

VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY  
HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY  
Faculty of Computer Science and Engineering



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CC02 — Lab Report

# Microprocessor - Microcontroller Lab 1

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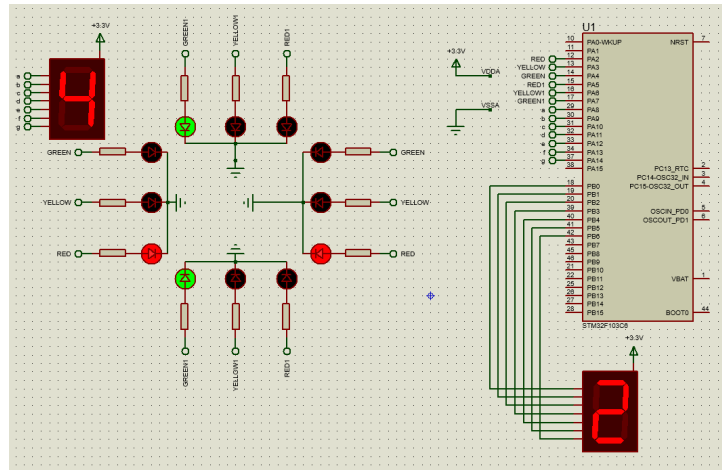
## 1 Exercise

The GitHub link for the lab schematics is at [here](#) or in this link: <https://github.com/ThanhTaiNguyen24/mcu-mpu-lab1>.

The default `while(1)` code for most of the exercise is:

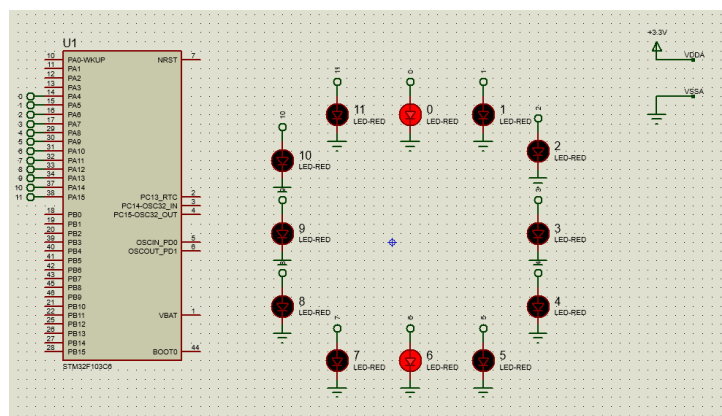
```
1 while(1) {  
2     // THE FUNCTION INPUT INSERTED HERE  
3     HAL_Delay(1000);  
4 }
```

The schematic for the exercises from 1 to 5 is located here:



**Figure 1:** The schematic for the exercises from 1 to 5.

The schematic for the exercises from 6 to 10 is located here:



**Figure 2:** The schematic for the exercises from 6 to 10.



## 1.1 Exercise 1

### 1.1.1 Report 1

Can be found at 1.

### 1.1.2 Report 2

This is the header file library for the exercise 1 :

```
1 while (1)
2 {
3     HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_5);
4     HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_6);
5     HAL_Delay(2000);
6 }
```

Pre-Setup GPIO output level for both LED:

- RED-LED: High
- RED-YELLOW: Low



## 1.2 Exercise 2

### 1.2.1 Report 1

Can be found at 1.

### 1.2.2 Report 2

This is the source code for the exercise 2:

```
1 int count = 3;
2 int counter1 = 3;
3 while (1)
4 {
5     //xanh
6     if (counter1 > 1 && count == 3){
7         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
8         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
9         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET);
10    }
11
12    //vang
13    if (counter1 > 1 && count == 2){
14        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
15        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
16        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET);
17    }
18    //do
19    if (counter1 > 1 && count == 5){
20        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
21        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
22        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
23    }
24    counter1--;
25    if (counter1 <= 0 && count == 3) {
26        count = 2;
27        counter1 = 2;
28    }
29    if (counter1 <= 0 && count == 2) {
30        count = 5;
31        counter1 = 5;
32    }
33    if (counter1 <= 0 && count == 5) {
34        count = 3;
35        counter1 = 3;
36    }
37    HAL_Delay(1000);
38 }
```



## 1.3 Exercise 3

### 1.3.1 Report 1

Can be found at 1.

### 1.3.2 Report 2

This is the source code for the exercise 3:

```
1 int counter1 = 3;
2 int count = 3;
3 while (1)
4 {
5     if (counter1 > 1 && count == 3){
6         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
7         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
8         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
9         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_SET);
10        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET);
11        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET);
12    }
13
14    if (counter1 > 1 && count == 2){
15        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
16        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
17        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
18        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_SET);
19        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET);
20        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET);
21    }
22
23    if (counter1 > 1 && count == 5){
24        if (counter1 > 2){
25            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET); //do
26            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET); //
27            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET); //
28            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_SET); //xanh
29            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_RESET); //
30            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET); //
31        } else {
32            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET); //do
33            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET); //
34            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET); //
35            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_SET); //xanh
36            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_RESET); //
37            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET); //
38        }
39    }
40    counter1--;
```



```
41         if (counter1 <= 0 && count == 3) {  
42             count = 2;  
43             counter1 = 2;  
44         }  
45         if (counter1 <= 0 && count == 2) {  
46             count = 5;  
47             counter1 = 5;  
48         }  
49         if (counter1 <= 0 && count == 5) {  
50             count = 3;  
51             counter1 = 3;  
52         }  
53         HAL_Delay(1000);  
54     }
```





## 1.4 Exercise 4

### 1.4.1 Report 1

Can be found at 1.

### 1.4.2 Report 2

This is the source code for the exercise 4:

```
1 uint8_t led7segment[10] = {0xC0,0xF9,0xA4,0xB0,0x99,0x92,0x82,0xF8,0x80,0x90};
2 uint8_t count = 0;
3 while (1)
4 {
5     led7segmentdisplay(count);
6     count++;
7     if (count >= 10) count = 0;
8     HAL_Delay(1000);
9 }
10 void led7segmentdisplay (uint8_t n){
11     uint8_t numberCode = led7segment[n];
12     uint32_t pin0 = GPIO_PIN_0;
13     for(uint8_t i = 0; i<8 ; i++)
14     {
15         uint32_t pin = pin0 << i;
16         uint8_t value = (numberCode >> i) & 0x01;
17         HAL_GPIO_WritePin(GPIOB, pin , value);
18     }
19 }
```



## 1.5 Exercise 5

### 1.5.1 Report 1

Can be found at 1.

### 1.5.2 Report 2

This is the source code for the exercise 5:

```
1 uint8_t led7segment[10] = {0xC0,0xF9,0xA4,0xB0,0x99,0x92};
2 int counter1 = 3;
3 int counter2 = 5;
4 int count = 3;
5 while (1)
6 {
7
8     if (counter1 > 1 && count == 3 && counter2 > 1){
9         HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
10        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
11        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
12        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_SET);
13        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET);
14        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET);
15
16    }
17    //vang
18    if (counter1 > 1 && count == 2 && counter2 > 1){
19        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
20        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
21        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
22        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_SET);
23        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET);
24        HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET);
25
26    }
27
28    //do
29    if (counter1 > 1 && count == 5 && counter2 > 1){
30
31        if (counter1 > 2){
32            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET); //do
33            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET); //
34            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET); //
35            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_SET); //xanh
36            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_RESET); //
37            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_RESET); //
38
39        } else {
40            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET); //do
```

```
41     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET); //
42     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET); //
43     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, GPIO_PIN_SET); //xanh
44     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_2, GPIO_PIN_RESET); //
45     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET); //
46
47     }
48 }
49 led7segmentdisplay(counter1);
50 led7segmentdisplay1(counter2);
51     counter1--;
52     counter2--;
53     if (counter1 <= 0 && count == 3) {
54         count = 2;
55         counter1 = 2;
56     }
57
58
59     if (counter1 <= 0 && count == 2) {
60         count = 5;
61         counter1 = 5;
62     }
63     if (counter1 <= 0 && count == 5) {
64         count = 3;
65         counter1 = 3;
66     }
67     if (counter2 <= 0 && count == 3){
68         counter2 = 5;
69     }
70     if (counter2 <= 0 && count == 2) {
71         counter2 = 5;
72     }
73     if (counter2 <= 0 && count == 5){
74         if (counter1 > 2){
75             counter2 = 3;
76         } else {
77             counter2 = 2;
78         }
79     }
80 }
81
82
83     HAL_Delay(1000);
84 }
85 void led7segmentdisplay (uint8_t n){
86     uint8_t numberCode = led7segment[n];
87     uint32_t pin0 = GPIO_PIN_0;
88     for(uint8_t i = 0; i < 8 ; i++)
89     {
```

```
90     uint32_t pin = pin0 << i;
91     uint8_t value = (numberCode >> i) & 0x01;
92     HAL_GPIO_WritePin(GPIOB, pin , value);
93 }
94 }
95 void led7segmentdisplay1 (uint8_t n){
96     uint8_t numberCode = led7segment[n];
97     uint32_t pin8 = GPIO_PIN_8;
98     for(uint8_t i = 0; i < 8 ; i++)
99     {
100         uint32_t pin = pin8 << i;
101         uint8_t value = (numberCode >> i) & 0x01;
102         HAL_GPIO_WritePin(GPIOA, pin , value);
103     }
104 }
```



## 1.6 Exercise 6

### 1.6.1 Report 1

Can be found at 2.

### 1.6.2 Report 2

This is the source code for the exercise 6:

```
1 uint16_t ledNumber[] = {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};  
2 while (1)  
3 {  
4     for (int i = 0; i < 12; i++){  
5         HAL_GPIO_TogglePin(GPIOA, ledNumber[i]);  
6     }  
7     HAL_Delay(1000);  
8 }
```



## 1.7 Exercise 7

This is the code for the exercise 7 void clearAllClock():

```
1 uint16_t ledNumber[] = {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};  
2 void clearAllClock(void){  
3     for (int i = 0; i < 12; i++) HAL_GPIO_WritePin(GPIOA, ledNumber[i],  
        GPIO_PIN_RESET);  
4 }
```

## 1.8 Exercise 8

This is the code for the exercise 8 void setNumberOnClock():

```
1 void setNumberOnClock(int num){
2     switch(num)
3     {
4         case 0:
5             HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_SET);
6             break;
7         case 1:
8             HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET);
9             break;
10        case 2:
11            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
12            break;
13        case 3:
14            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
15            break;
16        case 4:
17            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_8, GPIO_PIN_SET);
18            break;
19        case 5:
20            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_9, GPIO_PIN_SET);
21            break;
22        case 6:
23            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_10, GPIO_PIN_SET);
24            break;
25        case 7:
26            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_11, GPIO_PIN_SET);
27            break;
28        case 8:
29            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_12, GPIO_PIN_SET);
30            break;
31        case 9:
32            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_13, GPIO_PIN_SET);
33            break;
34        case 10:
35            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_14, GPIO_PIN_SET);
36            break;
37        case 11:
38            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_15, GPIO_PIN_SET);
39            break;
40    }
41 }
```

## 1.9 Exercise 9

This is the code for the exercise 9 void clearNumberOnClock(int num):

```
1 void clearNumberOnClock(int num){
2     switch(num)
3     {
4         case 0:
5             HAL_GPIO_WritePin(GPIOA, GPIO_PIN_4, GPIO_PIN_RESET);
6             break;
7         case 1:
8             HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_RESET);
9             break;
10        case 2:
11            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
12            break;
13        case 3:
14            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
15            break;
16        case 4:
17            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_8, GPIO_PIN_RESET);
18            break;
19        case 5:
20            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_9, GPIO_PIN_RESET);
21            break;
22        case 6:
23            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_10, GPIO_PIN_RESET);
24            break;
25        case 7:
26            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_11, GPIO_PIN_RESET);
27            break;
28        case 8:
29            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_12, GPIO_PIN_RESET);
30            break;
31        case 9:
32            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_13, GPIO_PIN_RESET);
33            break;
34        case 10:
35            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_14, GPIO_PIN_RESET);
36            break;
37        case 11:
38            HAL_GPIO_WritePin(GPIOA, GPIO_PIN_15, GPIO_PIN_RESET);
39            break;
40    }
41 }
```





## 1.10 Exercise 10

This is the code for the exercise 10:

```
1 int second = 0;
2 int minute = 0;
3 int hour = 0;
4 while (1)
5 {
6     HAL_Delay(10);
7
8     second++;
9     if (second >= 60){
10         clearNumberOnClock(second/5 - 1);
11         second = 0;
12         minute++;
13         if (minute >= 60){
14             clearNumberOnClock(minute/5 - 1);
15             minute = 0;
16             hour++;
17             if(hour >= 12){
18                 clearNumberOnClock(hour - 1);
19                 hour = 0;
20             }
21         }
22     }
23     clearNumberOnClock(hour - 1);
24     clearNumberOnClock(minute/5 - 1);
25     clearNumberOnClock(second/5 - 1);
26     setNumberOnClock(hour);
27     setNumberOnClock(minute/5);
28     setNumberOnClock(second/5);
29
30 }
```



## References