

## Interfacing a Light Sensor

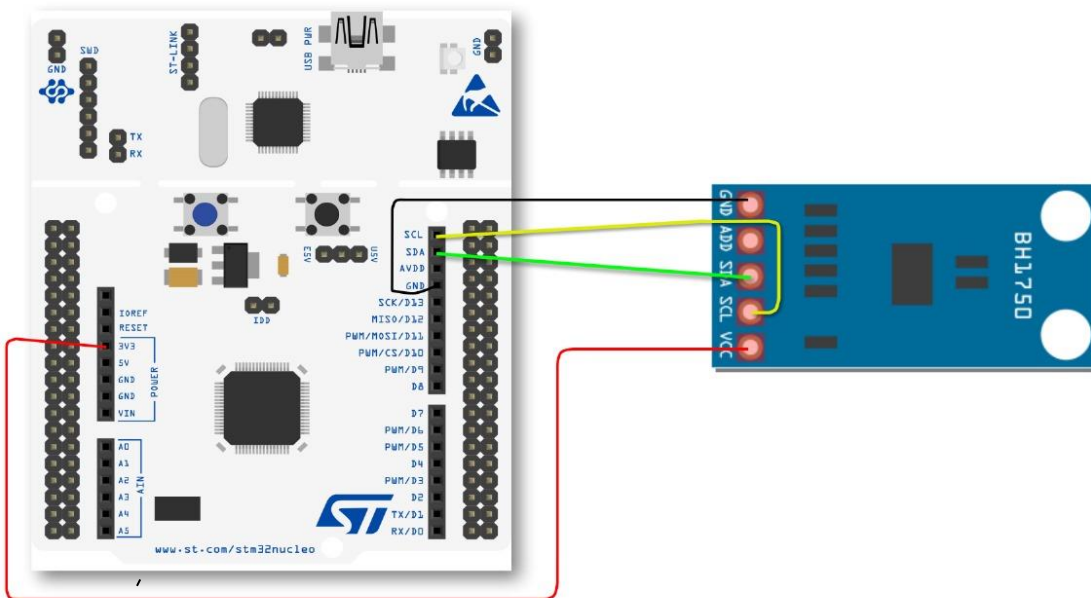
### Objective:

The Objective of this experiment is to interface a light sensor to an STM32 microcontroller.

### Requirements:

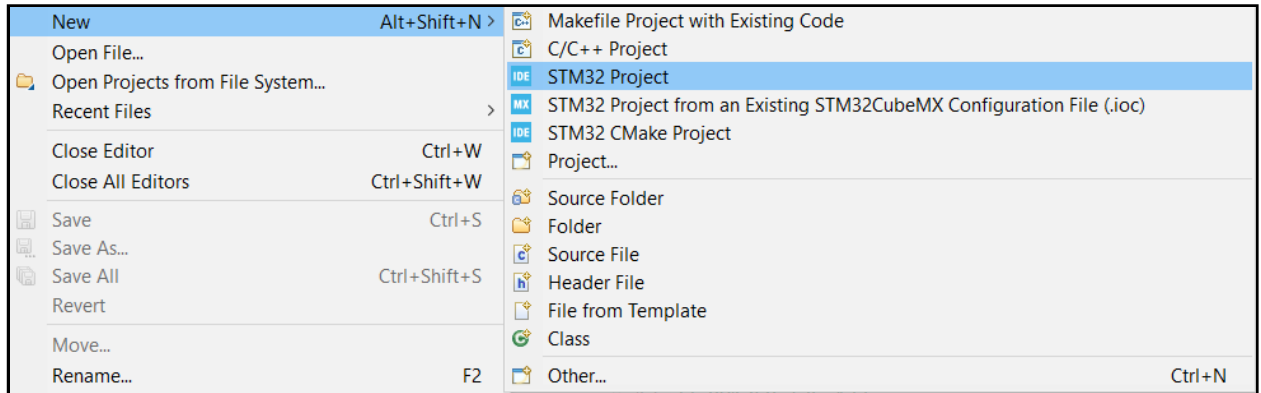
1. STM32 Cube IDE software.
2. Light Sensor (I2C).
3. STM32 Microcontroller.
4. USB Cable for the microcontroller.
5. Jumper Wires.

### Connection Diagram:

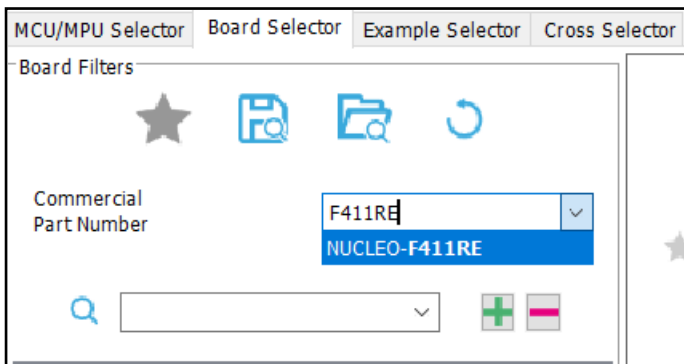


## Procedure:



1. Click on **File→New→STM32 Project** to start your project on Cube IDE.



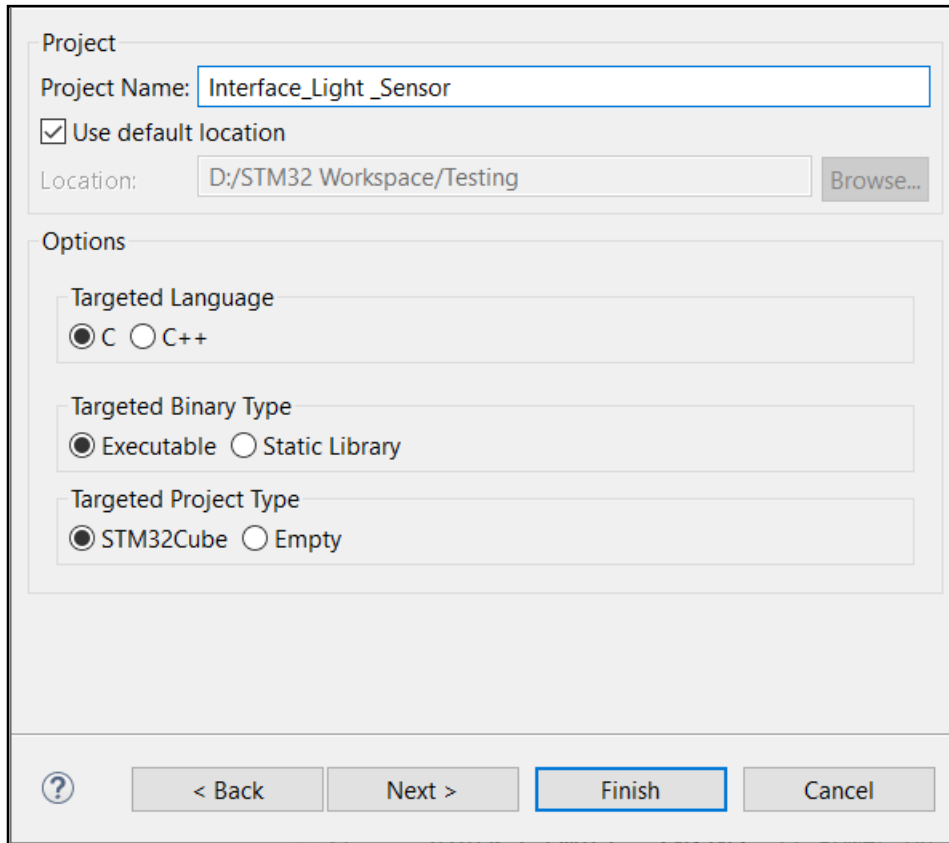
2. A **Target Selection** window will open. Click on **Board Selector**, where you need to select the microcontroller board you are working with.  
(NB: If you are having Nucleo-F401RE, you have to select the said Commercial Part Number)



3. After this on the right-hand side of the window, under **Board List** you will see the board you have selected. Click on the board and then click on **Next**.

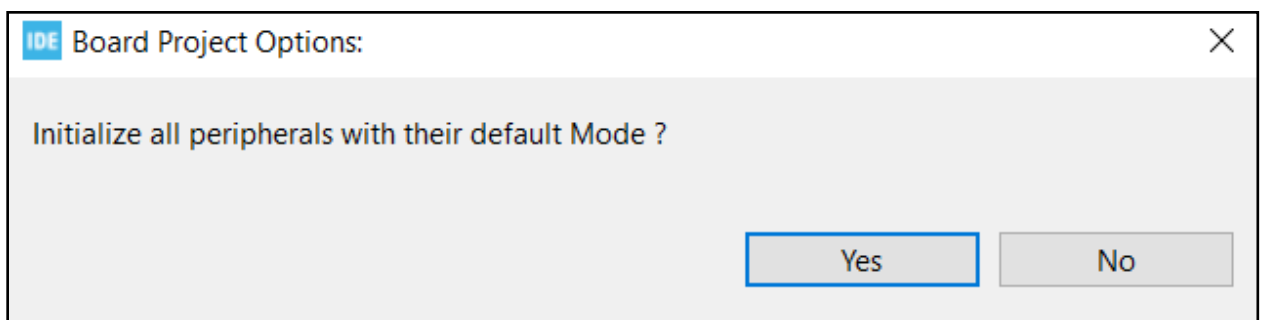
Overview	Commercial Part No	Type	Marketing Status	Unit Price (US\$)	Mounted Device
 	NUCLEO-F411RE	Nucleo-64	Active	13.0	STM32F411RET6

4. Give your project a name, rest of the things will remain by default as it is for now. Click on **Finish**.



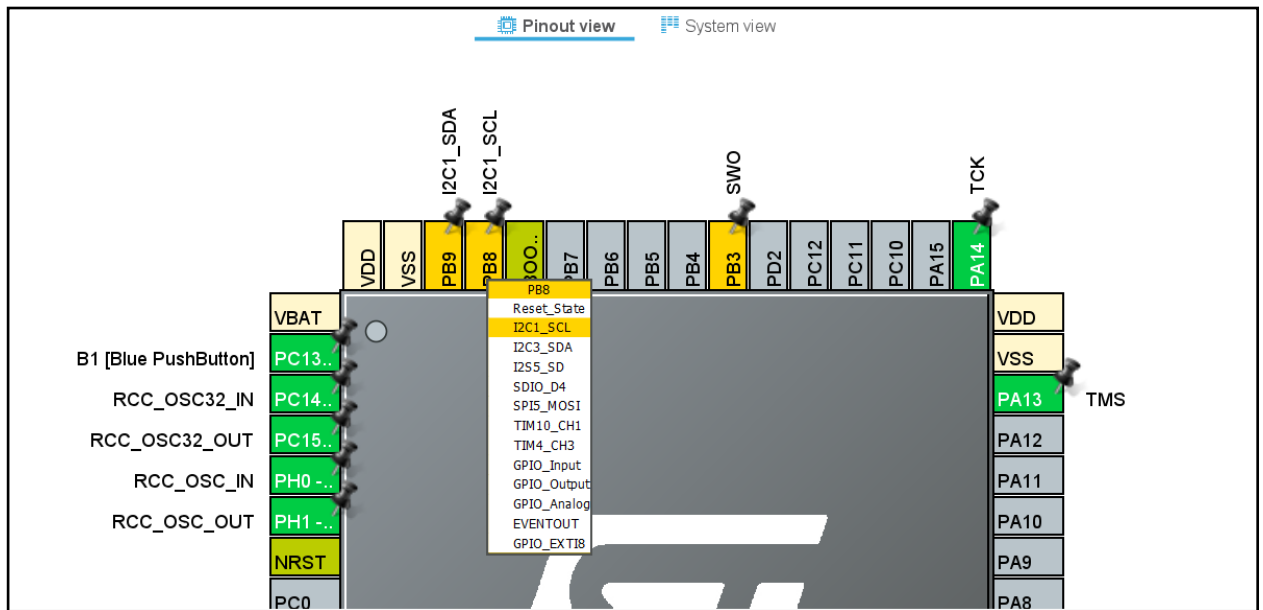
The image shows a 'Project' configuration dialog box. It has two main sections: 'Project' and 'Options'. In the 'Project' section, the 'Project Name' field is filled with 'Interface\_Light\_Sensor'. The 'Use default location' checkbox is checked. The 'Location' field shows 'D:/STM32 Workspace/Testing' with a 'Browse...' button next to it. The 'Options' section contains three groups of radio buttons: 'Targeted Language' with 'C' selected, 'Targeted Binary Type' with 'Executable' selected, and 'Targeted Project Type' with 'STM32Cube' selected. At the bottom, there are four buttons: a help icon (?), '< Back', 'Next >', and 'Finish' (which is highlighted with a blue border), and a 'Cancel' button.

5. Cube IDE will ask if you want to initialize all peripherals with their default mode, click on **Yes**.

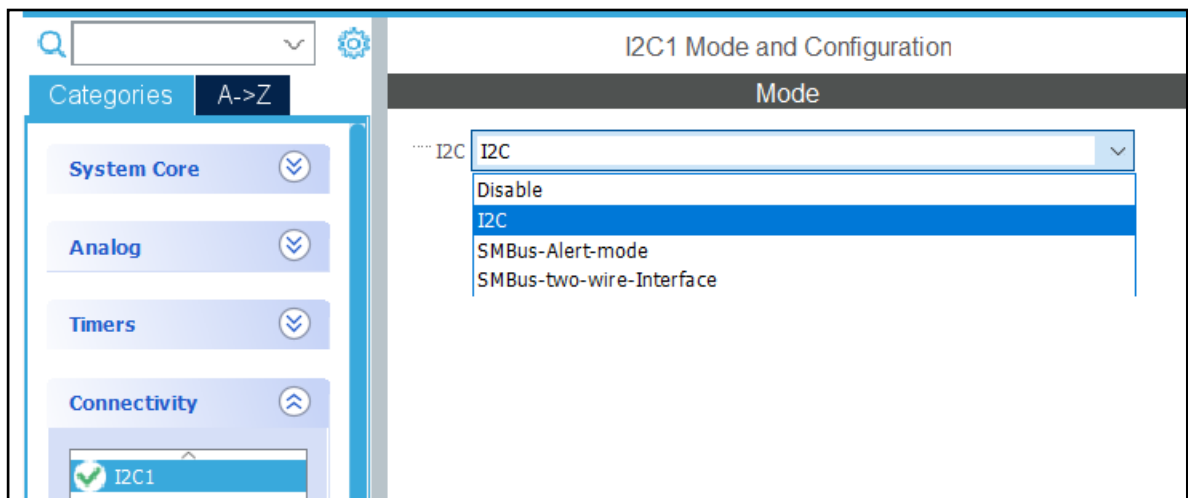


The image shows a 'Board Project Options' dialog box. It has a title bar with the 'IDE' logo and a close button (X). The main text asks 'Initialize all peripherals with their default Mode ?'. At the bottom right, there are two buttons: 'Yes' (highlighted with a blue border) and 'No'.

6. In the **Pinout & Configuration** tab, click on **PB8** pin and select it as an **I2C1\_SCL** and **PB9** pin as an **I2C1\_SDA**.

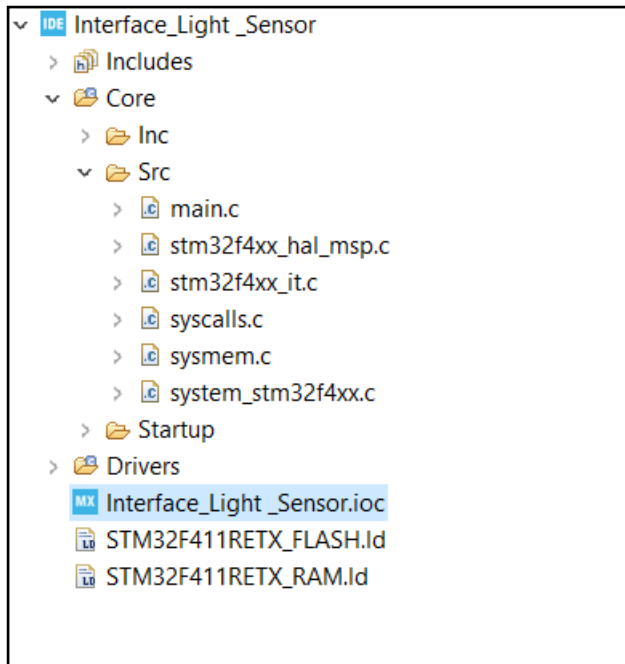


7. Next on the left-hand side under **Categories** → **Connectivity**, select **I2C1** and enable it.

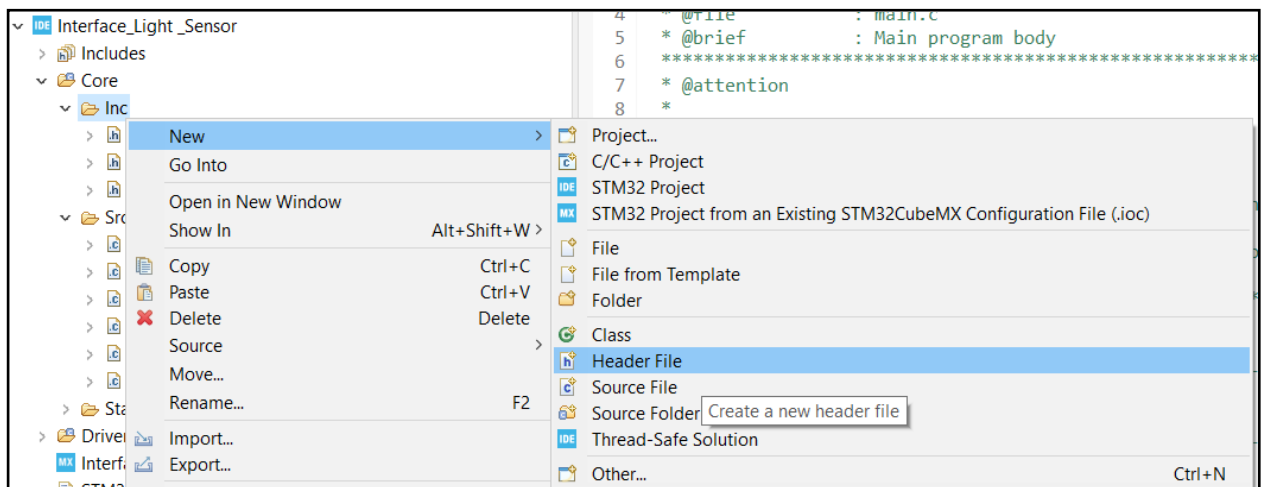


8. Press **Ctrl+S** to generate your code. On the left-hand side of the Cube IDE, under **Project Explorer** go to the project you have created (For example, I have named my project as

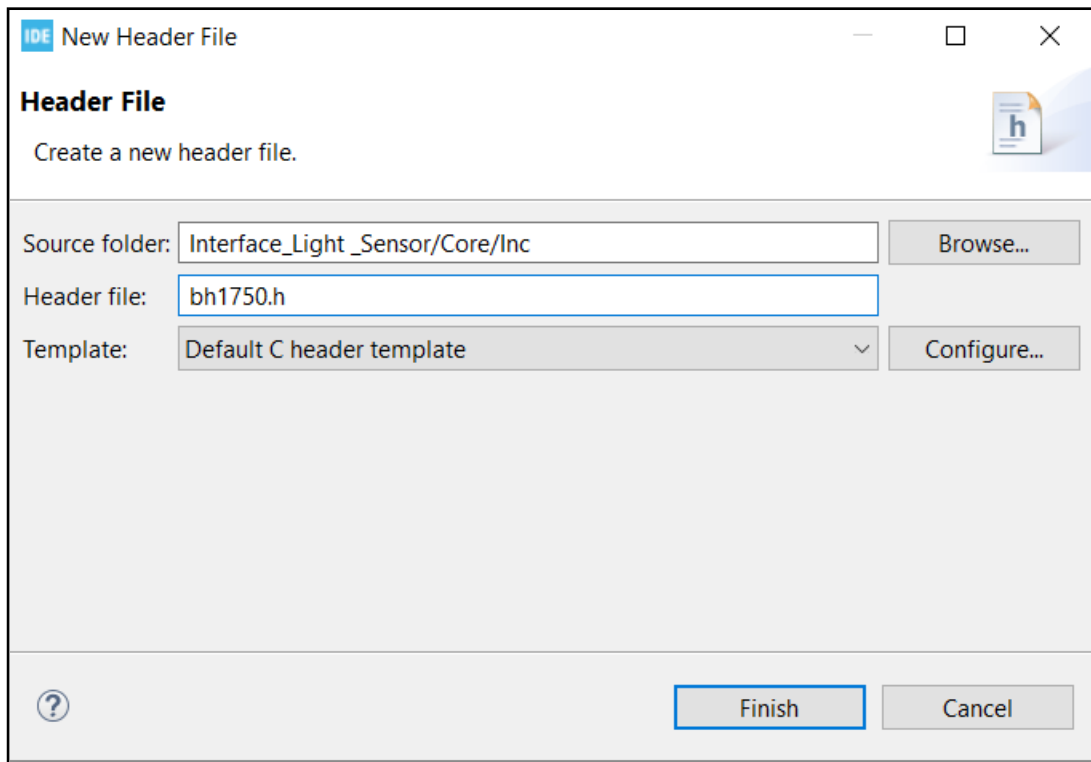
(Interface\_Light\_Sensor) **Interface\_Light\_Sensor**→**Core** →**Src**→**main.c** (double click to load the code).



- Now open your project tree **Interface\_Light\_Sensor**→**Core** →**Inc**. Right click on your **Inc** folder and create a new **Header File**.



10. Name the Header File as **bh1750.h** and select on **Finish**.

A screenshot of the 'IDE New Header File' dialog box. The title bar says 'IDE New Header File'. The main heading is 'Header File' with a subtext 'Create a new header file.' and a small icon of a header file. The dialog contains three input fields: 'Source folder:' with the text 'Interface\_Light\_Sensor/Core/Inc' and a 'Browse...' button; 'Header file:' with the text 'bh1750.h'; and 'Template:' with a dropdown menu showing 'Default C header template' and a 'Configure...' button. At the bottom, there is a question mark icon, a 'Finish' button, and a 'Cancel' button.

IDE New Header File

**Header File**

Create a new header file.

Source folder: Interface\_Light\_Sensor/Core/Inc

Header file: bh1750.h

Template: Default C header template

11. Below is the code snippets, please put your code in the appropriate places in the **bh1750.h** file.

```
2  #ifndef INC_BH1750_H_
3  #define INC_BH1750_H_
4
5  #include "stdio.h"
6
7  // BH1750 I2C Address
8  #define BH1750_ADDR 0x23 // BH1750 I2C address
9
10
11 // Function prototypes
12 void BH1750_Init(I2C_HandleTypeDef *hi2c);
13 float BH1750_ReadLux(I2C_HandleTypeDef *hi2c);
14
15 // Error Status
16 HAL_StatusTypeDef Transmit_Err, Receive_Err;
17
18
19 // BH1750 initialization
20 void BH1750_Init(I2C_HandleTypeDef *hi2c) {
21     uint8_t cmd[] = {0x10}; // Power on
22     Transmit_Err = HAL_I2C_Master_Transmit(hi2c, BH1750_ADDR << 1, cmd, sizeof(cmd), HAL_MAX_DELAY);
23     if(Transmit_Err != HAL_ERROR){
24         printf("\r\n");
25         printf("BH1750 has been initialized");
26         printf("\r\n");
27     }
28 }
29
30 // Reading Light Intensity from BH1750 sensor
31 float BH1750_ReadLux(I2C_HandleTypeDef *hi2c) {
32     uint8_t data[2];
33     HAL_I2C_Master_Receive(hi2c, BH1750_ADDR << 1, data, sizeof(data), HAL_MAX_DELAY);
34
35     uint16_t lux = (data[0] << 8) | data[1];
36     return (float)lux / 1.2;
37 }
38 #endif
```

12. Cube IDE automatically generates a code format based on the configurations you have done. Cube IDE uses HAL libraries. Below is the code snippets, please put your code in the appropriate places in the **main.c** file.

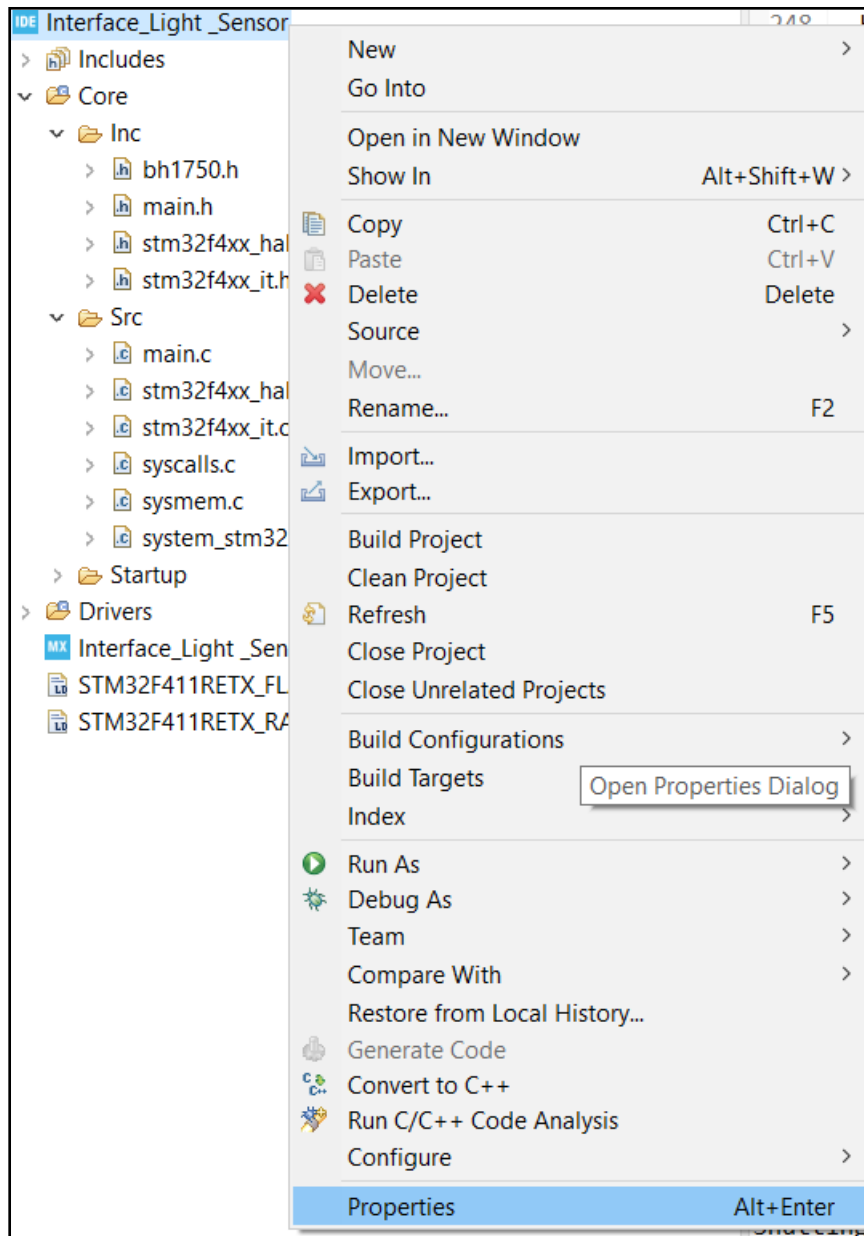
```

18 /* USER CODE END Header */
19 /* Includes ----- */
20 #include "main.h"
21
22 /* Private includes ----- */
23 /* USER CODE BEGIN Includes */
24 #include "bh1750.h"
25 #include "stdio.h"
26 #include "string.h"
27 /* USER CODE END Includes */
28
29 /* Private typedef ----- */
30 /* USER CODE BEGIN PTD */
31
93 /* Initialize all configured peripherals */
94 MX_GPIO_Init();
95 MX_USART2_UART_Init();
96 MX_I2C1_Init();
97 /* USER CODE BEGIN 2 */
98 BH1750_Init(&hi2c1);
99
100 /* USER CODE END 2 */
101
102 /* Infinite loop */
103 /* USER CODE BEGIN WHILE */
104 while (1)
105 {
106     float my_lux = BH1750_ReadLux(&hi2c1);
107     printf("Lux = %.2f\r\n", my_lux);
108     HAL_Delay(1000);
109
110     /* USER CODE END WHILE */
111
266
267 /* USER CODE BEGIN 4 */
268
269 int __io_putchar(int ch) {
270     HAL_UART_Transmit(&huart2, (uint8_t *)&ch, 1, HAL_MAX_DELAY);
271     return ch;
272 }
273
274 /* USER CODE END 4 */
275

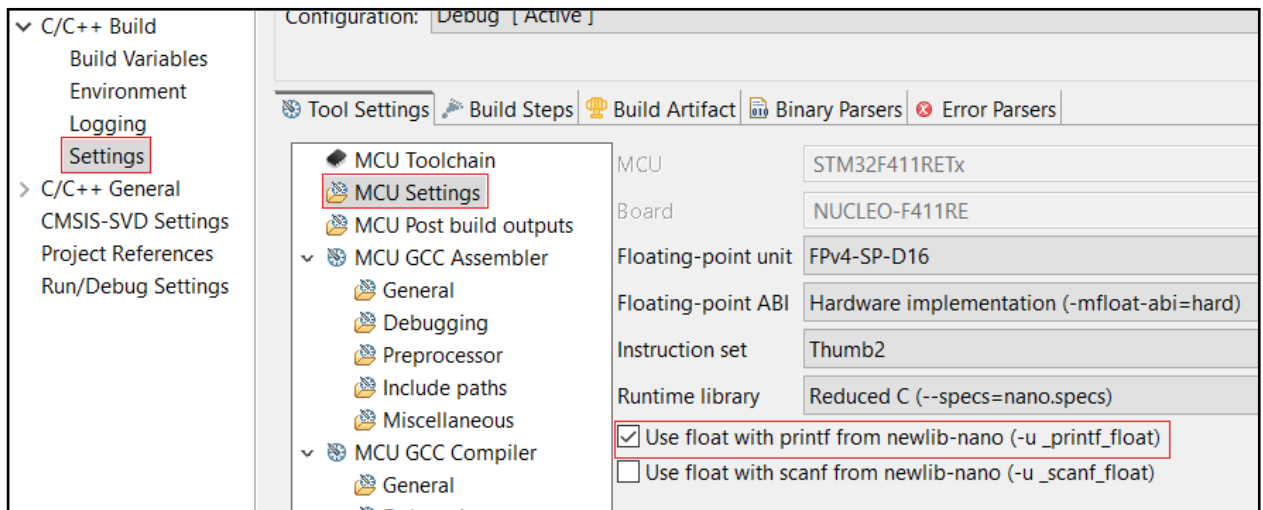
```




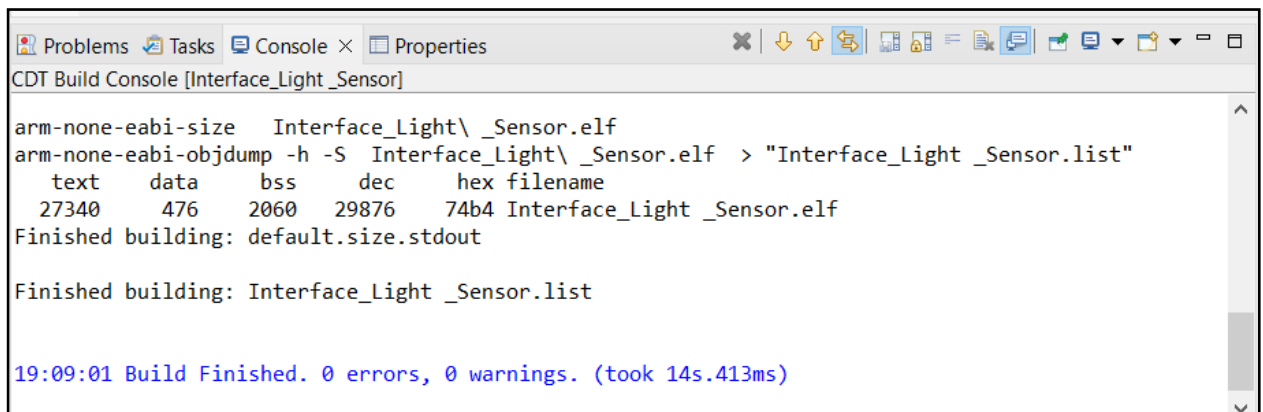
13. Now right click on your project tree, go to **Properties**.




14. After that select **Settings**→**MCU Settings** and enable the **float printf**.

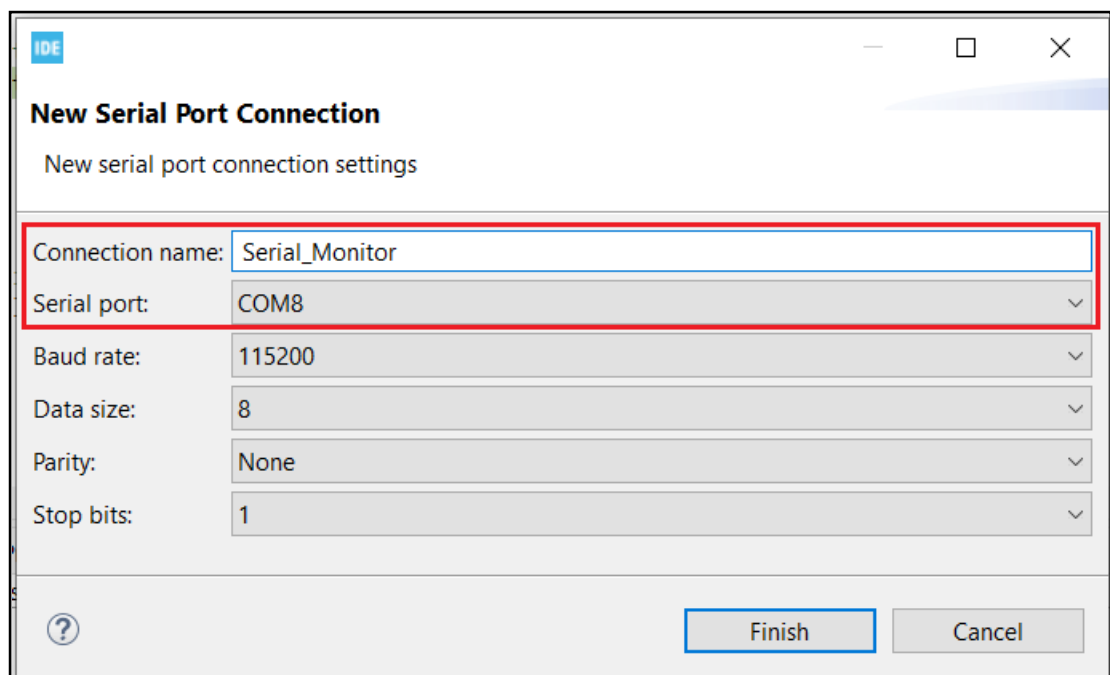
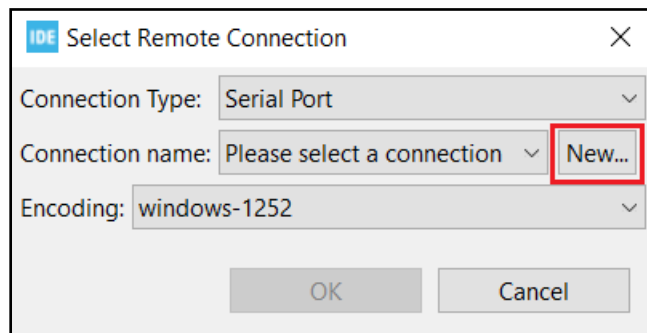
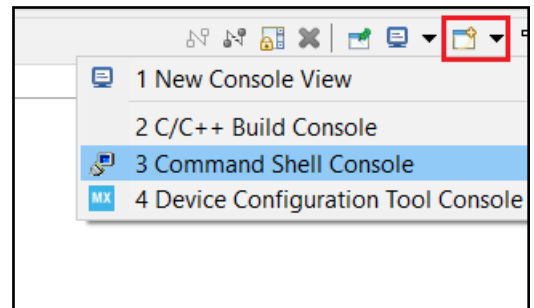



15. Now click on  the build symbol on the top left corner on your Cube IDE. If you have done everything correctly your code should be built without any errors.

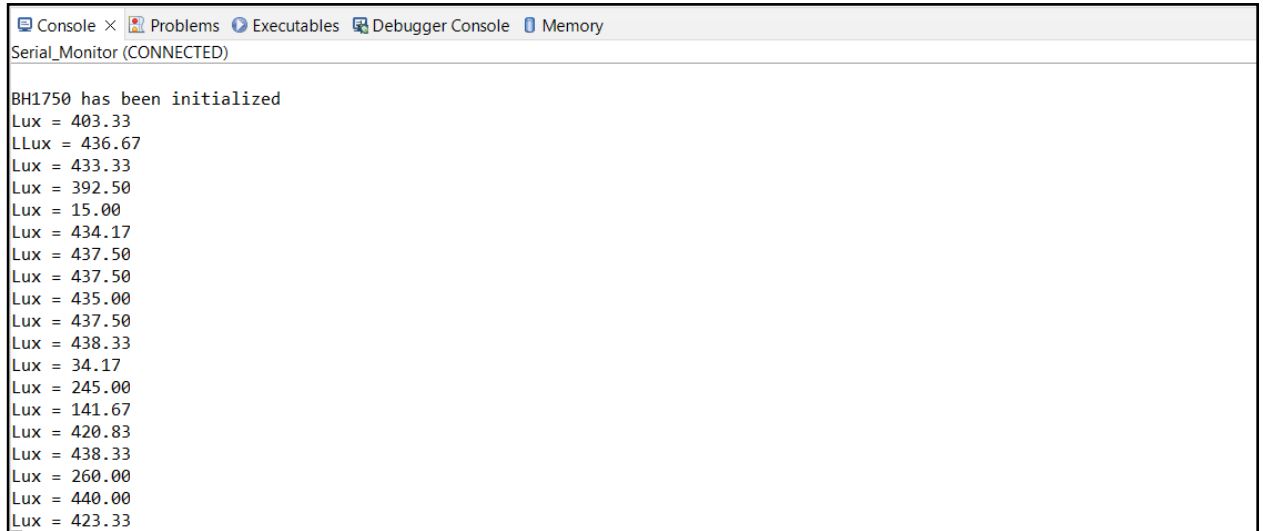


16. Next connect your STM32 board with your audio sensor connect to it to your PC and click on the **Debug**  icon to start the Debugging process. An **Edit Configuration** window will open, click on **OK**, without making any changes.

17. In the debug mode, go to the bottom right hand side corner, click on open console. Select the **Connection Type** as **Serial Port**, then click on **New**. In the new window, in **Connection name** give some name to your new connection, and select the **Serial port** correctly. Then click on **Finish** and then **Ok**. A console with the given name will be opened at the bottom of your screen.



18. Click on the **Resume** icon  to run your code. You should be able to see the value of light sensor in the **Console**.



```
Console x Problems Executables Debugger Console Memory
Serial_Monitor (CONNECTED)

BH1750 has been initialized
Lux = 403.33
LLux = 436.67
Lux = 433.33
Lux = 392.50
Lux = 15.00
Lux = 434.17
Lux = 437.50
Lux = 437.50
Lux = 435.00
Lux = 437.50
Lux = 438.33
Lux = 34.17
Lux = 245.00
Lux = 141.67
Lux = 420.83
Lux = 438.33
Lux = 260.00
Lux = 440.00
Lux = 423.33
```

19. Before moving out of the debugging mode, click on **Disconnect**  and close the console then click on the **Terminate**  icon. You will be moved out of the debugging mode.

**Note:** All important steps and parts are highlighted with a red colour box for the proper understanding of the user. This document is for the use of education purpose only.