

**VIETNAM NATIONAL UNIVERSITY, HO CHI MINH CITY**  
**HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY**



**REPORT**

**LAB 1**

**Class: Microprocessors-Microcontrollers – CC01**

**Lecture: NGUYỄN THIÊN ÂN**

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*Ho Chi Minh City, September 17<sup>th</sup> 2024*

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# 1 Exercise 1

## 1.1 Report 1

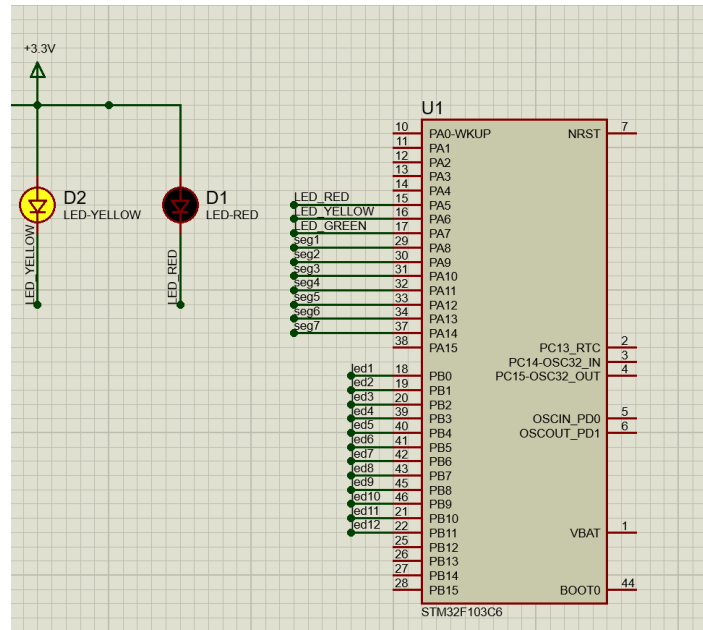


Figure 1: *The schematic of exercise 1*

## 1.2 Report 2

```
1 void exercise1()  
2 {  
3     HAL_GPIO_TogglePin(LED_RED_GPIO_Port , LED_RED_Pin);  
4     HAL_Delay(2000);  
5     HAL_GPIO_TogglePin(LED_YELLOW_GPIO_Port , LED_YELLOW_Pin  
6 );  
7 }
```

Program 1: Code in lab1.h

```
1 while (1)  
2 {  
3     exercise1();  
4 }
```

Program 2: Code in main.c

## 2 Exercise 2

### 2.1 Report 1

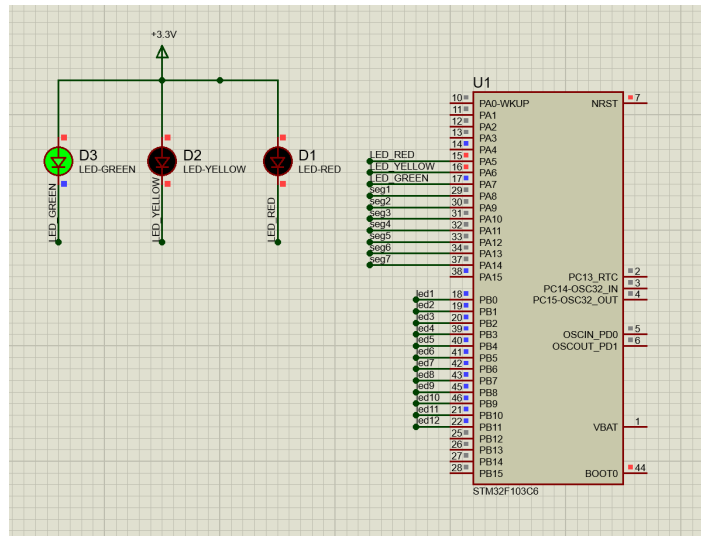


Figure 2: *The schematic of exercise 2*

### 2.2 Report 2

```
1 void exercise2()  
2 {  
3     HAL_GPIO_TogglePin(LED_YELLOW_GPIO_Port, LED_YELLOW_Pin)  
4     );  
5     HAL_GPIO_TogglePin(LED_GREEN_GPIO_Port, LED_GREEN_Pin);  
6     HAL_Delay(5000);  
7     HAL_GPIO_TogglePin(LED_GREEN_GPIO_Port, LED_GREEN_Pin);  
8     HAL_GPIO_TogglePin(LED_RED_GPIO_Port, LED_RED_Pin);  
9     HAL_Delay(3000);  
10    HAL_GPIO_TogglePin(LED_GREEN_GPIO_Port, LED_GREEN_Pin);  
11    HAL_GPIO_TogglePin(LED_YELLOW_GPIO_Port, LED_YELLOW_Pin  
12    );  
13    HAL_Delay(2000);  
14    HAL_GPIO_TogglePin(LED_RED_GPIO_Port, LED_RED_Pin);  
15    HAL_GPIO_TogglePin(LED_GREEN_GPIO_Port, LED_GREEN_Pin);  
16 }
```

Program 3: Code in lab1.h

```
1 while (1)  
2 {  
3     exercise2();  
4 }
```

Program 4: Code in main.c

## 3 Exercise 3

### 3.1 Report 1

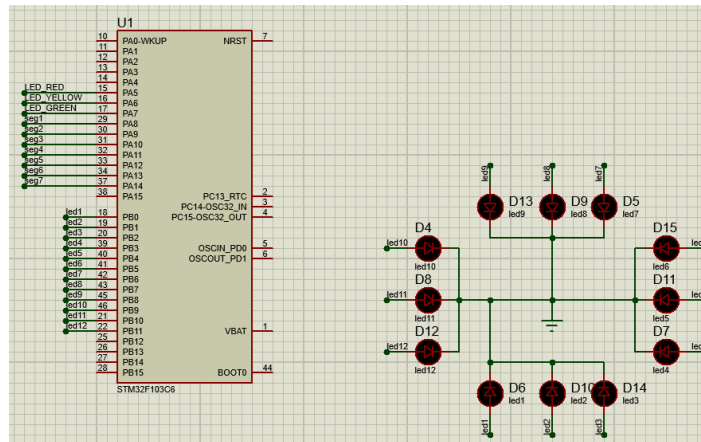


Figure 3: *The schematic of exercise 4*

### 3.2 Report 2

```
1 void exercise3()
2 {
3     // the red leds and the green leds run simultaneously
4     // in 3 seconds
5     HAL_GPIO_TogglePin(led1_GPIO_Port, led1_Pin);
6     HAL_GPIO_TogglePin(led7_GPIO_Port, led7_Pin);
7     HAL_GPIO_TogglePin(led6_GPIO_Port, led6_Pin);
8     HAL_GPIO_TogglePin(led12_GPIO_Port, led12_Pin);
9     HAL_Delay(3000);
10
11    // the red leds and the yellow leds run simultaneously
12    // in 2 seconds
13    HAL_GPIO_TogglePin(led6_GPIO_Port, led6_Pin);
14    HAL_GPIO_TogglePin(led12_GPIO_Port, led12_Pin);
15    HAL_GPIO_TogglePin(led5_GPIO_Port, led5_Pin);
16    HAL_GPIO_TogglePin(led11_GPIO_Port, led11_Pin);
17    HAL_Delay(2000);
18
19    // the green leds and the red leds run simultaneously
20    // in 3 seconds
21    HAL_GPIO_TogglePin(led1_GPIO_Port, led1_Pin);
22    HAL_GPIO_TogglePin(led7_GPIO_Port, led7_Pin);
23    HAL_GPIO_TogglePin(led5_GPIO_Port, led5_Pin);
24    HAL_GPIO_TogglePin(led11_GPIO_Port, led11_Pin);
25    HAL_GPIO_TogglePin(led4_GPIO_Port, led4_Pin);
26    HAL_GPIO_TogglePin(led10_GPIO_Port, led10_Pin);
27    HAL_GPIO_TogglePin(led3_GPIO_Port, led3_Pin);
```



## 4.2 Report 2

```
1 void display7SEG(int num)
2 {
3     uint8_t segMap[] =
4     {
5         0b00111111, // 0
6         0b00000110, // 1
7         0b01011011, // 2
8         0b01001111, // 3
9         0b01100110, // 4
10        0b01101101, // 5
11        0b01111101, // 6
12        0b00000111, // 7
13        0b01111111, // 8
14        0b01101111 // 9
15    };
16
17    GPIO_TypeDef *port = seg1_GPIO_Port;
18    uint16_t gpio_pin[] =
19    {
20        seg1_Pin, seg2_Pin, seg3_Pin, seg4_Pin,
21        seg5_Pin, seg6_Pin, seg7_Pin
22    };
23
24    if (num > 9 || num < 0)
25    {
26        return;
27    }
28    else
29    {
30        uint8_t segment = segMap[num];
31        for(int i = 0; i < 7; i++)
32        {
33            HAL_GPIO_WritePin(port, gpio_pin[i], (segment &
34            (1 << i))? RESET : SET);
35        }
36    }
37
38 void exercise4()
39 {
40     int counter = 0;
41     while (1)
42     {
43         display7SEG(counter);
44         HAL_Delay(1000);
45
46         counter ++;
```

```

47         if (counter >= 10) counter = 0;
48     }
49 }

```

Program 7: Code in lab1.h

```

1 while (1)
2 {
3     exercise4();
4 }

```

Program 8: Code in main.c

## 5 Exercise 5

### 5.1 Report 1

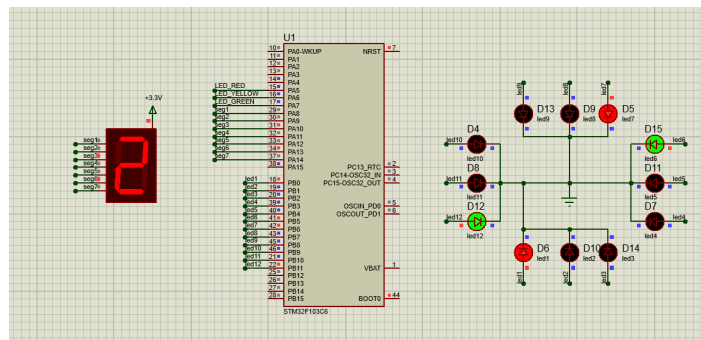


Figure 5: The schematic of exercise 5

### 5.2 Report 2

```

1 void display7SEG(int num, int num2)
2 {
3     uint8_t segMap[] =
4     {
5         0b00111111, // 0
6         0b00000110, // 1
7         0b01011011, // 2
8         0b01001111, // 3
9         0b01100110, // 4
10        0b01101101, // 5
11        0b01111101, // 6
12        0b00000111, // 7
13        0b01111111, // 8
14        0b01101111  // 9
15    };
16
17    GPIO_TypeDef *port = seg1_GPIO_Port;

```



```

18
19 uint16_t gpio_pin[] =
20 {
21     seg1_Pin,
22     seg2_Pin,
23     seg3_Pin,
24     seg4_Pin,
25     seg5_Pin,
26     seg6_Pin,
27     seg7_Pin,
28 };
29
30 uint16_t gpio_pin2[] =
31 {
32     LED_RED_Pin,
33     LED_YELLOW_Pin,
34     LED_GREEN_Pin,
35     s4_Pin,
36     s5_Pin,
37     s6_Pin,
38     LED_1_Pin
39 };
40
41 if (num > 9 || num < 0)
42 {
43     return;
44 }
45
46 else
47 {
48     uint8_t segment = segMap[num];
49     uint8_t segment2 = segMap[num2];
50     for(int i = 0; i < 7; i++)
51     {
52         HAL_GPIO_WritePin(port, gpio_pin[i], (segment & (1 <<
53             i)) ? RESET : SET);
54         HAL_GPIO_WritePin(port, gpio_pin2[i], (segment2 & (1
55             << i)) ? RESET : SET);
56     }
57 }
58
59 void exercise5()
60 {
61     int counter1, counter2 = 0;
62     HAL_GPIO_TogglePin(led1_GPIO_Port, led1_Pin);
63     HAL_GPIO_TogglePin(led7_GPIO_Port, led7_Pin);
64     HAL_GPIO_TogglePin(led6_GPIO_Port, led6_Pin);

```

```

65 HAL_GPIO_TogglePin(led12_GPIO_Port, led12_Pin);
66 counter1 = 3; counter2 = 5;
67 for (int i = 3; i > 0; i--)
68 {
69     display7SEG(counter1, counter2);
70     counter1 --;
71     counter2 --;
72 }
73
74 HAL_GPIO_TogglePin(led6_GPIO_Port, led6_Pin);
75 HAL_GPIO_TogglePin(led12_GPIO_Port, led12_Pin);
76 HAL_GPIO_TogglePin(led5_GPIO_Port, led5_Pin);
77 HAL_GPIO_TogglePin(led11_GPIO_Port, led11_Pin);
78 counter1 = 2; counter2 = 2;
79 for (int i = 2; i > 0; i--)
80 {
81     display7SEG(counter1, counter2);
82     counter1 --;
83     counter2 --;
84 }
85
86 HAL_GPIO_TogglePin(led1_GPIO_Port, led1_Pin);
87 HAL_GPIO_TogglePin(led7_GPIO_Port, led7_Pin);
88 HAL_GPIO_TogglePin(led5_GPIO_Port, led5_Pin);
89 HAL_GPIO_TogglePin(led11_GPIO_Port, led11_Pin);
90 HAL_GPIO_TogglePin(led4_GPIO_Port, led4_Pin);
91 HAL_GPIO_TogglePin(led10_GPIO_Port, led10_Pin);
92 HAL_GPIO_TogglePin(led3_GPIO_Port, led3_Pin);
93 HAL_GPIO_TogglePin(led9_GPIO_Port, led9_Pin);
94 counter1 = 5; counter2 = 3;
95 for (int i = 3; i > 0; i--)
96 {
97     display7SEG(counter1, counter2);
98     counter1 --;
99     counter2 --;
100 }
101
102 HAL_GPIO_TogglePin(led3_GPIO_Port, led3_Pin);
103 HAL_GPIO_TogglePin(led9_GPIO_Port, led9_Pin);
104 HAL_GPIO_TogglePin(led2_GPIO_Port, led2_Pin);
105 HAL_GPIO_TogglePin(led8_GPIO_Port, led8_Pin);
106 counter1 = 2; counter2 = 2;
107 for (int i = 2; i > 0; i--)
108 {
109     display7SEG(counter1, counter2);
110     counter1 --;
111     counter2 --;
112 }
113

```

```

114 HAL_GPIO_TogglePin(led2_GPIO_Port, led2_Pin);
115 HAL_GPIO_TogglePin(led8_GPIO_Port, led8_Pin);
116 HAL_GPIO_TogglePin(led4_GPIO_Port, led4_Pin);
117 HAL_GPIO_TogglePin(led10_GPIO_Port, led10_Pin);
118 }

```

Program 9: Code in lab1.h

```

1 while (1)
2 {
3     exercise5();
4 }

```

Program 10: Code in main.c

## 6 Exercise 6

### 6.1 Report 1

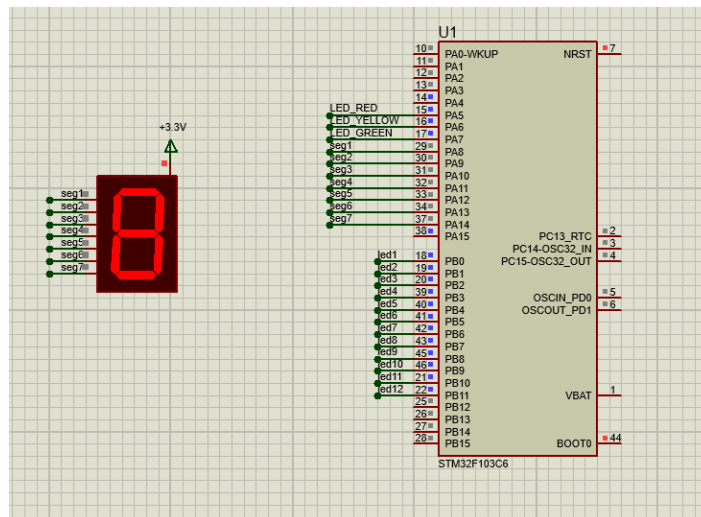


Figure 6: *The schematic of exercise 6*

### 6.2 Report 2

```

1 void setNumberOnClock(int num)
2 {
3     if (num < 0) return;
4
5     GPIO_TypeDef *port = LED_1_GPIO_Port;
6
7     switch (num)
8     {
9         case 0:
10             HAL_GPIO_WritePin(port, LED_1_Pin, SET);
11             break;

```

```

12     case 1:
13         HAL_GPIO_WritePin(port, LED_RED_Pin, SET);
14         break;
15     case 2:
16         HAL_GPIO_WritePin(port, LED_YELLOW_Pin, SET);
17         break;
18     case 3:
19         HAL_GPIO_WritePin(port, LED_GREEN_Pin, SET);
20         break;
21     case 4:
22         HAL_GPIO_WritePin(port, seg1_Pin, SET);
23         break;
24     case 5:
25         HAL_GPIO_WritePin(port, seg2_Pin, SET);
26         break;
27     case 6:
28         HAL_GPIO_WritePin(port, seg3_Pin, SET);
29         break;
30     case 7:
31         HAL_GPIO_WritePin(port, seg4_Pin, SET);
32         break;
33     case 8:
34         HAL_GPIO_WritePin(port, seg5_Pin, SET);
35         break;
36     case 9:
37         HAL_GPIO_WritePin(port, seg6_Pin, SET);
38         break;
39     case 10:
40         HAL_GPIO_WritePin(port, seg7_Pin, SET);
41         break;
42     case 11:
43         HAL_GPIO_WritePin(port, LED_12_Pin, SET);
44         break;
45     default: break;
46 }
47 }
48
49
50 void exercise6()
51 {
52     for (int i = 0; i < 12; i++)
53     {
54         setNumberOnClock(i);
55         HAL_Delay(1000);
56     }
57 }

```

Program 11: Code in la1.h

```

1 while (1)

```

```

2 {
3     exercise6();
4 }

```

Program 12: Code in main.c

## 7 Exercise 7

### 7.1 Report 1

```

1 void clearAllClock()
2 {
3     GPIO_TypeDef *port = LED_1_GPIO_Port;
4     uint16_t pins[] =
5     {
6         LED_1_Pin,
7         LED_RED_Pin,
8         LED_YELLOW_Pin,
9         LED_GREEN_Pin,
10        seg1_Pin,
11        seg2_Pin,
12        seg3_Pin,
13        seg4_Pin,
14        seg5_Pin,
15        seg6_Pin,
16        seg7_Pin,
17        LED_12_Pin
18    };
19
20    for (int i = 0; i < 12; i++)
21    {
22        HAL_GPIO_WritePin(port, pins[i], RESET);
23    }
24 }
25
26 void exercise7()
27 {
28     void clearAllClock();
29 }

```

Program 13: Code in la1.h

```

1 while (1)
2 {
3     exercise7();
4 }

```

Program 14: Code in main.c

## 8 Exercise 8

### 8.1 Report 1

```
1 void clearNumberOnClock(int num)
2 {
3     if (num < 0) return;
4
5     GPIO_TypeDef *port = LED_1_GPIO_Port;
6
7     switch (num)
8     {
9         case 0:
10             HAL_GPIO_WritePin(port, LED_1_Pin, RESET);
11             break;
12         case 1:
13             HAL_GPIO_WritePin(port, LED_RED_Pin, RESET);
14             break;
15         case 2:
16             HAL_GPIO_WritePin(port, LED_YELLOW_Pin, RESET);
17             break;
18         case 3:
19             HAL_GPIO_WritePin(port, LED_GREEN_Pin, RESET);
20             break;
21         case 4:
22             HAL_GPIO_WritePin(port, seg1_Pin, RESET);
23             break;
24         case 5:
25             HAL_GPIO_WritePin(port, seg2_Pin, RESET);
26             break;
27         case 6:
28             HAL_GPIO_WritePin(port, seg3_Pin, RESET);
29             break;
30         case 7:
31             HAL_GPIO_WritePin(port, seg4_Pin, RESET);
32             break;
33         case 8:
34             HAL_GPIO_WritePin(port, seg5_Pin, RESET);
35             break;
36         case 9:
37             HAL_GPIO_WritePin(port, seg6_Pin, RESET);
38             break;
39         case 10:
40             HAL_GPIO_WritePin(port, seg7_Pin, RESET);
41             break;
42         case 11:
43             HAL_GPIO_WritePin(port, LED_12_Pin, RESET);
44             break;
45         default: break;
```

```

46     }
47 }
48
49 void exercise8()
50 {
51     for (int i = 0; i < 12; i++)
52     {
53         setNumberOnClock(i);
54         HAL_Delay(1000);
55     }
56
57     clearAllClock();
58 }

```

Program 15: Code in la1.h

```

1 while (1)
2 {
3     exercise8();
4 }

```

Program 16: Code in main.c

## 9 Exercise 9

### 9.1 Report 1

```

1 void exercise9()
2 {
3     for (int i = 0; i < 12; i++)
4     {
5         setNumberOnClock(i);
6         HAL_Delay(1000);
7     }
8
9     for (int i = 0; i < 12; i++)
10    {
11        clearNumberOnClock(i);
12        HAL_Delay(1000);
13    }
14 }

```

Program 17: Code in la1.h

```

1 while (1)
2 {
3     exercise9();
4 }

```

Program 18: Code in main.c

## 10 Exercise 10

### 10.1 Report 1

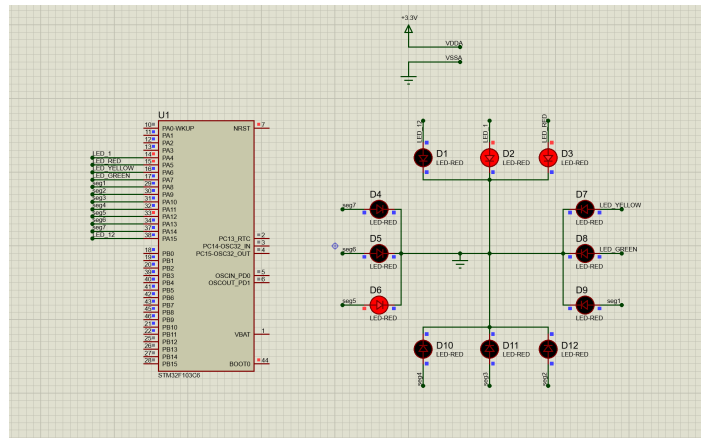


Figure 7: The schematic of exercise 10

### 10.2 Report 2

```
1 void exercise10()
2 {
3     int second = 0;
4     int hour = 0, minute = 0;
5     int counter_min = 0;
6
7     while (1)
8     {
9         switch (second)
10        {
11            case 0:
12                setNumberOnClock(second);
13                if (minute != 11)
14                    clearNumberOnClock(11);
15                second++;
16                break;
17
18            default:
19                setNumberOnClock(second);
20
21                if (second - 1 != minute && second - 1 != hour)
22                {
23                    clearNumberOnClock(second - 1);
24                }
25                second++;
26
27                if (second == 12)
```



```

28     {
29         counter_min++;
30         if (counter_min == 5)
31         {
32             minute ++;
33             counter_min = 0;
34         }
35         second = 0;
36     }
37     break;
38 }
39
40 HAL_Delay(50);
41
42 switch (minute)
43 {
44     case 0:
45         setNumberOnClock(minute);
46         if (hour != 11)
47             clearNumberOnClock(11);
48         break;
49
50     default:
51
52         setNumberOnClock(minute);
53
54         if (minute - 1 != hour && minute - 1 != second)
55         {
56             clearNumberOnClock(minute - 1);
57         }
58
59         if (minute == 12)
60         {
61             ++hour;
62             second = 0;
63             minute = 0;
64         }
65         break;
66     }
67
68     switch (hour)
69     {
70         case 0:
71             setNumberOnClock(hour);
72             break;
73
74         default:
75             if (minute == 0)
76             {

```

```

77 //          HAL_Delay(50000);
78     }
79
80     setNumberOnClock(hour);
81
82     if (hour - 1 != minute && hour - 1 != second)
83     {
84         clearNumberOnClock(hour - 1);
85     }
86
87     if (hour == 12)
88     {
89         clearAllClock();
90         hour = 0;
91         second = 0;
92         minute = 0;
93     }
94     break;
95 }
96 }
97 }

```

Program 19: Code in lab1.h

```

1 while (1)
2 {
3     exercise10();
4 }

```

Program 20: Code in main.c

## 11 Source

You can find the source code on my GitHub repository: **My GitHub Repository**.