Then, this screen below will appear. Select Upgrade.

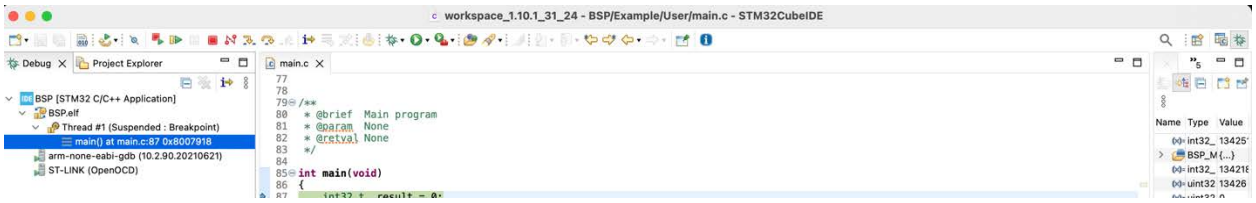


34. After completion of this step, return to the STM32CubeIDE application.

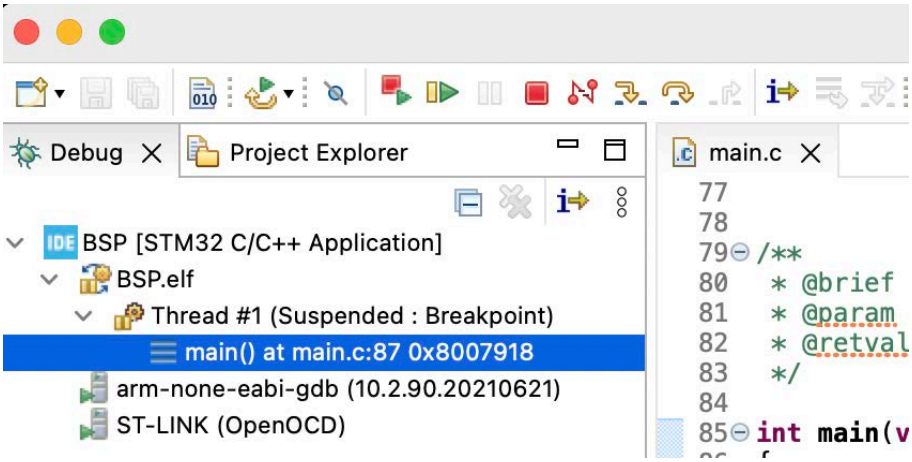
35. Again select Run > Debug As > STM32 C/C++



36. Now, the Debug Window will appear. Note that the task is shown as Suspended



37. This is a close-up view

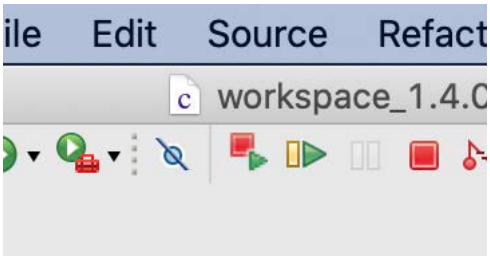


38. It is essential to wait until the Debug window shows that the Thread is Suspended

39. Do not proceed until this appears. It may require 3 to 5 seconds of delay.

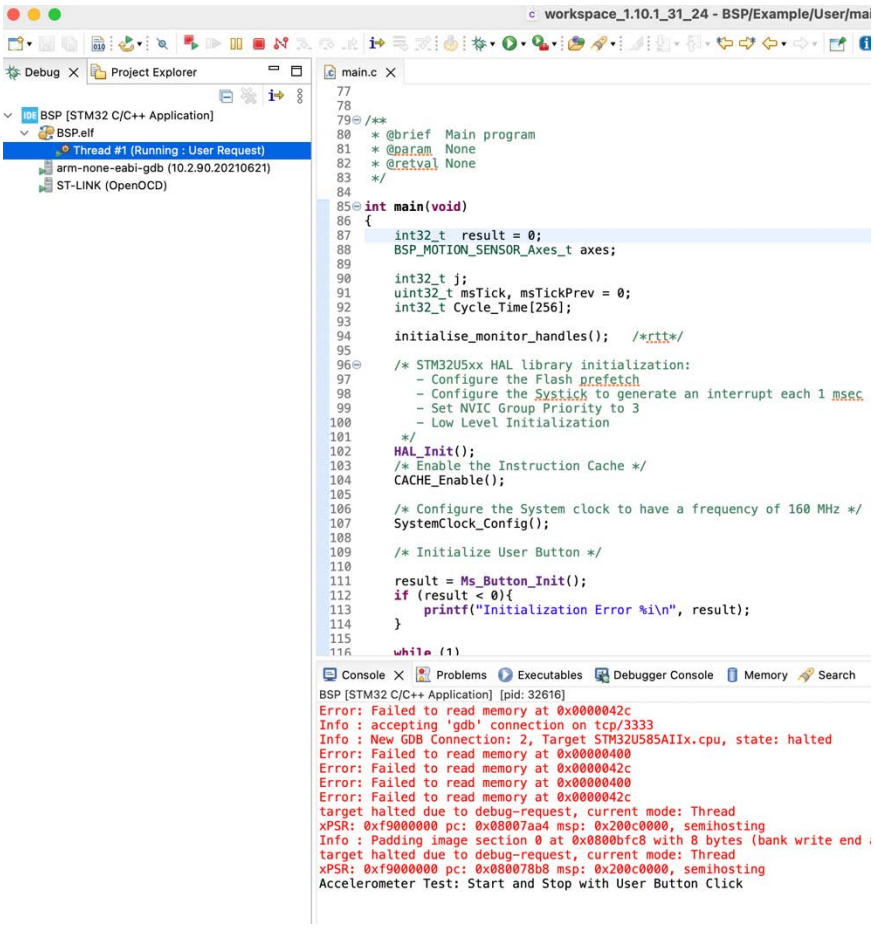
40. Now, find the Resume button underneath the “Source” entry.

41. The resume button in the right facing green arrow.



42. Click on the resume button. The screen will change and indicate that the Project is running.

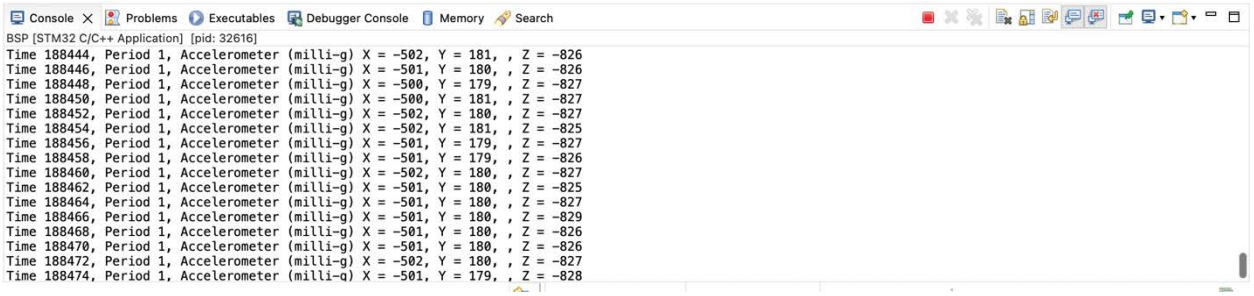
43. The Console window at the lower part of the IDE screen will show this



44. Note the message: Accelerometer Test: Start and Stop with User Button Click

45. Press the User Button (shown in Figure 3).

46. Real Time accelerometer data will be displayed



47. Examine Figure 5 showing the orientation of Sensor Axes.

48. Rotate the orientation of the platform and note that when each of the X, Y, and Z axes become vertical, their value reaching 1000 mg = 1g.

49. Press the User Button again

50. This will halt execution of accelerometer measurement and enable a start of Gyroscope measurement

51. Real Time Gyroscope data will be displayed

52. This data is displayed in units of milli-degree/second

53. Rotate about the X, Y, and Z axes and observe the signals change.

54. Now, press the User Button again

55. Click in the Console window and mark and copy the text in this window and paste this into a Word or other text document.

56. Your assignment will be completed when you upload this file.

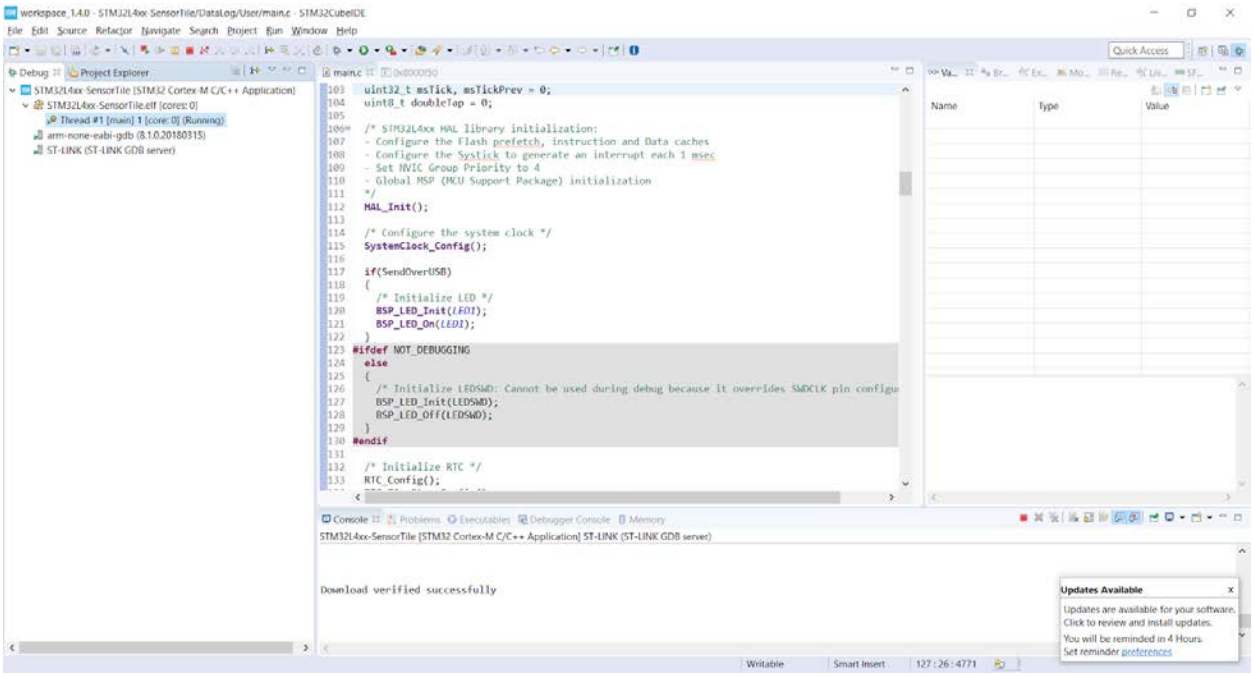
57. The system is now ready for the next Tutorials!

7. Stopping Execution and Restarting a Project

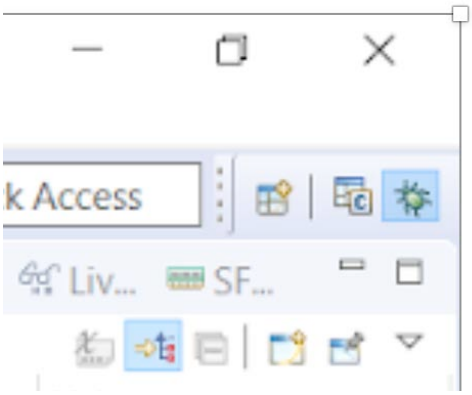
There are many times when it is needed to halt execution on the IoT Platform, remove the IoT Platform application, and build a new application.

1. Then, navigate to the Debug Window on the STM32CubeIDE.

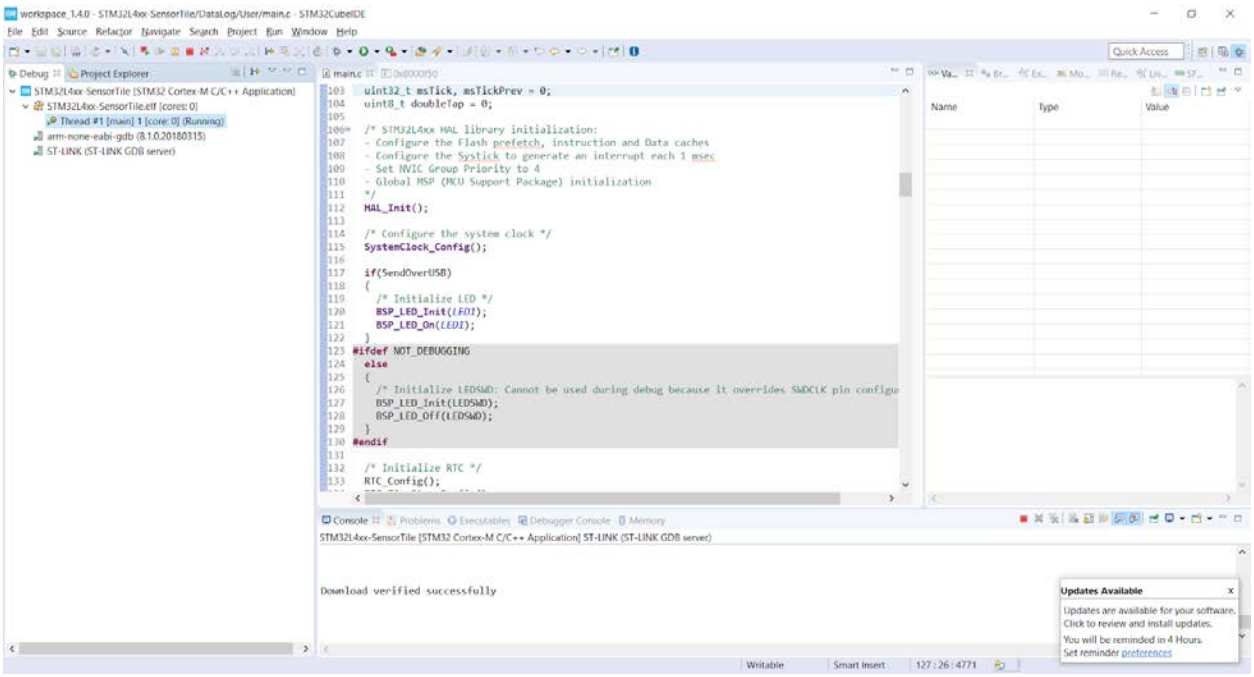
2. This is selected by pressing on the “Bug” symbol at the upper right corner



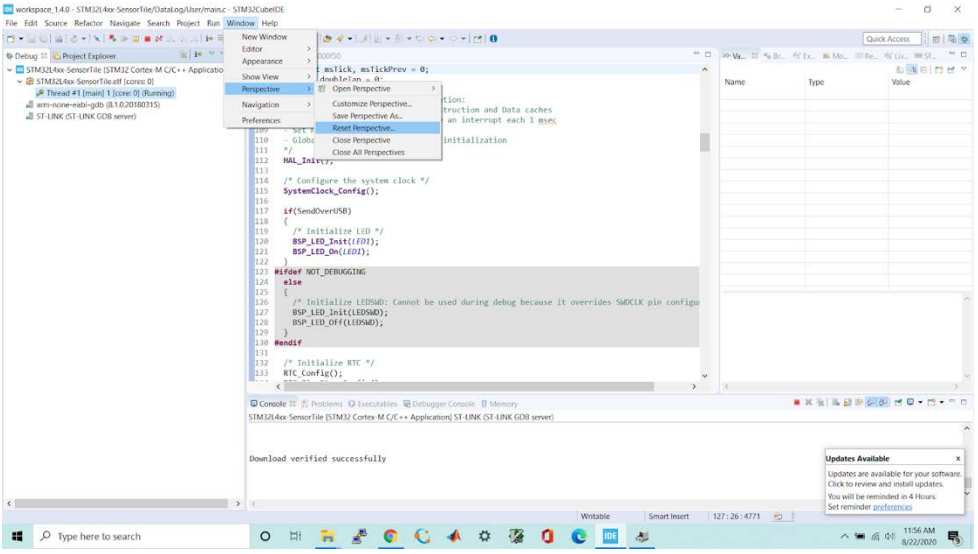
3. This is the “Bug” symbol



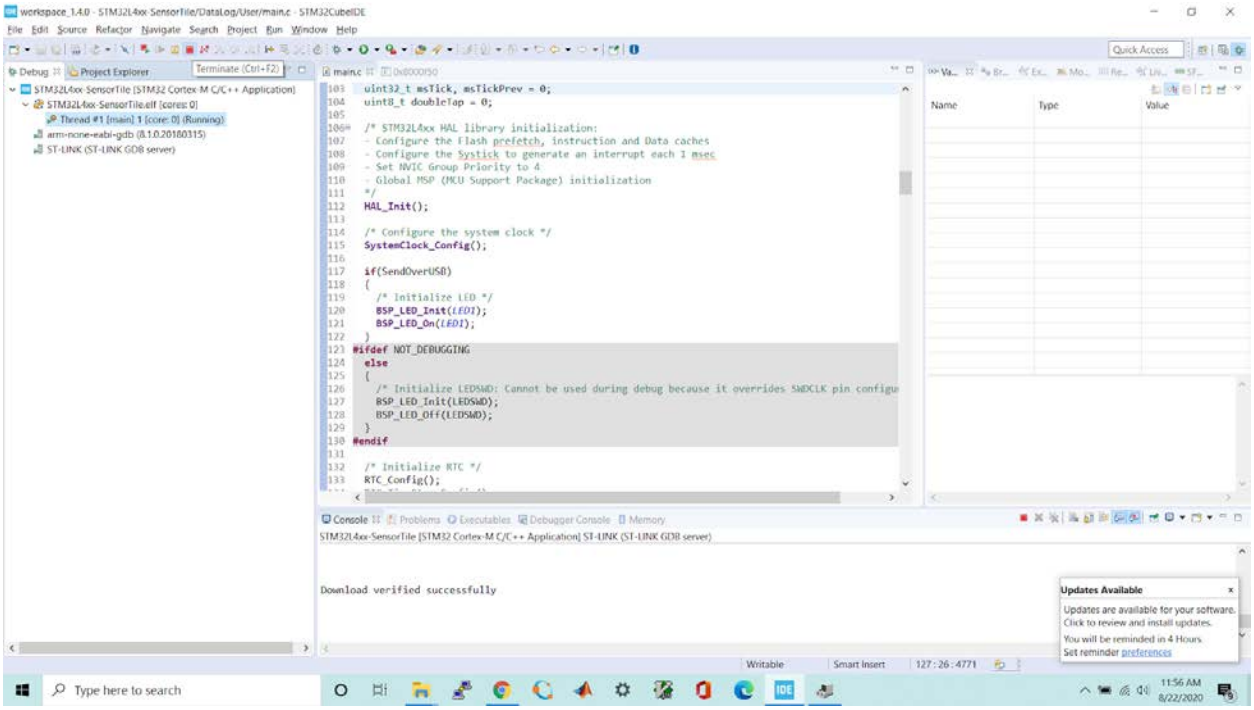
4. The screen should appear this way:

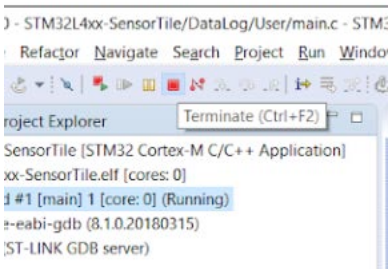


5. If the screen does not appear in this format, select Window > Perspective > Reset Perspective

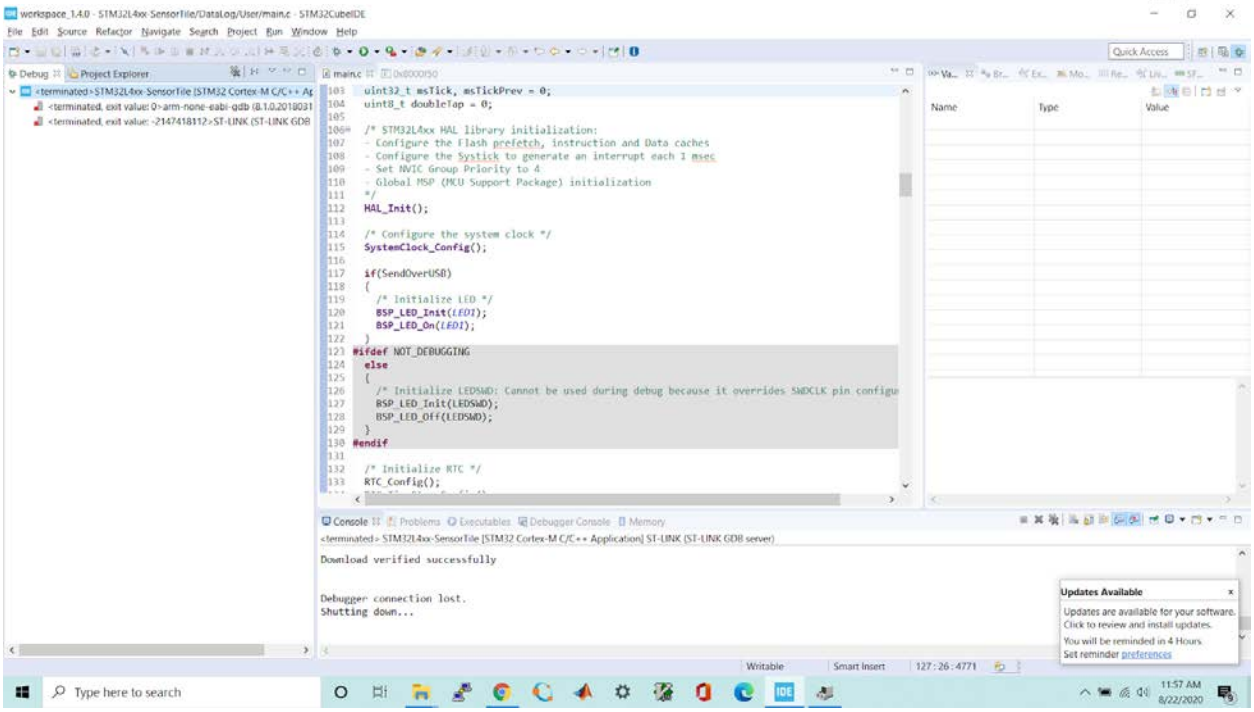


6. Now, press on the Red Square “Terminate” button as below.

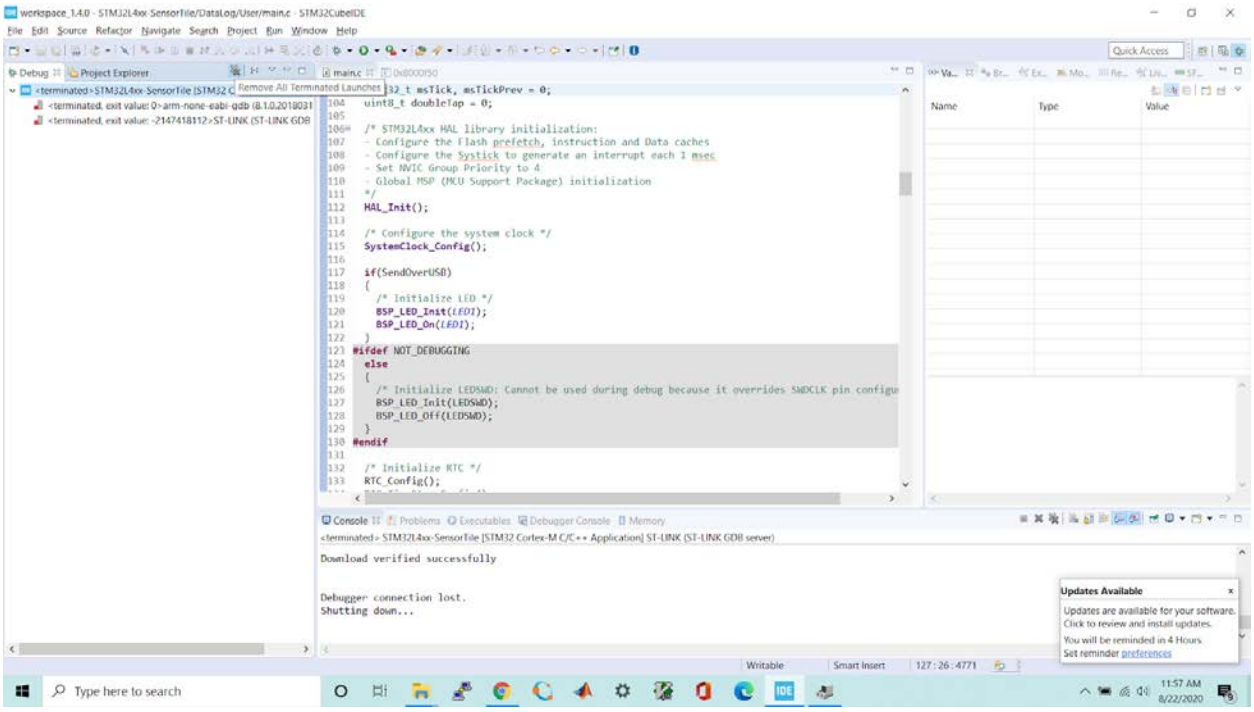




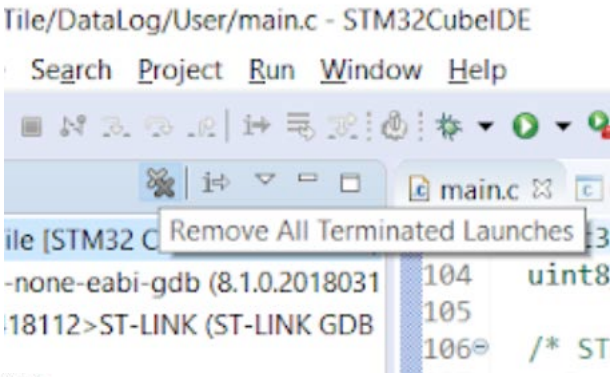
7. The screen will now appear with the application shown as terminated

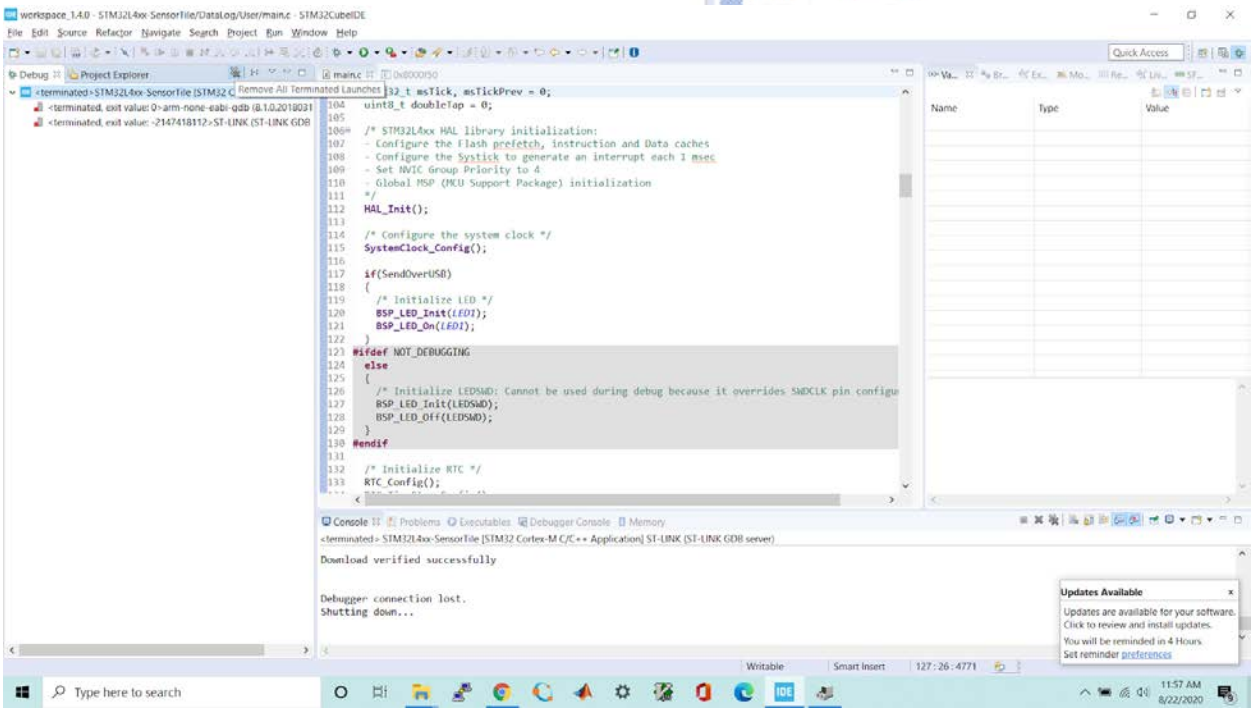


8. Then, remove this terminated application with the Remove All Terminated Launches button

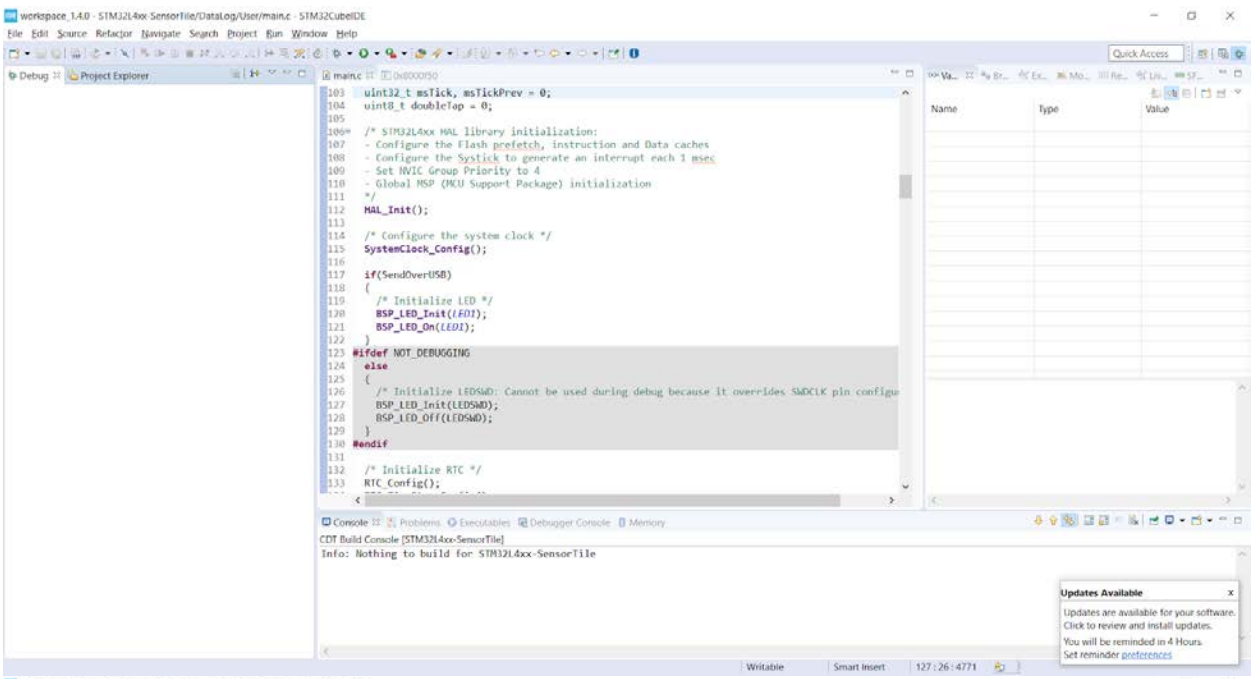


9. The Remove All Terminated Launches button appears at the upper left of the screen.


Tile/DataLog/User/main.c - STM32CubeIDE
Search Project Run Window Help
main.c
Remove All Terminated Launches
-none-eabi-gdb (8.1.0.2018031
18112>ST-LINK (ST-LINK GDB
104 uint8
105
106 /* ST


Remove All Terminated Launches
Download verified successfully
Debugger connection lost.
Shutting down...
Updates Available
Updates are available for your software.
Click to review and install updates.
You will be reminded in 4 Hours.
Set reminder preferences
Type here to search

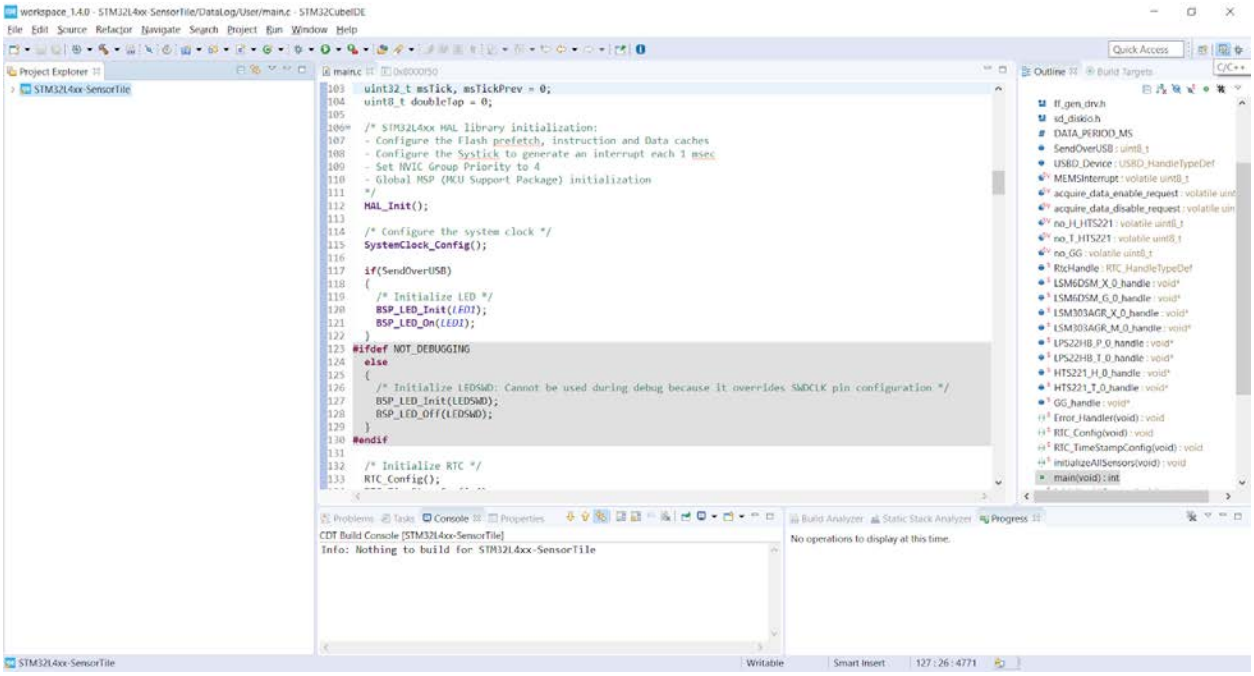
10. Now, the Debug tab in the screen will show no terminated launches



11. Navigate back to the C/C++ window by clicking on the symbol at upper right

12. The C/C++ window selector symbol at the upper and far right of the screen.

13. The C/C++ window will appear



14. Select Run > Debug As > STM32 C/C++ Application once again and test with the screen application as in previous steps

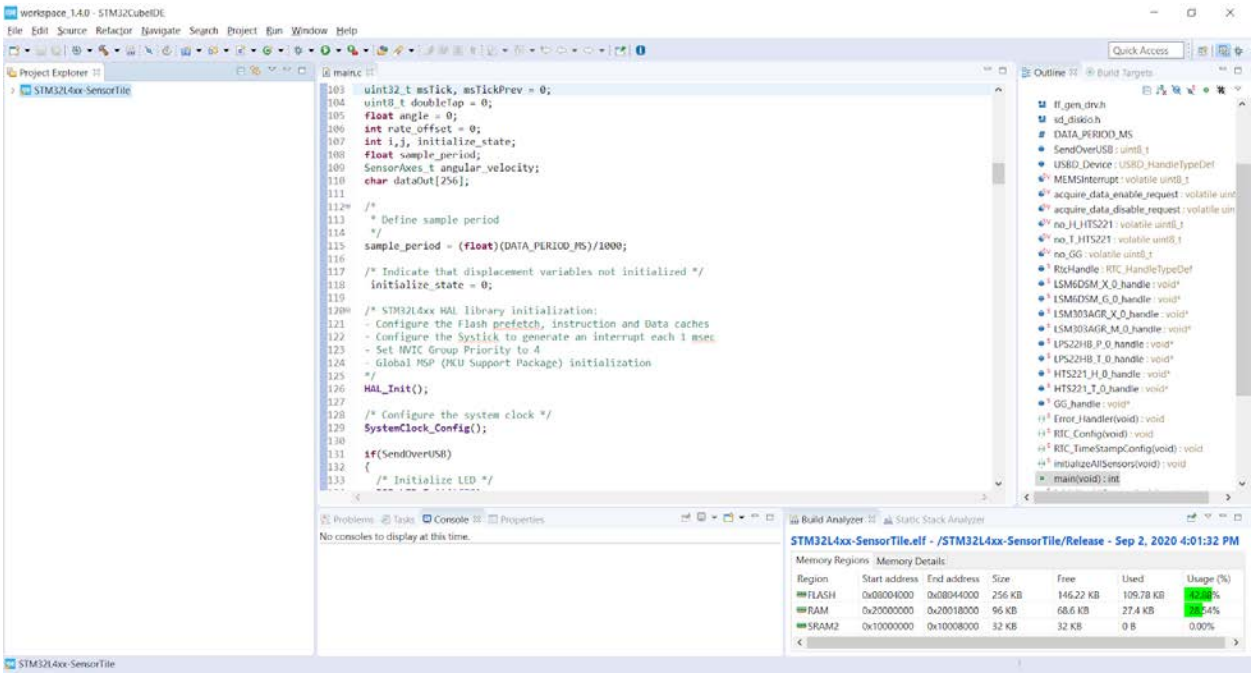
8. Removing a Project from the Workspace

After development and testing of a Project is completed, it will be important to remove the Project from the Workspace **but not delete the Project.**

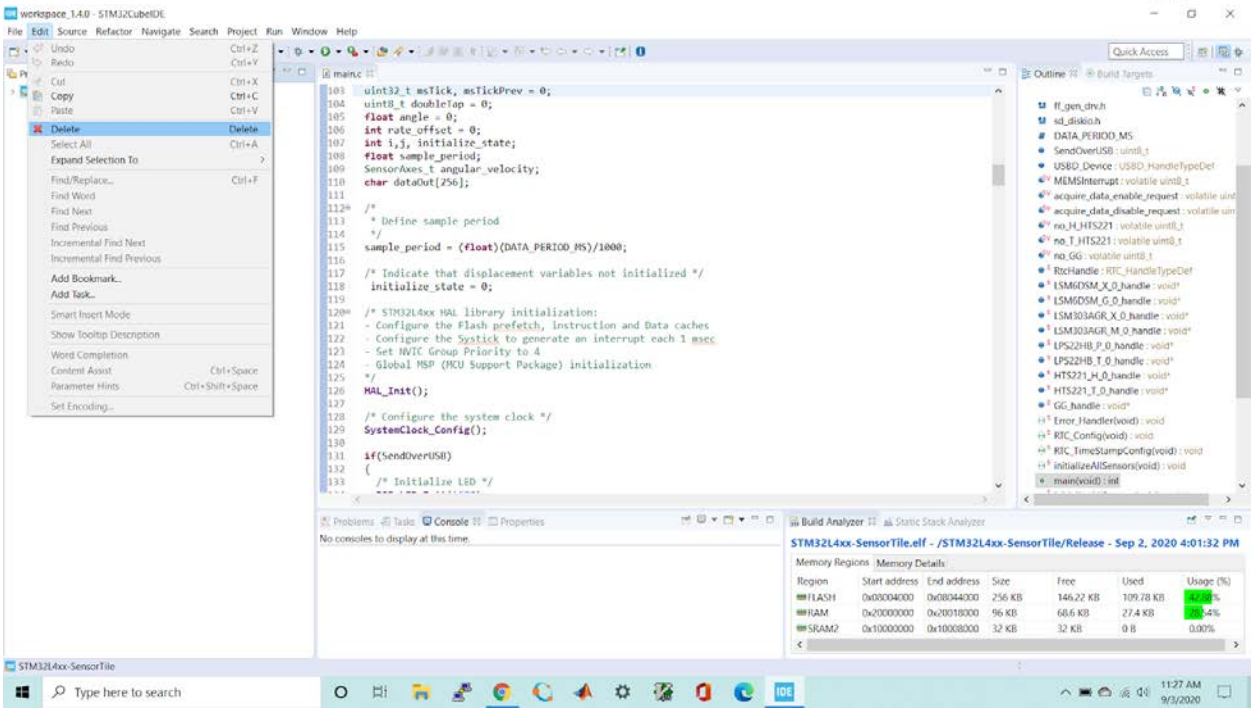
This will permit the import of a new Project.

1. Navigate to the C/C++ Window

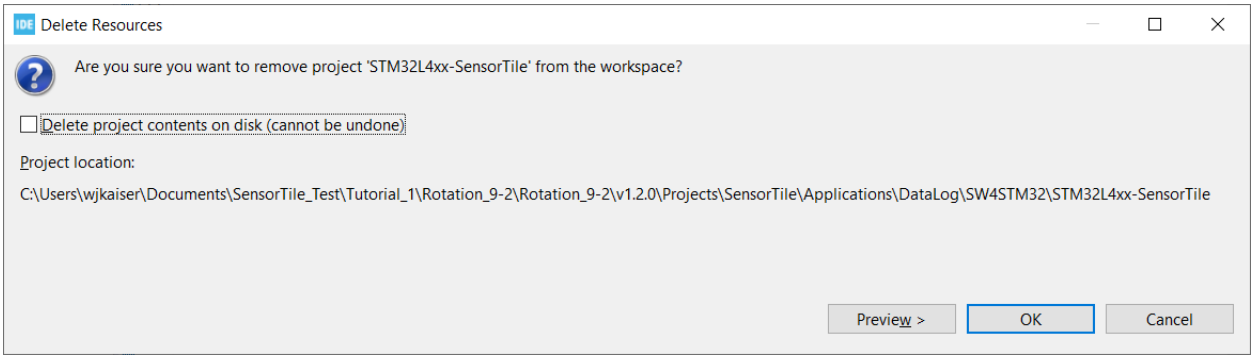
2. If the screen does not appear in this format, select Window > Perspective > Reset Perspective



3. Highlight the Project in the Project Explorer tab and the select Edit > Delete



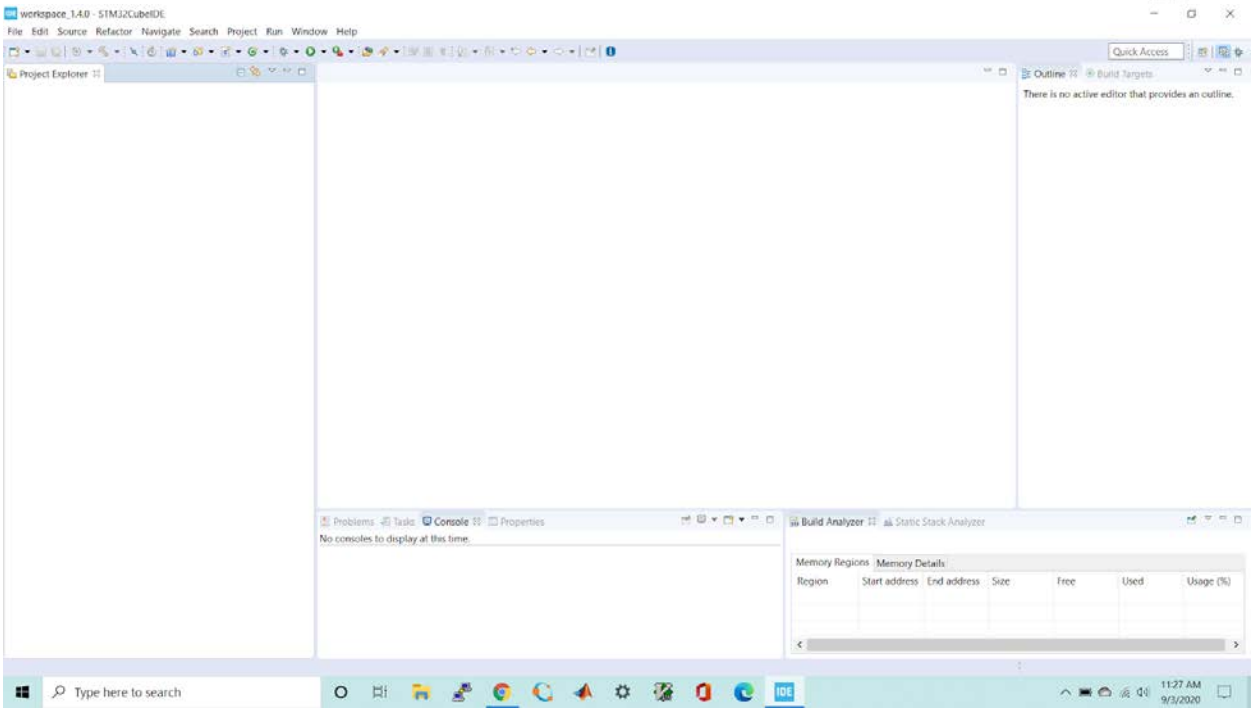
4. After clicking Delete this window will appear



5. Do Not Check the Box – there is no need to delete the Project from the file system. You may wish to retain this so that it can be imported later.

6. Just click OK.

7. This screen will appear with no Projects shown.


workspace_1.4.0 - STM32CubeIDE
File Edit Source Refactor Navigate Search Project Run Window Help
Quick Access
Project Explorer
Outline
Build Targets
There is no active editor that provides an outline.
Problems Tasks Console Properties
No consoles to display at this time.
Build Analyzer
Static Stack Analyzer
Memory Regions
Memory Details
Region
Start address
End address
Size
Free
Used
Usage (%)
Type here to search
11:27 AM
9/3/2020