**VI XỬ LÝ – VI ĐIỀU KHIỂN**

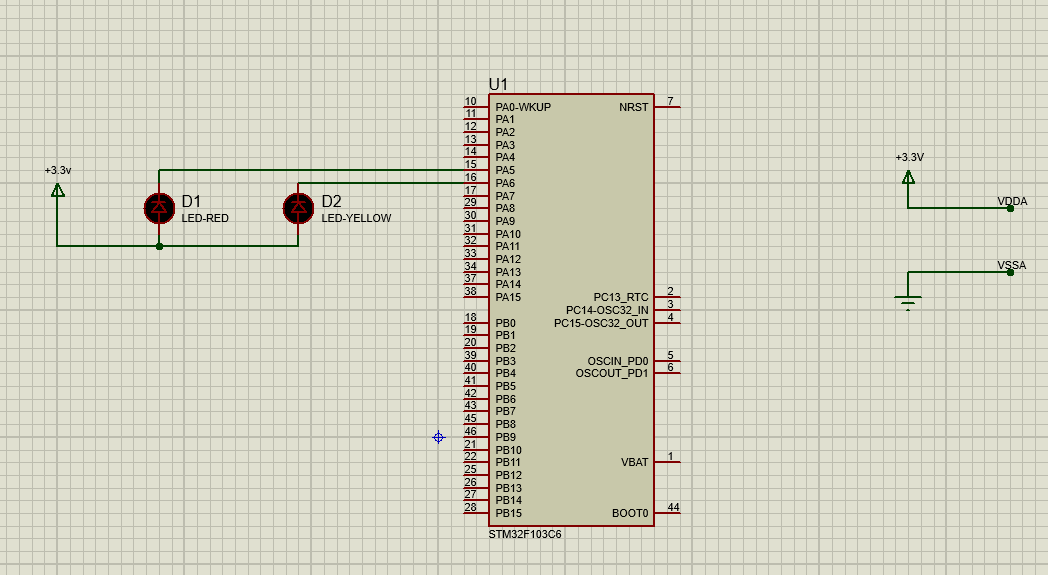
**Lớp: L03**

**Họ và tên:** Nguyễn Đình Đạt

**Mssv:** 1811869

**Exercise 1:**

Schematic:



[Figure 1: Schematic transitions for 2 LEDs](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/d6751fb38d8cd0a7b837b4fd31a23df2c83ca8ee/STM32.pdsprj)

The source code in the infinite loop while:

**while** (1)

{

/\* USER CODE END WHILE \*/

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_6); // turn off led yellow

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5 | GPIO\_PIN\_6); // turn off led red and turn on led yellow

HAL\_Delay(1000);

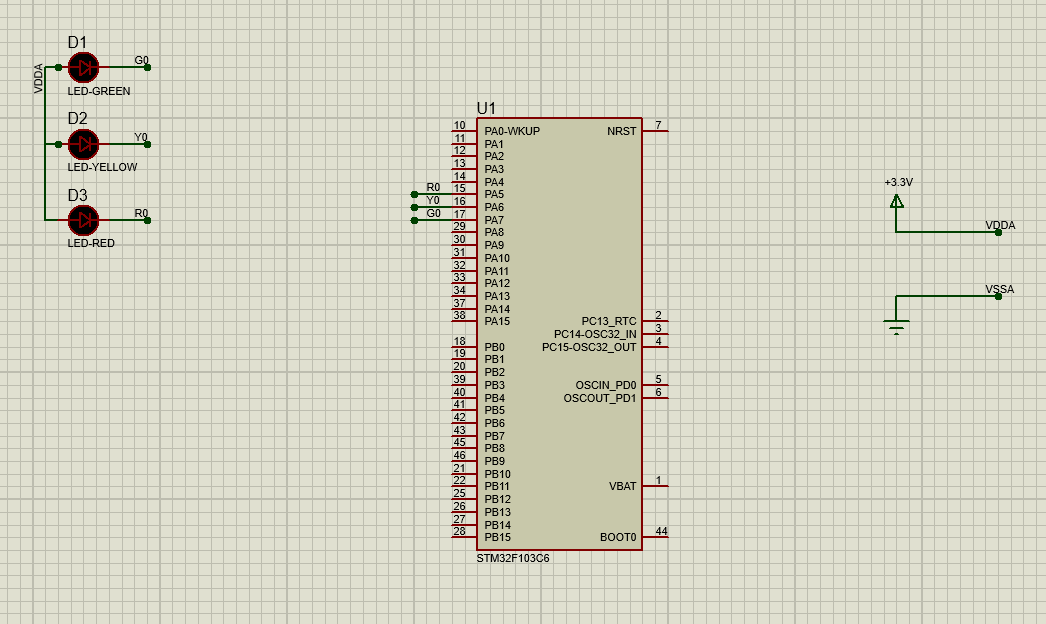
HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5); // turn on led red

/\* USER CODE BEGIN 3 \*/

}

**Exercise 2:**

Schematic:



[Figure 2: Schematic for a traffic light](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/d6751fb38d8cd0a7b837b4fd31a23df2c83ca8ee/exercise2.pdsprj)

The source code in the infinite loop while:

**while** (1)

{

/\* USER CODE END WHILE \*/

// turn off led red and led yellow

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6);

HAL\_Delay(3000);

// turn off led green, turn on led yellow

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_6);

HAL\_Delay(2000);

// turn on led red, turn off led yellow

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6);

HAL\_Delay(5000);

// turn on led green, led yellow

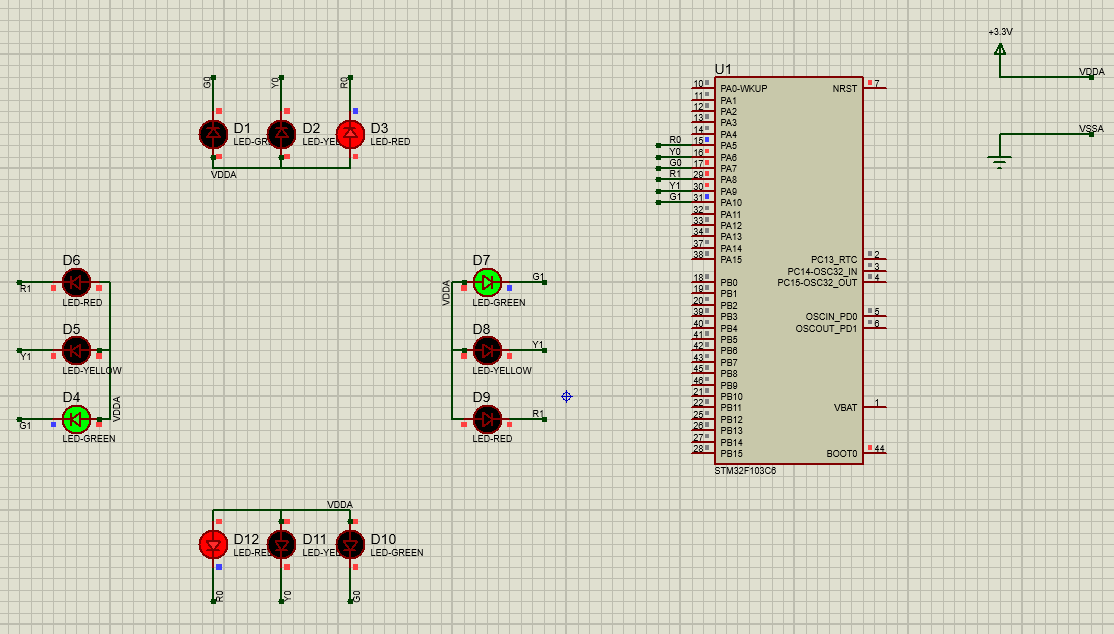
HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_6);

/\* USER CODE BEGIN 3 \*/

}

**Exercise 3:**

Schematic:



[Figure 3: Schematic for a 4 way traffic light](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/d6751fb38d8cd0a7b837b4fd31a23df2c83ca8ee/exercise3.pdsprj)

The source code in the infinite loop while:

**while** (1)

{

/\* USER CODE END WHILE \*/

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_9|GPIO\_PIN\_10); // turn off led yellow\_1, turn off led green\_1

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6); // turn off led red\_0, turn off led yellow\_0

HAL\_Delay(3000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_6); // turn on led yellow\_0, turn off led green\_0

HAL\_Delay(2000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_10); // turn on led green\_1, turn off led red\_1

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6); // turn on led red\_0, turn off led yellow\_0

HAL\_Delay(3000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_9|GPIO\_PIN\_10); // turn on led yellow\_1, turn off led green\_1

HAL\_Delay(2000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_6); // turn on led green\_0, turn on led yellow\_0

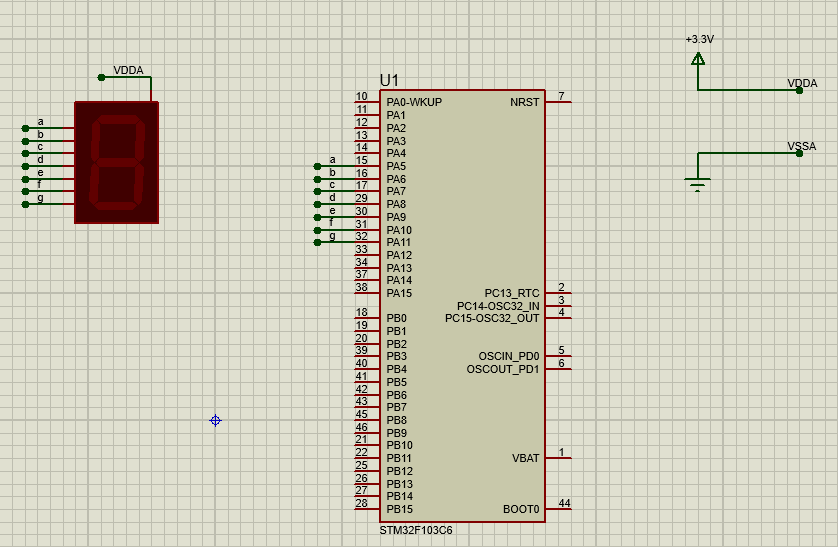
HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_10); // turn on led red\_1, turn on led green\_1

/\* USER CODE BEGIN 3 \*/

}

**Exercise 4:**

Schematic:



[Figure 4: Schematic transitions for 2 LEDs](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/d6751fb38d8cd0a7b837b4fd31a23df2c83ca8ee/exercise4.pdsprj)

The source code for display7SEG function:

**void** **display7SEG**(**int** counter){

**switch**(counter){

**case** 0:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10, 0);

**break**;

**case** 1:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6|GPIO\_PIN\_7, 0);

**break**;

**case** 2:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_10, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_8|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_11, 0);

**break**;

**case** 3:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9|GPIO\_PIN\_10, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_11, 0);

**break**;

**case** 4:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_8|GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 5:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6|GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 6:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 7:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7, 0);

**break**;

**case** 8:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 9:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

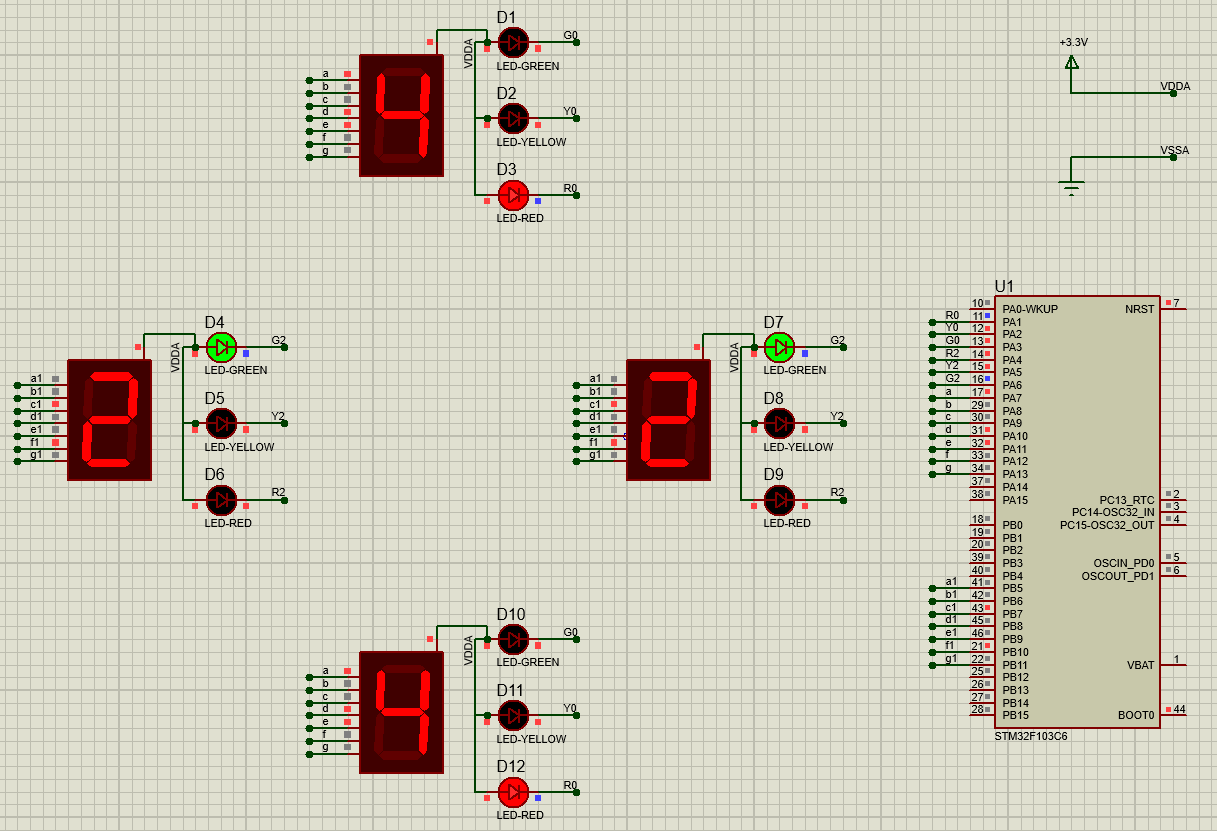
**break**;

}

}

**Exercise 5:**

Schematic:



[Figure 5: Integrate the 7SEG-LED to the 4 way traffic light](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/d6751fb38d8cd0a7b837b4fd31a23df2c83ca8ee/exercise5.pdsprj)

The source code to Integrate the 7SEG-LED to the 4 way traffic light

// Display led 7 segment top and bottom

**void** **display7SEG**(**int** counter){

**switch**(counter){

**case** 0:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_13, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_12, 0);

**break**;

**case** 1:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_12|GPIO\_PIN\_13, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_9, 0);

**break**;

**case** 2:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9|GPIO\_PIN\_12, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_13, 0);

**break**;

**case** 3:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11|GPIO\_PIN\_12, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_13, 0);

**break**;

**case** 4:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_10|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_12|GPIO\_PIN\_13, 0);

**break**;

**case** 5:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_12|GPIO\_PIN\_13, 0);

**break**;

**case** 6:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_12|GPIO\_PIN\_13, 0);

**break**;

**case** 7:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_12|GPIO\_PIN\_13, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9, 0);

**break**;

**case** 8:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11|GPIO\_PIN\_12|GPIO\_PIN\_13, 0);

**break**;

**case** 9:

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_12|GPIO\_PIN\_13, 0);

**break**;

}

}

// Display led 7 segment right and left

**void** **display7SEG\_1**(**int** counter){

**switch**(counter){

**case** 0:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10, 0);

**break**;

**case** 1:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_6|GPIO\_PIN\_7, 0);

**break**;

**case** 2:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_7|GPIO\_PIN\_10, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_11, 0);

**break**;

**case** 3:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_9|GPIO\_PIN\_10, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_11, 0);

**break**;

**case** 4:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_8|GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 5:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_6|GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 6:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_6, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 7:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7, 0);

**break**;

**case** 8:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_9|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

**case** 9:

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_9, 1);

HAL\_GPIO\_WritePin(GPIOB, GPIO\_PIN\_5|GPIO\_PIN\_6|GPIO\_PIN\_7|GPIO\_PIN\_8|GPIO\_PIN\_10|GPIO\_PIN\_11, 0);

**break**;

}

}

**int** counter\_g = 3;

**int** counter\_r = 5;

**int** counter\_y = 2;

**int** counter\_g1= 3;

**int** counter\_r1= 5;

**int** counter\_y1= 2;

**while** (1)

{

/\* USER CODE END WHILE \*/

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_1|GPIO\_PIN\_2);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6);

**while**(counter\_g > 0){

display7SEG\_1(counter\_r1) ;

counter\_r1 --;

display7SEG(counter\_g);

counter\_g --;

HAL\_Delay (1000) ;

}

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_3|GPIO\_PIN\_2);

**while**(counter\_y > 0){

display7SEG\_1(counter\_r1) ;

counter\_r1 --;

display7SEG(counter\_y);

counter\_y --;

HAL\_Delay (1000) ;

}

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_1|GPIO\_PIN\_2);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_4|GPIO\_PIN\_6);

**while**(counter\_g1 > 0){

display7SEG\_1(counter\_g1) ;

counter\_g1 --;

display7SEG(counter\_r);

counter\_r --;

HAL\_Delay (1000) ;

}

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5|GPIO\_PIN\_6);

**while**(counter\_y1 > 0){

display7SEG\_1(counter\_y1) ;

counter\_y1 --;

display7SEG(counter\_r);

counter\_r --;

HAL\_Delay (1000) ;

}

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_4|GPIO\_PIN\_6);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_3|GPIO\_PIN\_2);

counter\_g = 3;

counter\_r = 5;

counter\_y = 2;

counter\_g1= 3;

counter\_r1= 5;

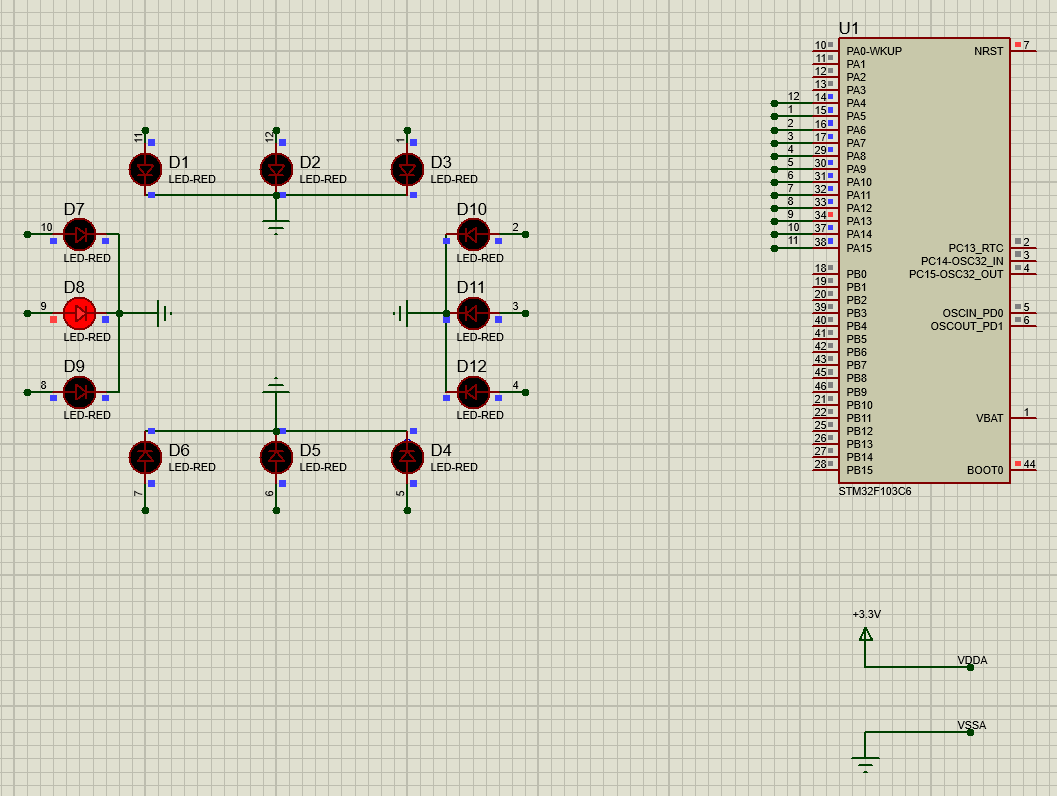
counter\_y1= 2;

/\* USER CODE BEGIN 3 \*/

}

**Exercise 6:**

Schematic:



[Figure 6: Schematic transitions for 12 LEDs](https://github.com/ngddat2706/Vxl_Vdk_lab/blob/2b42ab60a00bbb9a0e5eac5a2440277f60d35ceb/exercise6.pdsprj)

The source code in the infinite loop while:

**while** (1)

{

/\* USER CODE END WHILE \*/

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_4);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_4| GPIO\_PIN\_5);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_5| GPIO\_PIN\_6);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_6| GPIO\_PIN\_7);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_7| GPIO\_PIN\_8);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_8| GPIO\_PIN\_9);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_9| GPIO\_PIN\_10);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_10| GPIO\_PIN\_11);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_11| GPIO\_PIN\_12);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_12| GPIO\_PIN\_13);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_13| GPIO\_PIN\_14);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_14| GPIO\_PIN\_15);

HAL\_Delay(1000);

HAL\_GPIO\_TogglePin(GPIOA, GPIO\_PIN\_15);

/\* USER CODE BEGIN 3 \*/

}

**Exercise 7:**

Implement a function named **clearAllClock()** to turn off all 12 LEDs. Present the source code of this function:

**void** **clearAllClock**(){

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4|GPIO\_PIN\_5| GPIO\_PIN\_6|

GPIO\_PIN\_7| GPIO\_PIN\_8|GPIO\_PIN\_9| GPIO\_PIN\_10|GPIO\_PIN\_11|

GPIO\_PIN\_12|GPIO\_PIN\_13| GPIO\_PIN\_14|GPIO\_PIN\_15, 0);

}

**Exercise 8:**

Implement a function named **setNumberOnClock(int num)**. The input for this function is from **0 to 11** and an appropriate LED is turn on. Present the source code of this function.

**void** **setNumberOnClock**(**int** num){

**switch**(num){

**case** 0: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4, 1);

**break**;

**case** 1: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5, 1);

**break**;

**case** 2: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6, 1);

**break**;

**case** 3: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7, 1);

**break**;

**case** 4: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8, 1);

**break**;

**case** 5: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9, 1);

**break**;

**case** 6: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_10, 1);

**break**;

**case** 7: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 1);

**break**;

**case** 8: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_12, 1);

**break**;

**case** 9: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_13, 1);

**break**;

**case** 10: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_14, 1);

**break**;

**case** 11: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_15, 1);

**break**;

}

}

**Exercise 9:**

Implement a function named **clearNumberOnClock(int num)**. The input for this function is from **0 to 11** and an appropriate LED is turn off:

**void** **clearNumberOnClock**(**int** num){

**switch**(num){

**case** 0: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4, 0);

**break**;

**case** 1: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5, 0);

**break**;

**case** 2: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6, 0);

**break**;

**case** 3: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7, 0);

**break**;

**case** 4: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8, 0);

**break**;

**case** 5: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9, 0);

**break**;

**case** 6: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_10, 0);

**break**;

**case** 7: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 0);

**break**;

**case** 8: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_12, 0);

**break**;

**case** 9: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_13, 0);

**break**;

**case** 10: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_14, 0);

**break**;

**case** 11: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_15, 0);

**break**;

}

}

**Exercise 10:**

Integrate the whole system and use 12 LEDs to display a clock. At a given time, there are only 3 LEDs are turn on for hour, minute and second information:

**void** **clearAllClock**(){

HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4|GPIO\_PIN\_5| GPIO\_PIN\_6|

GPIO\_PIN\_7| GPIO\_PIN\_8|GPIO\_PIN\_9| GPIO\_PIN\_10|GPIO\_PIN\_11|

GPIO\_PIN\_12|GPIO\_PIN\_13| GPIO\_PIN\_14|GPIO\_PIN\_15, 0);

}

**void** **setNumberOnClock**(**int** num){

**switch**(num){

**case** 0: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4, 1);

**break**;

**case** 1: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5, 1);

**break**;

**case** 2: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6, 1);

**break**;

**case** 3: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7, 1);

**break**;

**case** 4: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8, 1);

**break**;

**case** 5: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9, 1);

**break**;

**case** 6: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_10, 1);

**break**;

**case** 7: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 1);

**break**;

**case** 8: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_12, 1);

**break**;

**case** 9: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_13, 1);

**break**;

**case** 10: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_14, 1);

**break**;

**case** 11: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_15, 1);

**break**;

}

}

**void** **clearNumberOnClock**(**int** num){

**switch**(num){

**case** 0: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_4, 0);

**break**;

**case** 1: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_5, 0);

**break**;

**case** 2: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_6, 0);

**break**;

**case** 3: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_7, 0);

**break**;

**case** 4: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_8, 0);

**break**;

**case** 5: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_9, 0);

**break**;

**case** 6: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_10, 0);

**break**;

**case** 7: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_11, 0);

**break**;

**case** 8: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_12, 0);

**break**;

**case** 9: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_13, 0);

**break**;

**case** 10: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_14, 0);

**break**;

**case** 11: HAL\_GPIO\_WritePin(GPIOA, GPIO\_PIN\_15, 0);

**break**;

}

}

**int** h = 0; // hour

**int** m = 0; // minute

**int** s = 0; // second

**while** (1)

{

/\* USER CODE END WHILE \*/

clearAllClock();

setNumberOnClock(s % 12);

setNumberOnClock(m % 12);

setNumberOnClock(h % 12);

**if**(s == 59 ) {

s = 0;

m = m+1;

}

**else** {

s= s+1;

}

**if**(m == 60 ) {

m = 0;

h = h+1;

}

**if**(h == 24 ) {

h = 0;

}

HAL\_Delay(500);

/\* USER CODE BEGIN 3 \*/

}