

Count 24 game

Group G08

Meet the Group G08



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Flowchart



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Count 24 game

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Overview Requirement

01

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✓ Count 24

หากฝ่ายไหนบันทึกตัวเลขได้ถึง 24 ก่อนจะเป็นฝ่ายชนะ

✓ Show status numbers from LCD

- ไม่มีสี -> ตัวเลขที่เลือกเป็นเลข 1
- สีเขียว -> ตัวเลขที่เลือกเป็นเลข 2
- สีน้ำเงิน -> ตัวเลขที่เลือกเป็นเลข 3
- สีเขียวและน้ำเงิน -> ตัวเลขที่เลือกเป็นเลข random

✓ Music box

เกมจะเล่นเพลง เมื่อผู้เล่นเป็นฝ่ายชนะ

2 Specification

System information

- MCU : STM32L152RB
- LCD : 6-digit, 24 segment
- Pushbuttons : user button
- TIMER : PWM Mode
- Software : Keil / Language C



Function

- Show game count number (LCD)
- Selected number (Matrix Switch)
- Confirm number (push button)
- Indicate Number status (LEDs)
- Music box (PWM Mode)

Behavior

- Show game count number (LCD)
 - 6-digit EG: xx-p-y
 - xx : current total number
 - p: p-player, c-computer
 - y: selected number
- Selected number (Matrix Switch)
 - 00 -> 1, 01 -> 2 ,10 -> 3 , 11-> rand
- Confirm number (push button) : User button
- Indicate Number status (LEDs)
 - None -> 1 ,Green -> 2, Blue -> 3
,Green & Blue -> rand
- Music box (PWM Mode)
 - win: play soundtrack
 - lose: buzzer

Specification

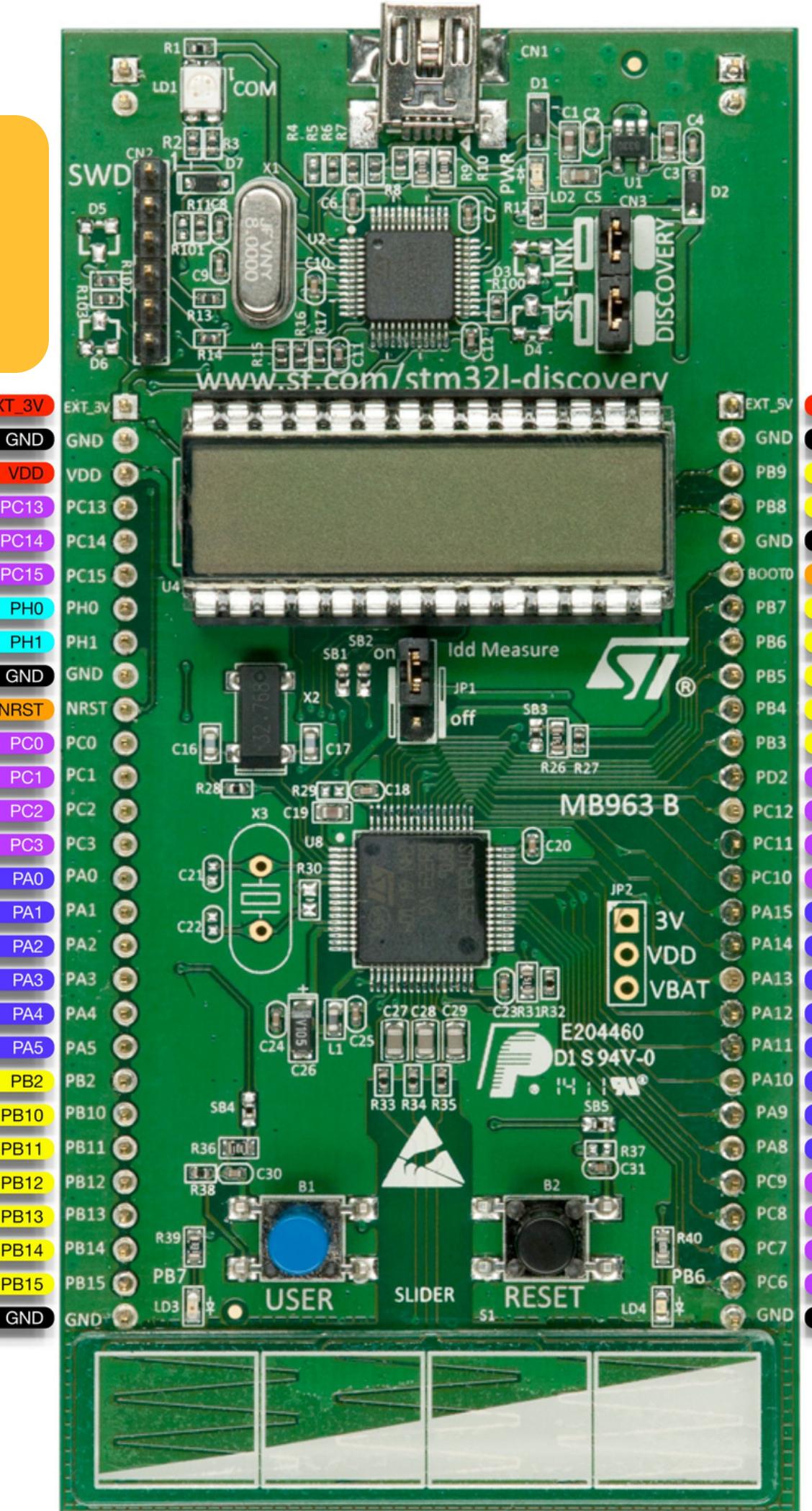
Project planning

| Task | December | | January | | | February | | |
|------------------------|----------|---|---------|---|---|----------|---|---|
| | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 |
| Requirement & planning | 1 | | | | | | | |
| Specification | | 1 | | | | | | |
| Architectural design | | 1 | | | | | | |
| Detailed design | | | 1 | | | | | |
| Coding | | | 1 | 1 | | | | |
| Unit testing | | | | 1 | | | | |
| Integration testing | | | | | 1 | | | |
| System testing | | | | | 1 | 1 | | |
| Acceptance testing | | | | | | 1 | 1 | |
| Presentation | | | | | 1 | 1 | | |

MODEL DESIGN ARCHITECTURAL DESIGN

Count 24 game - Group G08

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p

Input

05

Push Button

Matrix Switch

Process

EXTI

DAC

TIM

Output

LED

LCD

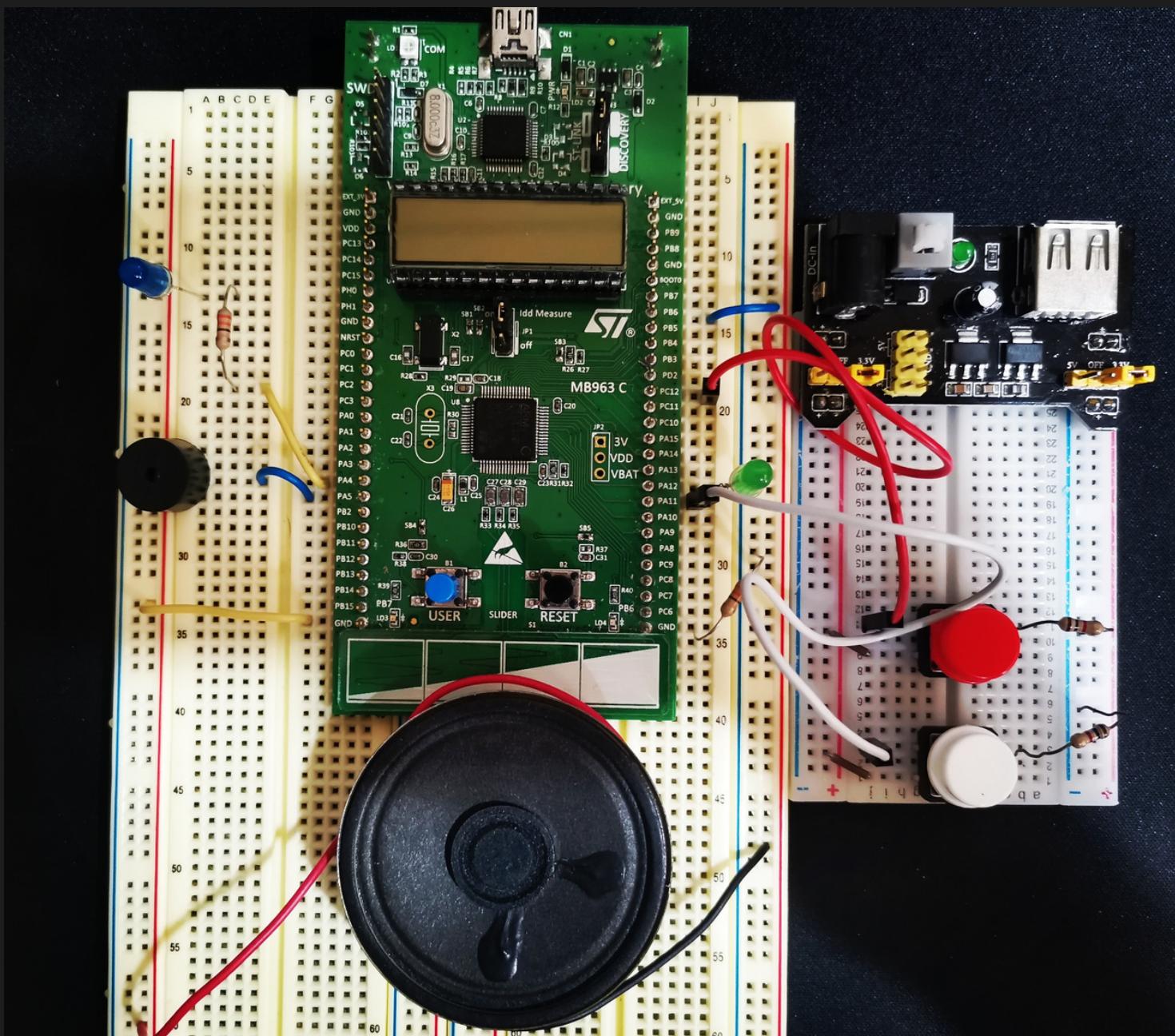
Buzzer

Speaker

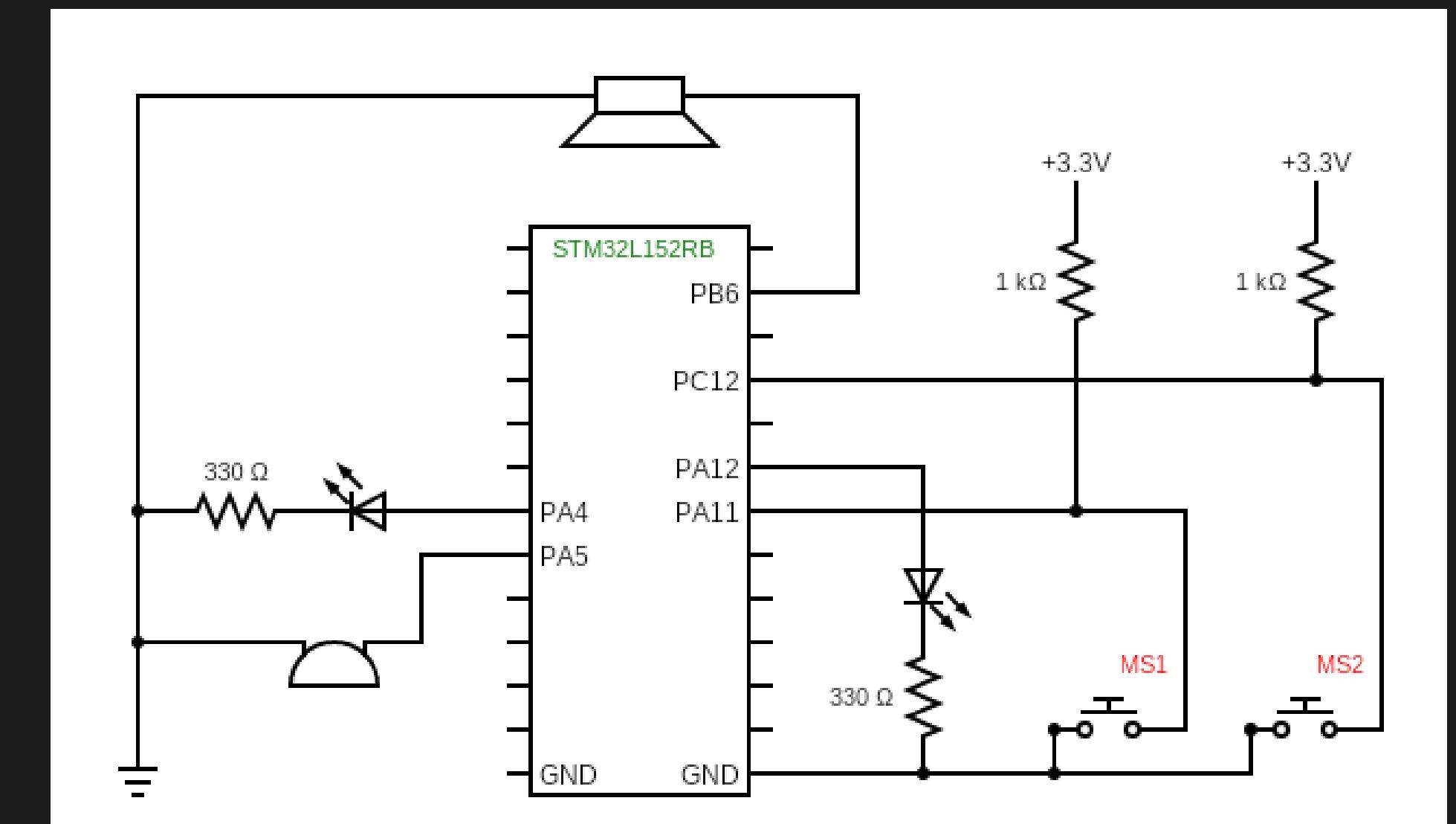
Hardware and circuit

HARDWARE

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CIRCUIT

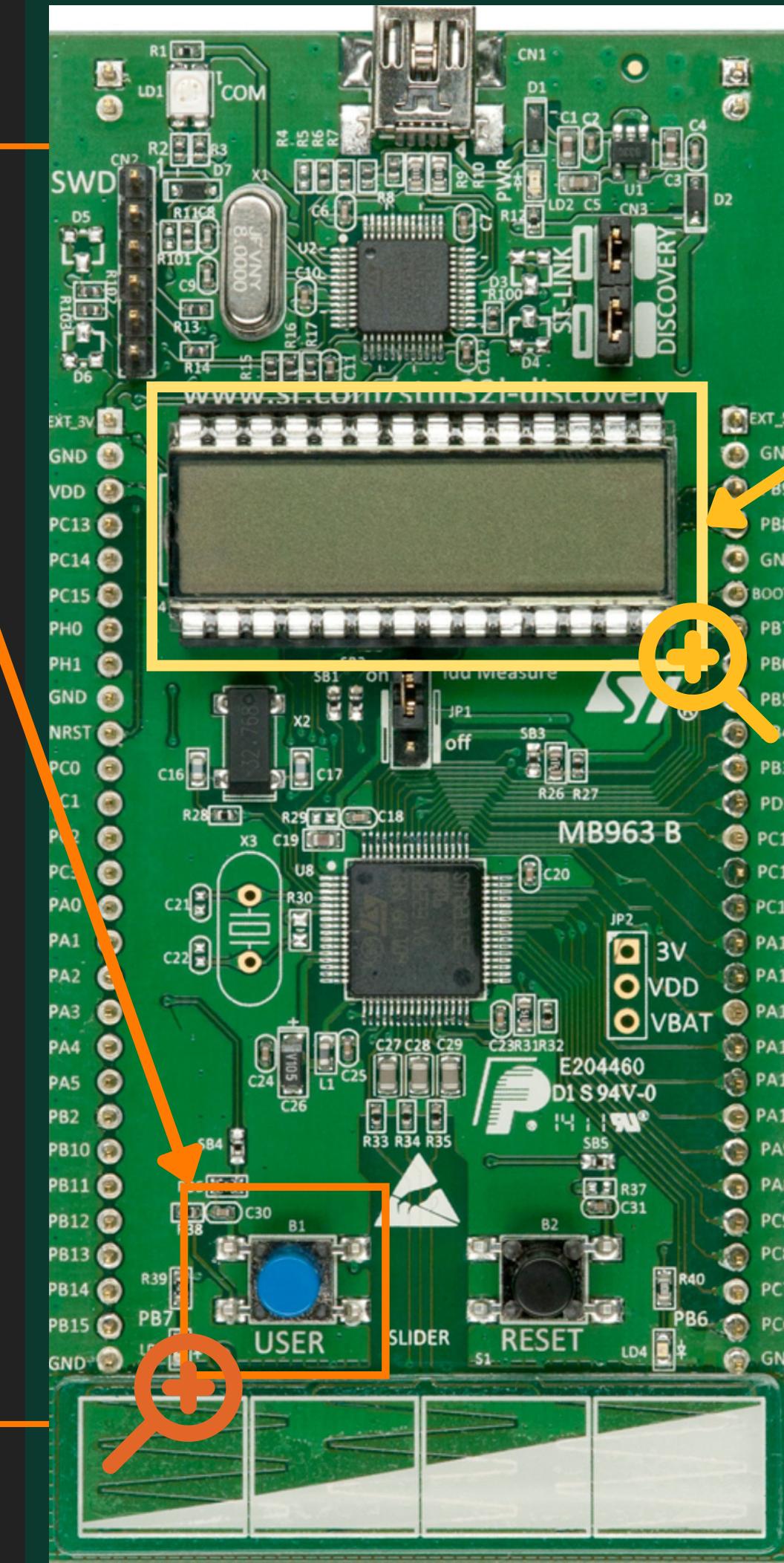
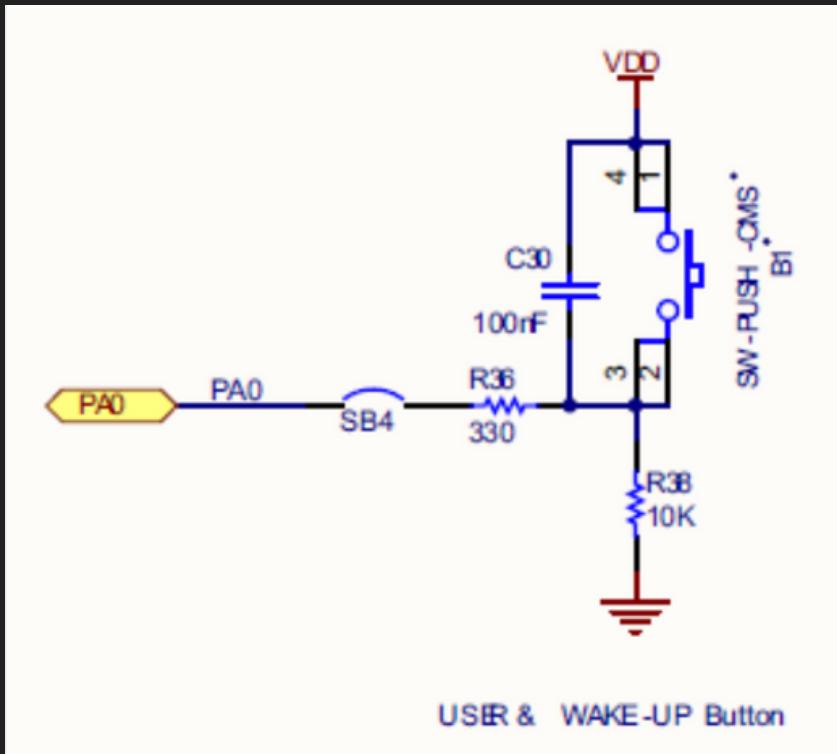


Architectural Design : User Button

3 Features

The STM32L1 discovery offers the following features:

- Two pushbuttons (user and reset)
- One linear touch sensor and four touchkeys



Architectural Design : LCD

4.9 LCD (24 segments, 4 commons)

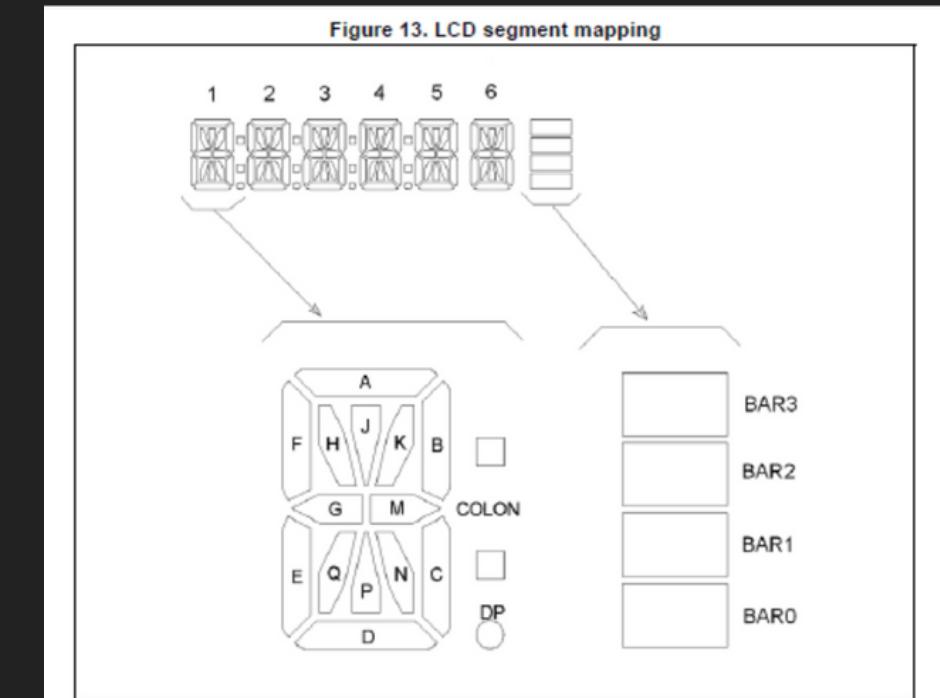
This LCD allows the STM32L152 to display any information on six 14-segment digits and 4 bars, using all COMs. (See the LCD segment mapping in [Figure 18](#) and pin connections in [Table 7](#).)

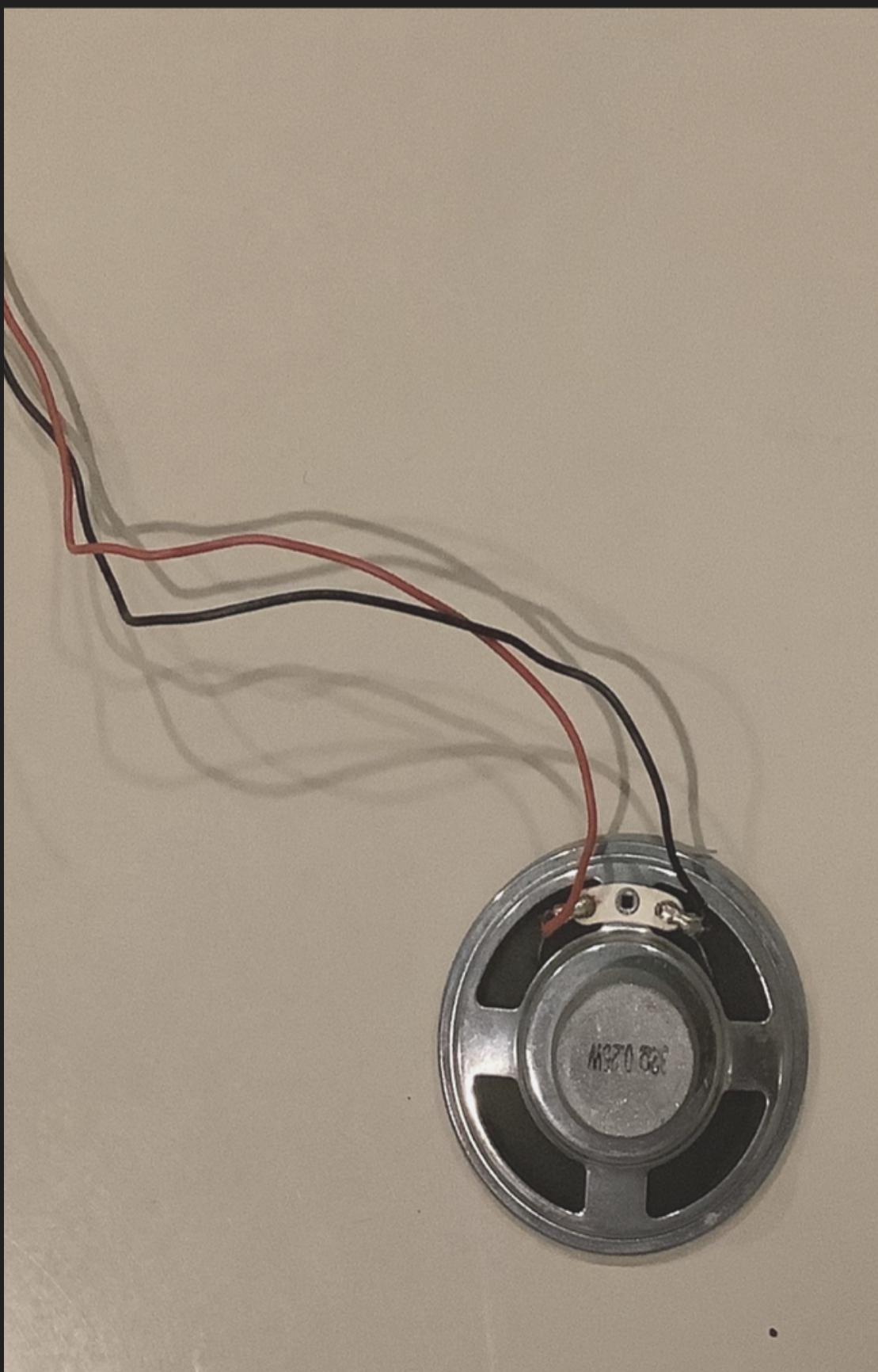
Note: This LCD also supports six 8-segment digits by only using COM0 and COM1. This configuration allows COM2 and COM3 to be used as I/O ports. In this case the 2 LCD pins must not be plugged into the LCD socket. To proceed with this configuration, remove the LCD carefully, slightly open the COM2 and COM3 pins (pin 13 and pin 14) of the LCD, then replug it in the socket.

Characteristics overview:

- 24 segments and 4 commons
- Drive method: multiplexed 1/4 duty, 1/3 bias
- Operating voltage: 3 V
- Operating temperature: 0 to 50°C
- Connector: 28-pin DIL 2.54 mm pitch

Note: When the LCD is plugged, all I/O ports listed in [Table 7](#) are unavailable. To use one of these as I/O, you must remove the LCD.





Architectural Design : Timer

3.15 Timers and watchdogs

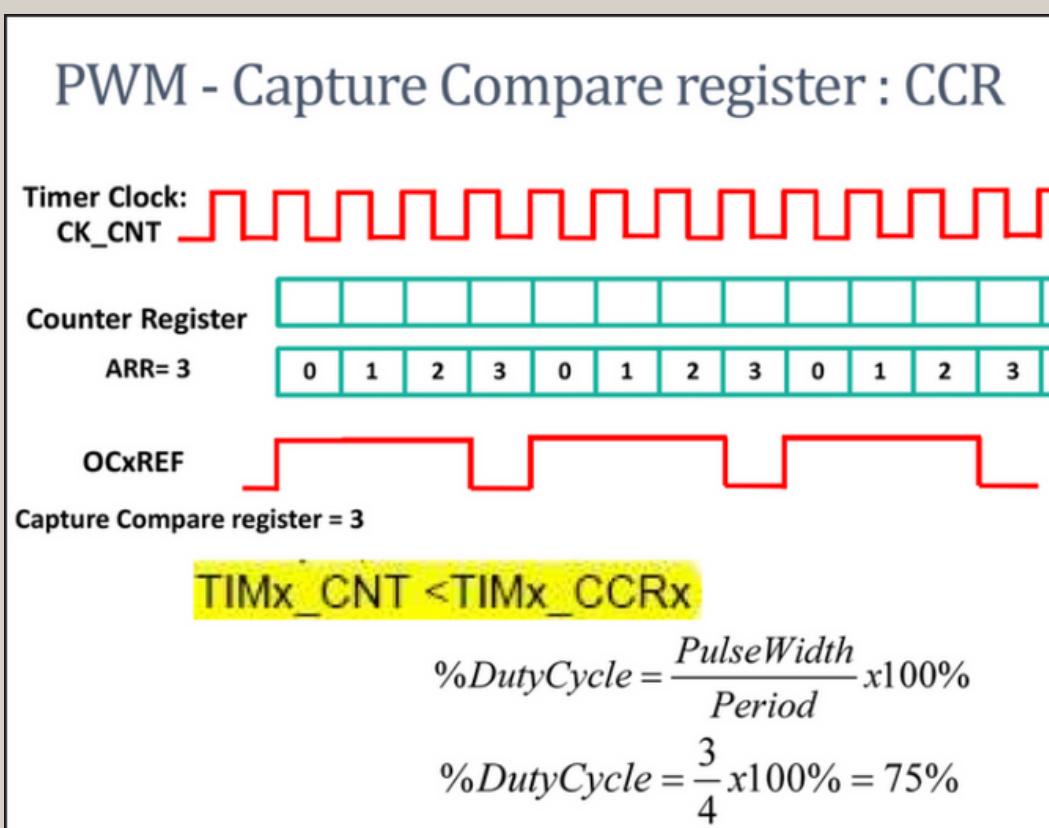
The ultra-low-power STM32L15xxx devices include six general-purpose timers, two basic timers and two watchdog timers.

| Timer | Counter resolution | Counter type | Prescaler factor | DMA request generation | Capture/compare channels | Complementary outputs |
|------------------------|--------------------|-------------------------|---------------------------------------|------------------------|--------------------------|-----------------------|
| TIM2, TIM3, TIM4 | 16-bit | Up, down, up/down | Any integer between 1 and 65536 | Yes | 4 | No |
| TIM9 | 16-bit | Up | Any integer between 1 and 65536 | No | 2 | No |

| Timer | Counter resolution | Counter type | Prescaler factor | DMA request generation | Capture/compare channels | Complementary outputs |
|-----------------|--------------------|--------------|---------------------------------------|------------------------|--------------------------|-----------------------|
| TIM10, TIM11 | 16-bit | Up | Any integer between 1 and 65536 | No | 1 | No |
| TIM6, TIM7 | 16-bit | Up | Any integer between 1 and 65536 | Yes | 0 | No |

PWM mode

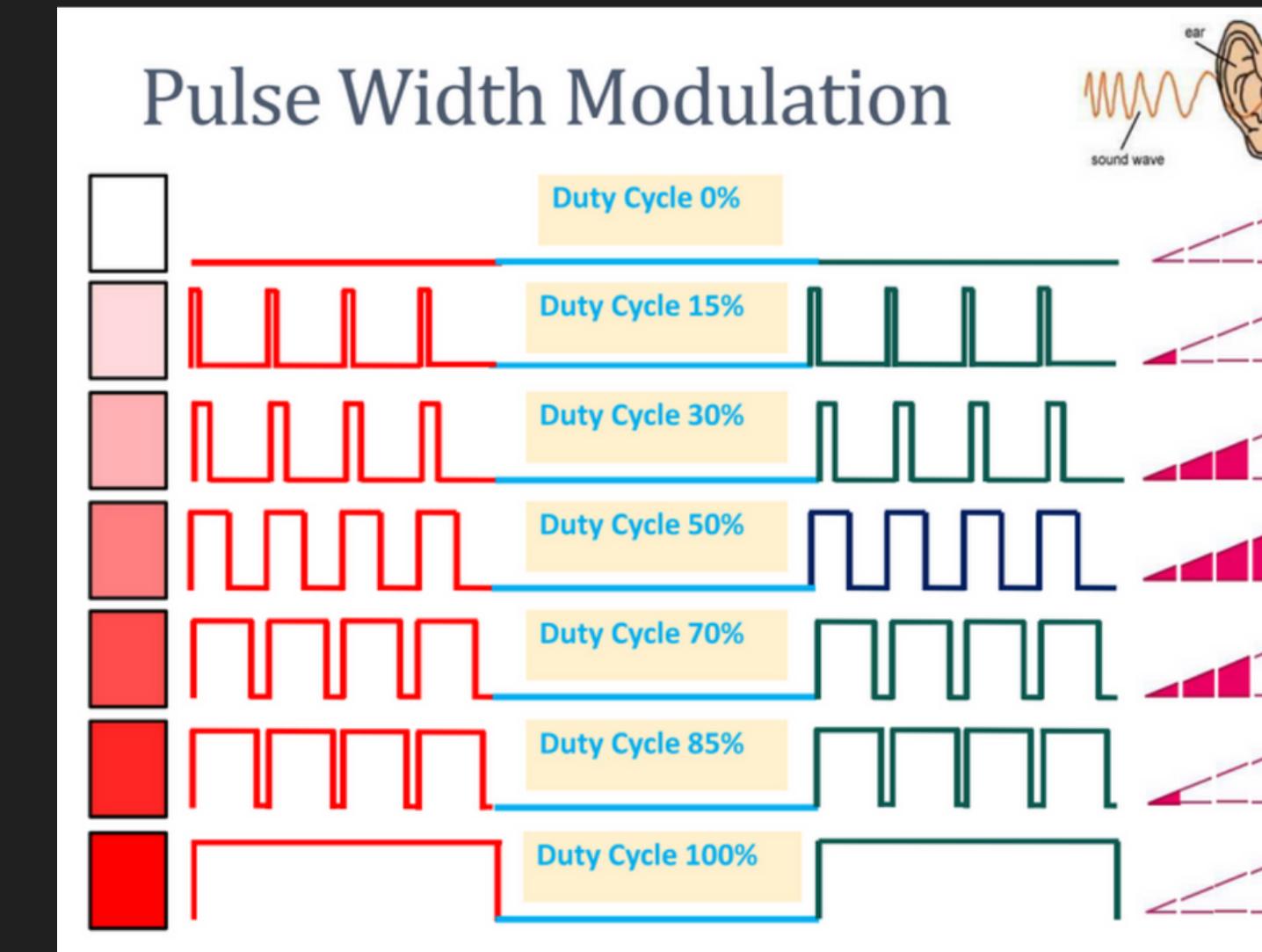
Pulse Width Modulation mode allows you to generate a signal with a frequency determined by the value of the **TIMx_ARR** register and a duty cycle determined by the value of the **TIMx_CCRx** register.



Architectural Design :

Timer

TIM -> PWM Mode



Architectural Design :

TIM Music box



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Piano

| Note | Frequency |
|------|-----------|
| E | 1318.5 |

STM32L152RB Time base

Time base generator

The update event period is calculated as follows:

$$\text{Timer clock} = CK_CNT = \frac{\text{TIM_CLK}}{(PSC+1) \times (ARR+1)}$$

Where: TIM_CLK = timer clock input = 16 MHz

PSC = 16-bit Prescaler register

ARR = 16/32-bit Auto Reload register

** 16-bit value = 0 - 65535 **

$$1318.5 = \frac{16\text{MHz}}{(PSC+1) \times (ARR+1)}$$

$$= \frac{16\text{MHz}}{(0+1) \times (ARR+1)}$$

$$= \frac{16\text{MHz}}{(ARR+1)}$$

$$ARR+1 = 16,000,000 \times \frac{1}{1318.5}$$

$$ARR = 12135.0018 - 1 = 12135 - 1 = 12134$$

| | C | C# | D | Eb | E | F | F# | G | G# | A | Bb | B |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 16.35 | 17.32 | 18.35 | 19.45 | 20.60 | 21.83 | 23.12 | 24.50 | 25.96 | 27.50 | 29.14 | 30.87 |
| 1 | 32.70 | 34.65 | 36.71 | 38.89 | 41.20 | 43.65 | 46.25 | 49.00 | 51.91 | 55.00 | 58.27 | 61.74 |
| 2 | 65.41 | 69.30 | 73.42 | 77.78 | 82.41 | 87.31 | 92.50 | 98.00 | 103.8 | 110.0 | 116.5 | 123.5 |
| 3 | 130.8 | 138.6 | 146.8 | 155.6 | 164.8 | 174.6 | 185.0 | 196.0 | 207.7 | 220.0 | 233.1 | 246.9 |
| 4 | 261.6 | 277.2 | 293.7 | 311.1 | 329.6 | 349.2 | 370.0 | 392.0 | 415.3 | 440.0 | 466.2 | 493.9 |
| 5 | 523.3 | 554.4 | 587.3 | 622.3 | 659.3 | 698.5 | 740.0 | 784.0 | 830.6 | 880.0 | 932.3 | 987.8 |
| 6 | 1047 | 1109 | 1175 | 1245 | 1319 | 1397 | 1480 | 1568 | 1661 | 1760 | 1865 | 1976 |
| 7 | 2093 | 2217 | 2349 | 2489 | 2637 | 2794 | 2960 | 3136 | 3322 | 3520 | 3729 | 3951 |
| 8 | 4186 | 4435 | 4699 | 4978 | 5274 | 5588 | 5920 | 6272 | 6645 | 7040 | 7459 | 7902 |

Board pin allocation

p

G08 Pin allocation

| \Pin Port | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|--------------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|----|
| A | Cyan | Green | Green | Green | Orange | Blue | Grey | Grey | Green | Green | Green | Pink | Orange | Grey | Green | |
| B | Grey | Grey | Grey | Green | Green | Green | White | Green | Green | Green | Green | Green | Green | Green | Green | |
| C | Green | Green | Green | Green | Grey | Grey | Green | Green | Green | Green | Green | Pink | Grey | Grey | Grey | |
| D | Grey | Grey | White | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | |
| H | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | Grey | |

User Button

Matrix Switch

LED

Buzzer - DAC

LCD

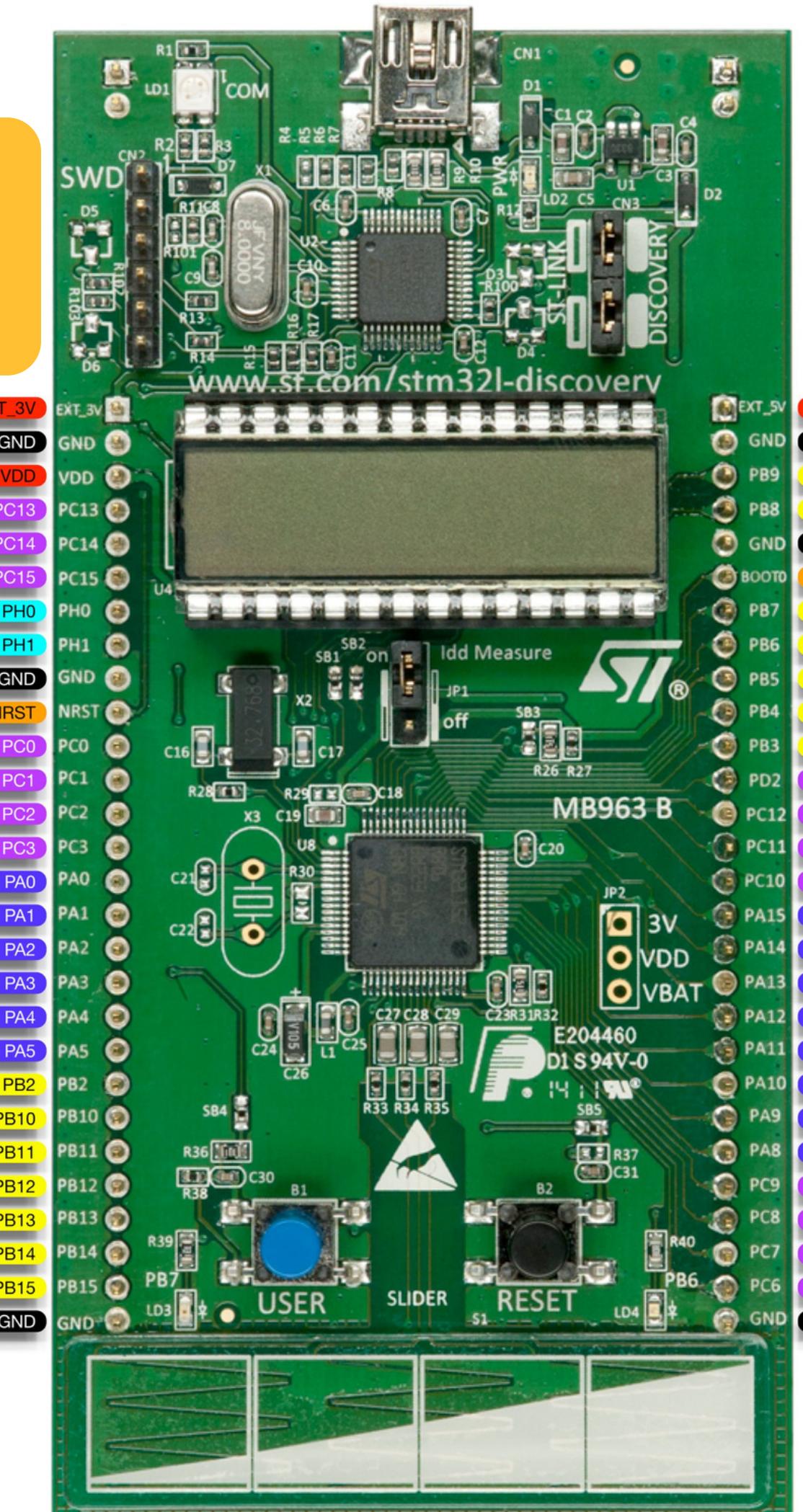
Speaker -
TIM4_CH1

MODEL DESIGN DETAILED DESIGN

Count 24 game -Group G08

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Top-down design

COUNT 24 GAME

p

Count 24 game

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Function :
Show game
count number

Function :
Selected
number

Function :
Confirm
number

Function :
Indicate
Number status

Function :
Music
box

LCD

Matrix
switch

User
button

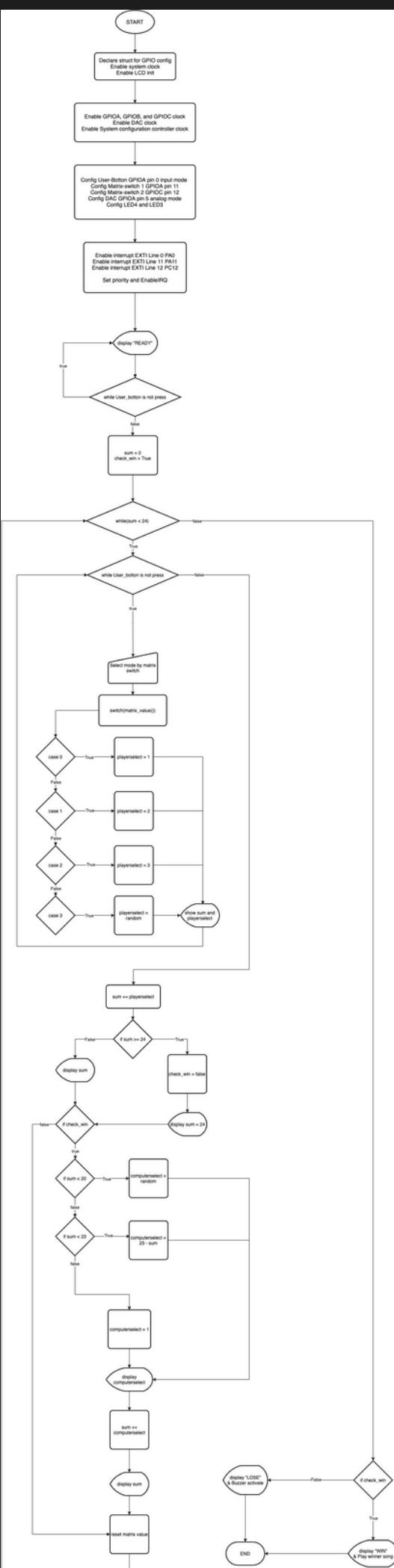
LED

Buzzer
Speaker



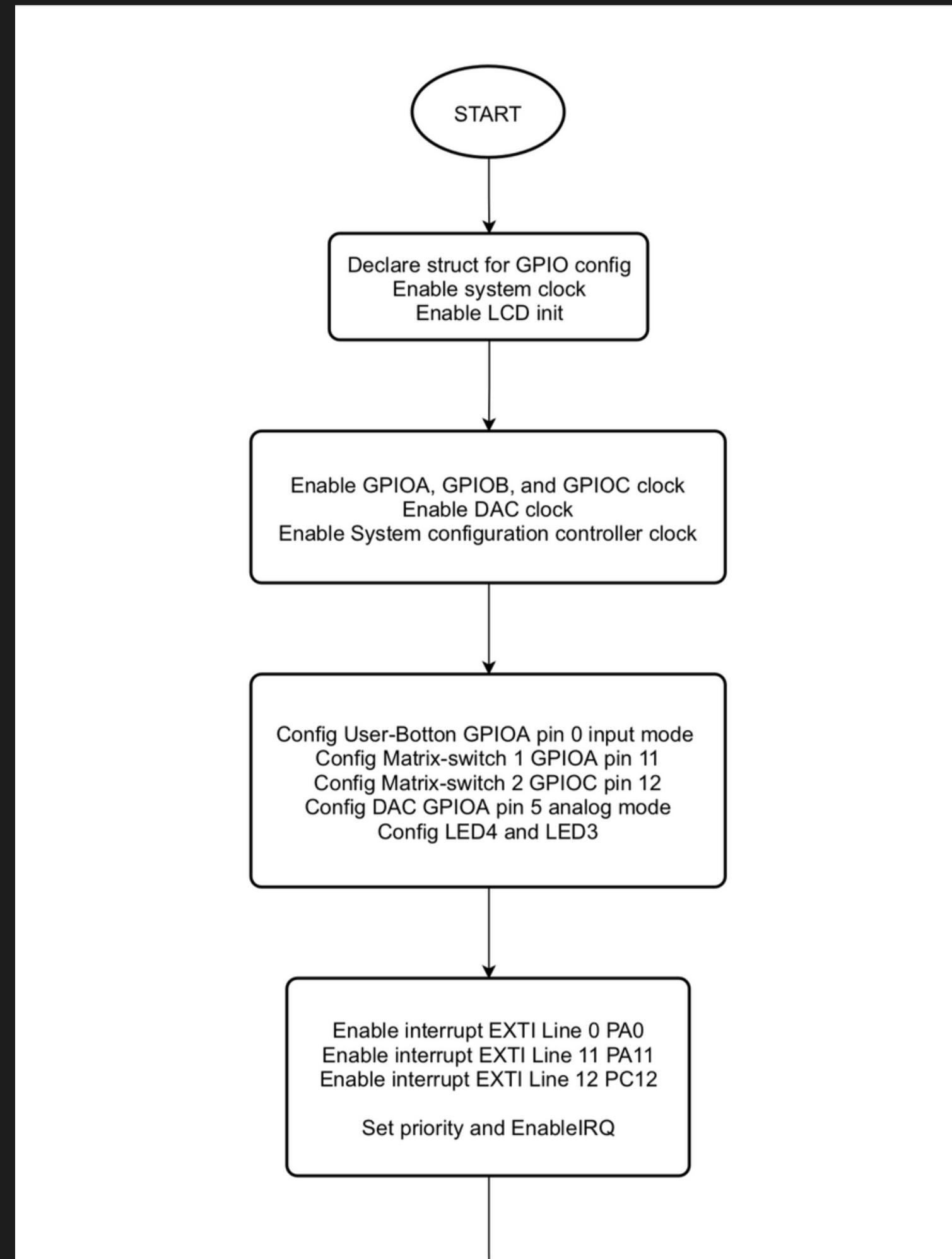
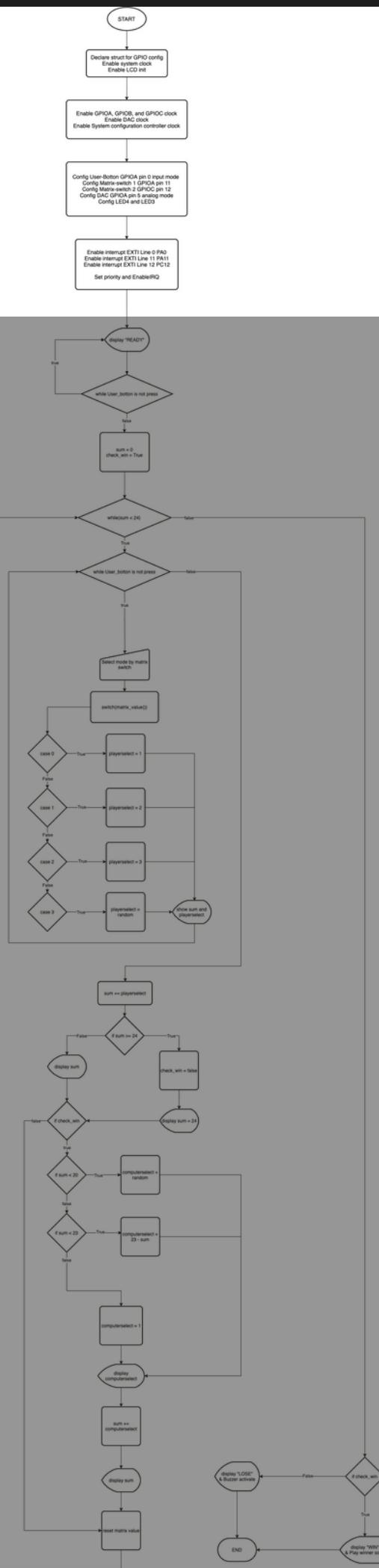


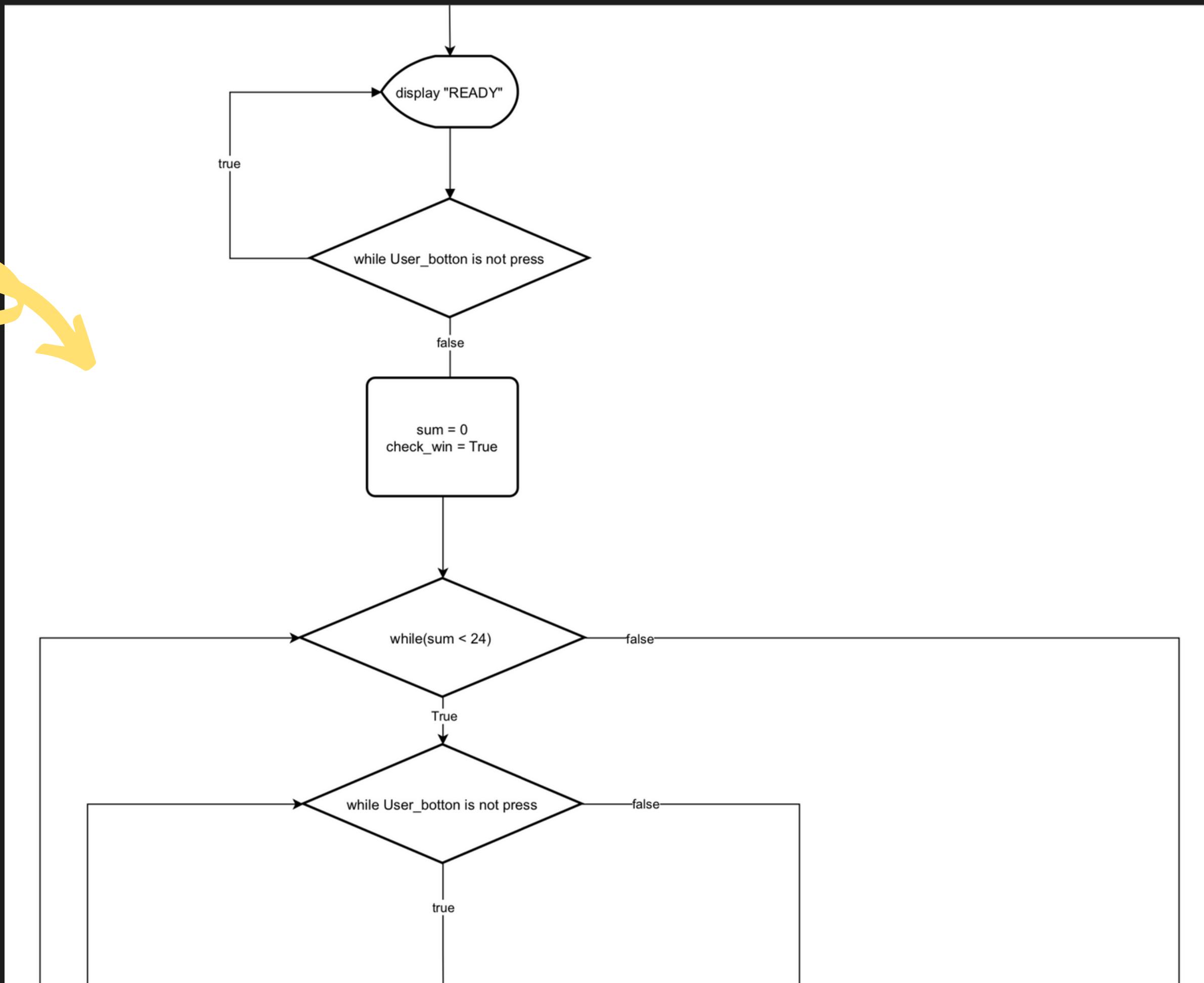
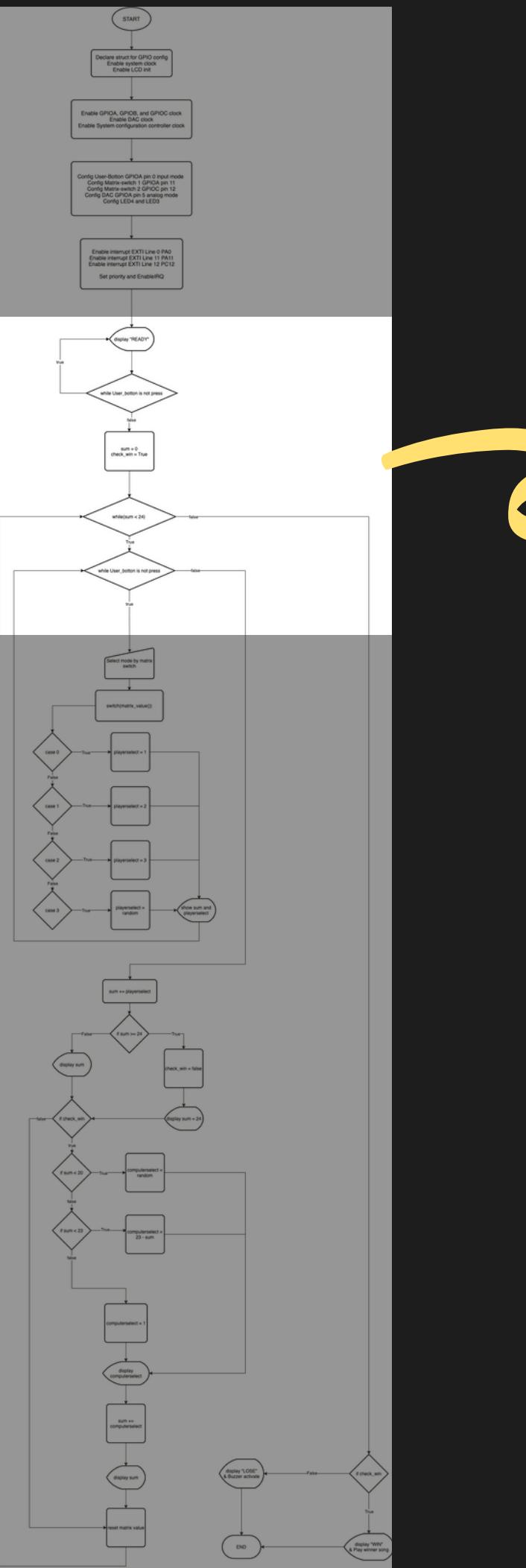
14

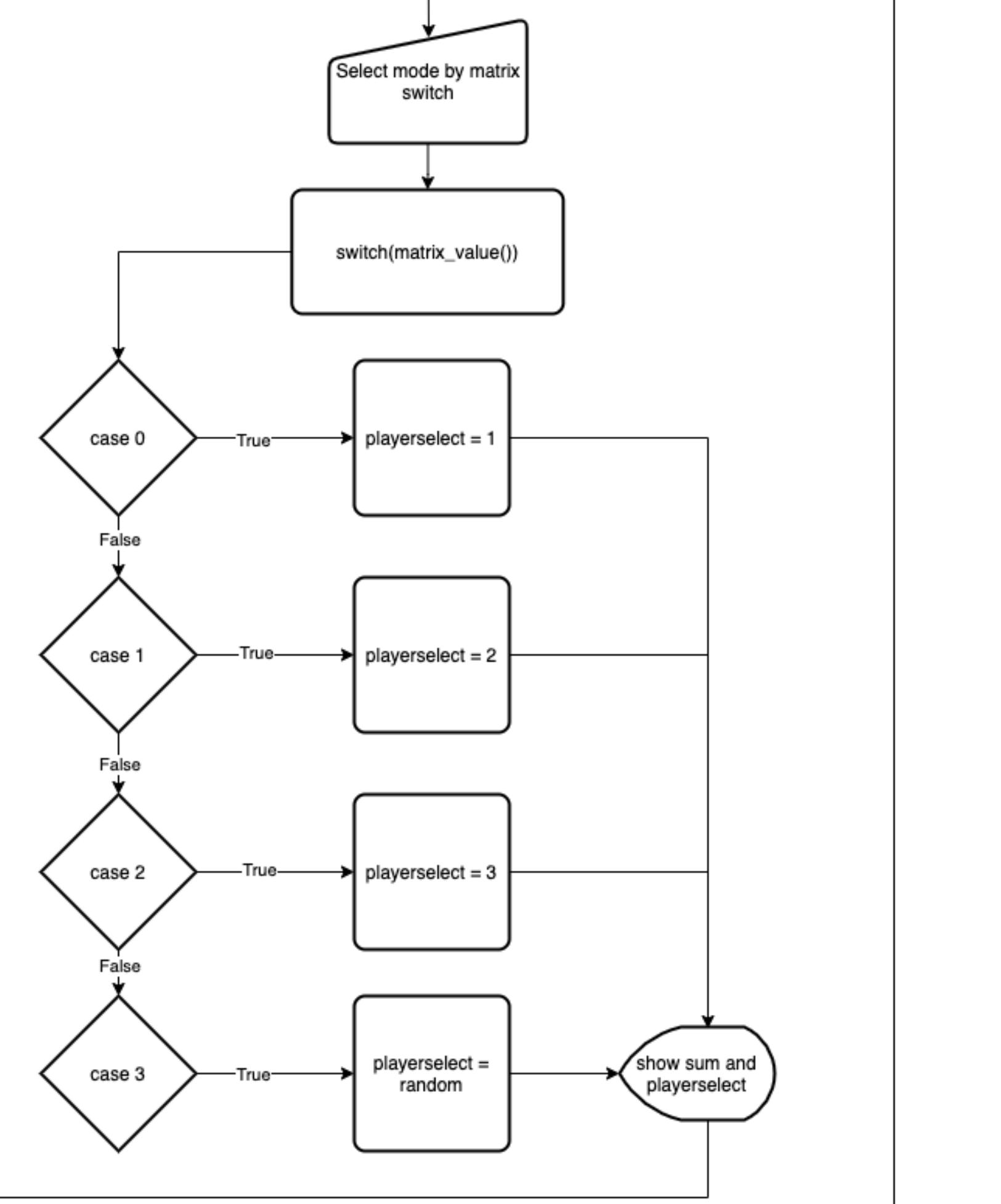
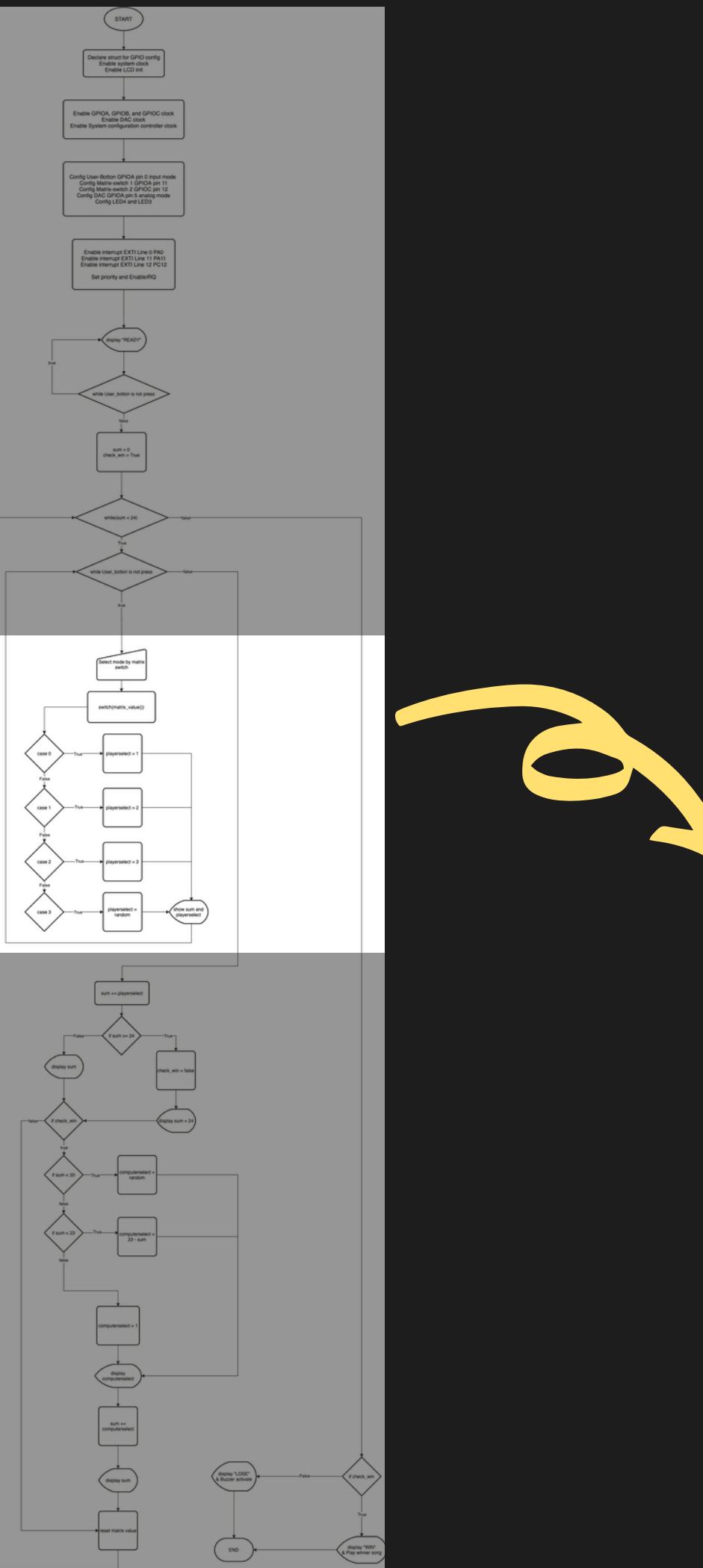


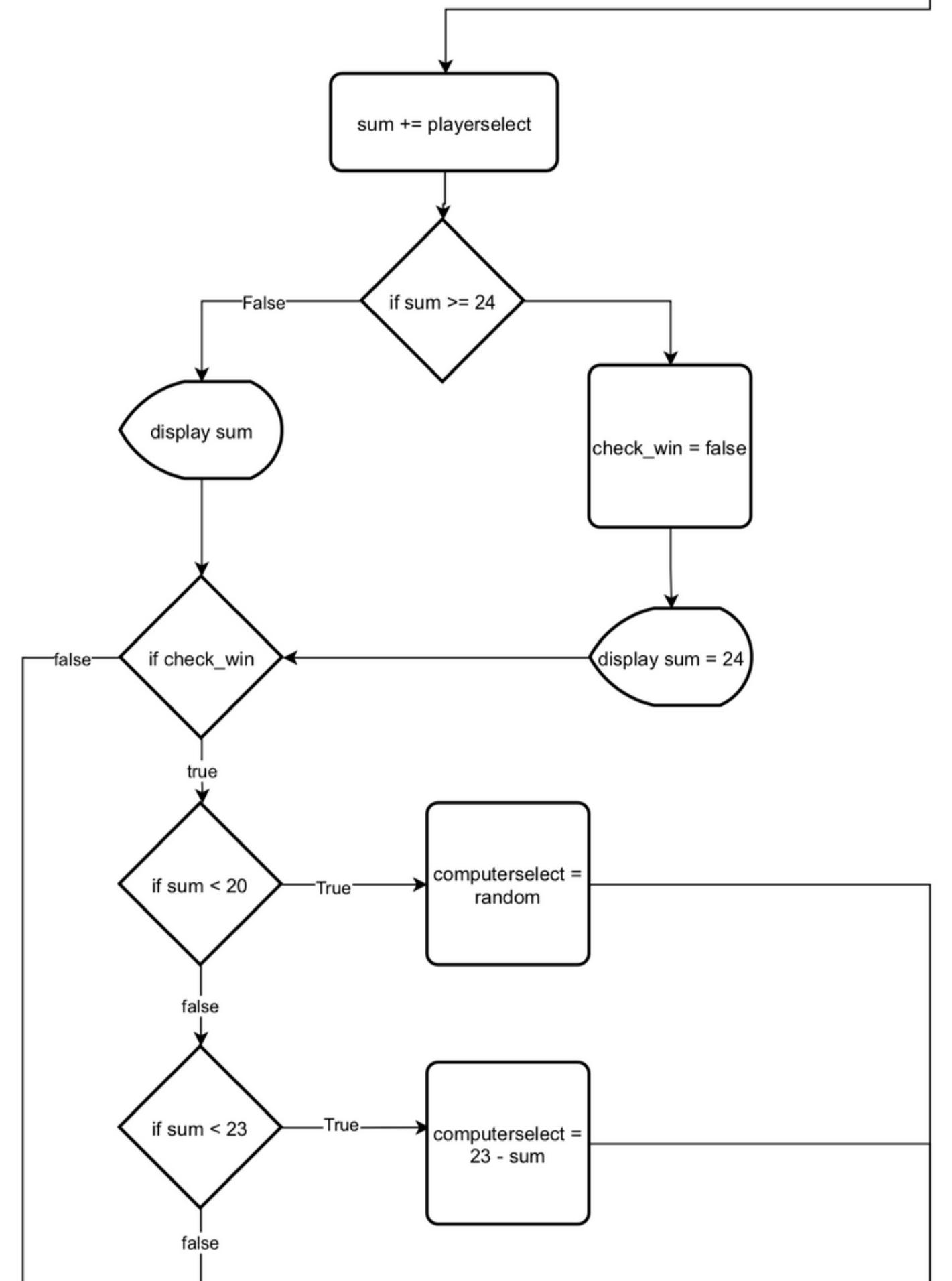
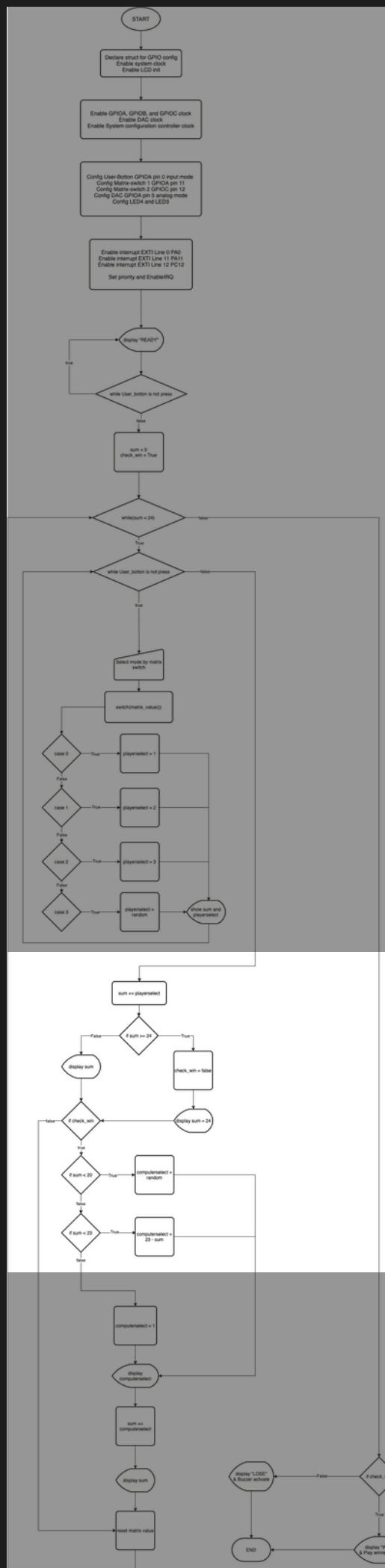
Coding flowchart

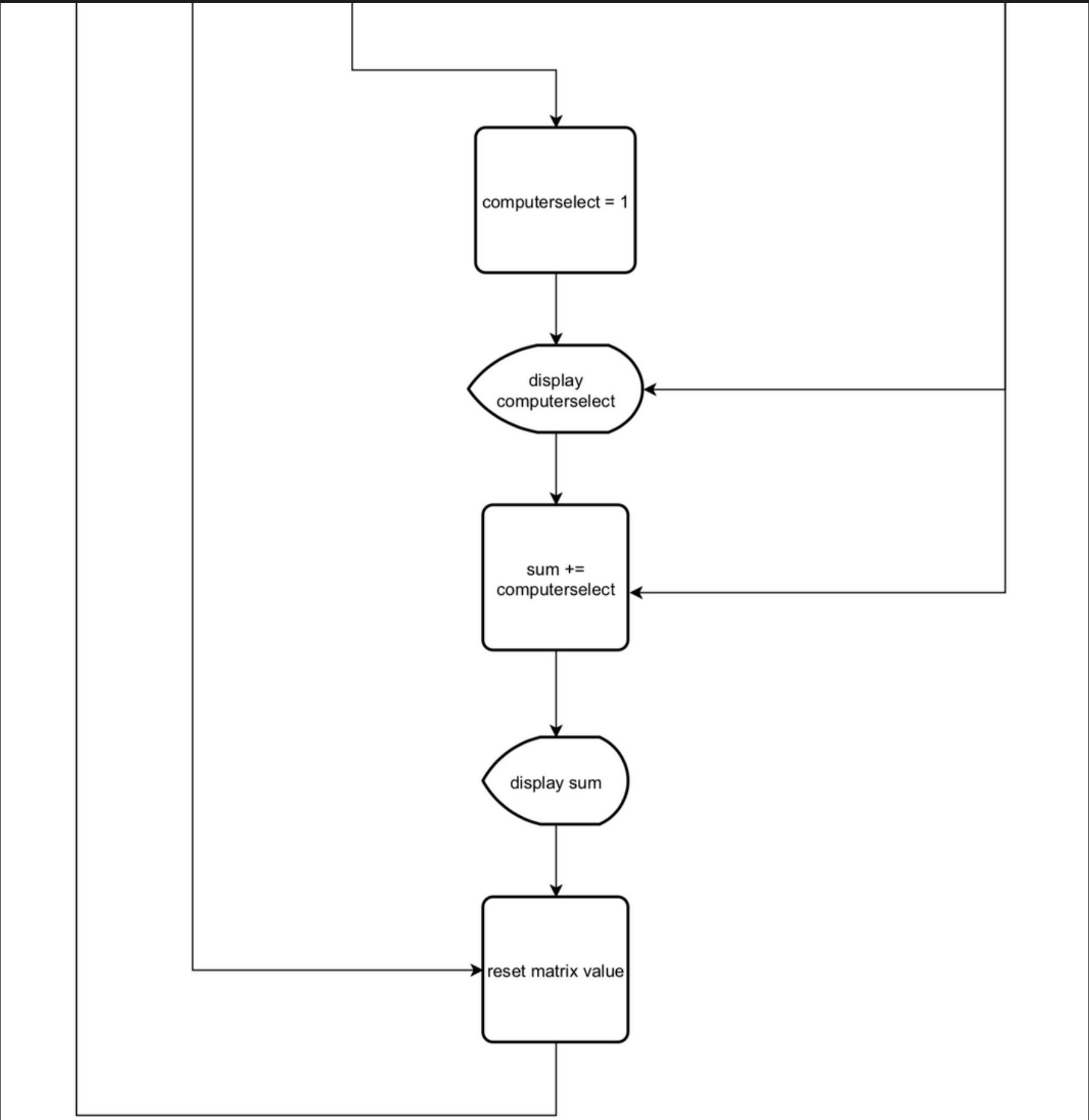
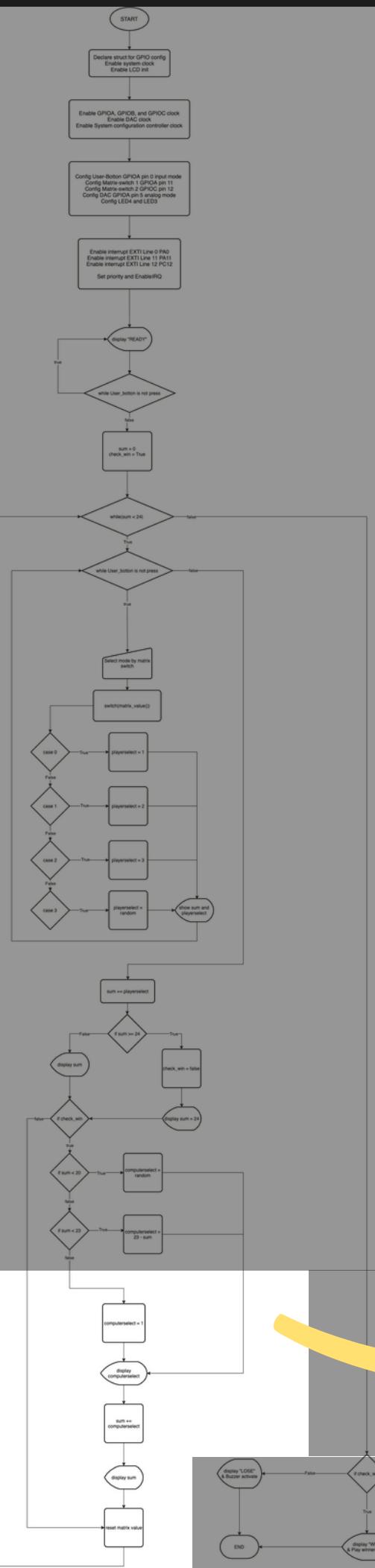
COUNT 24 GAME





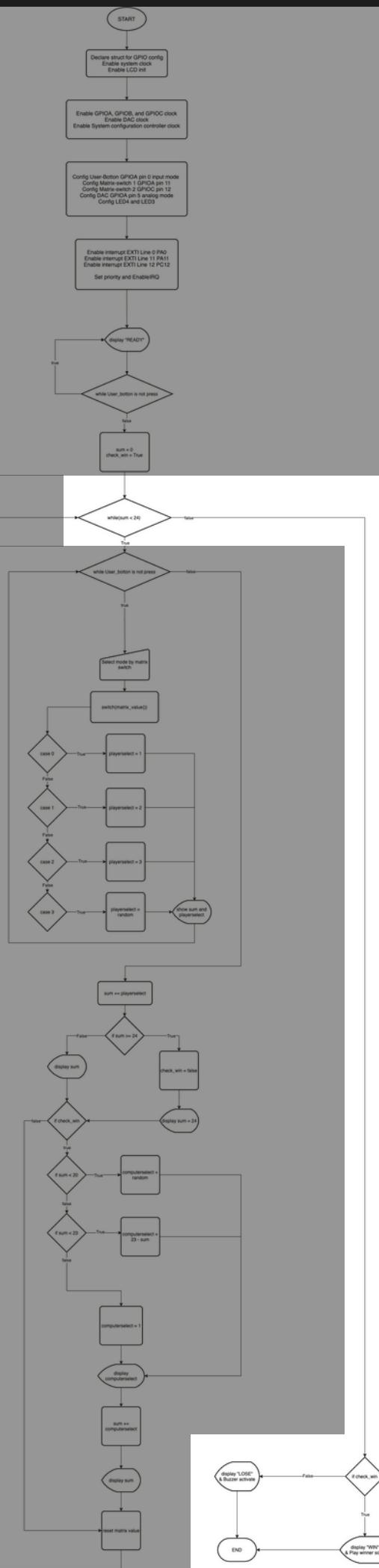
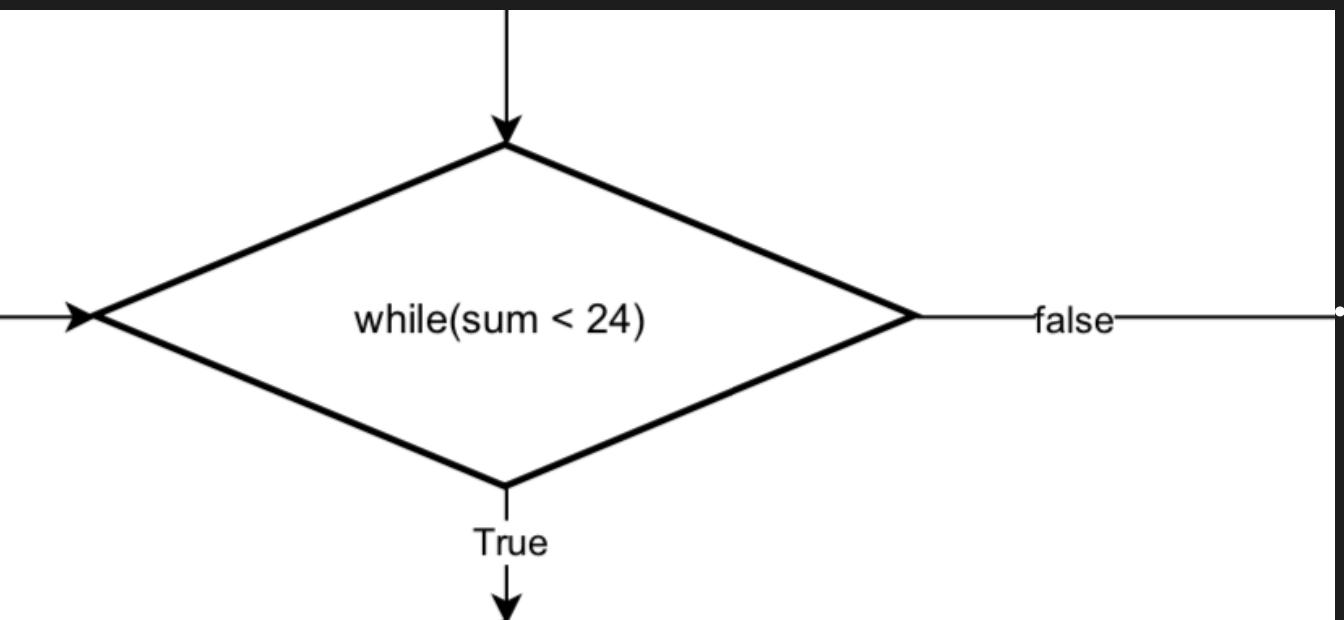
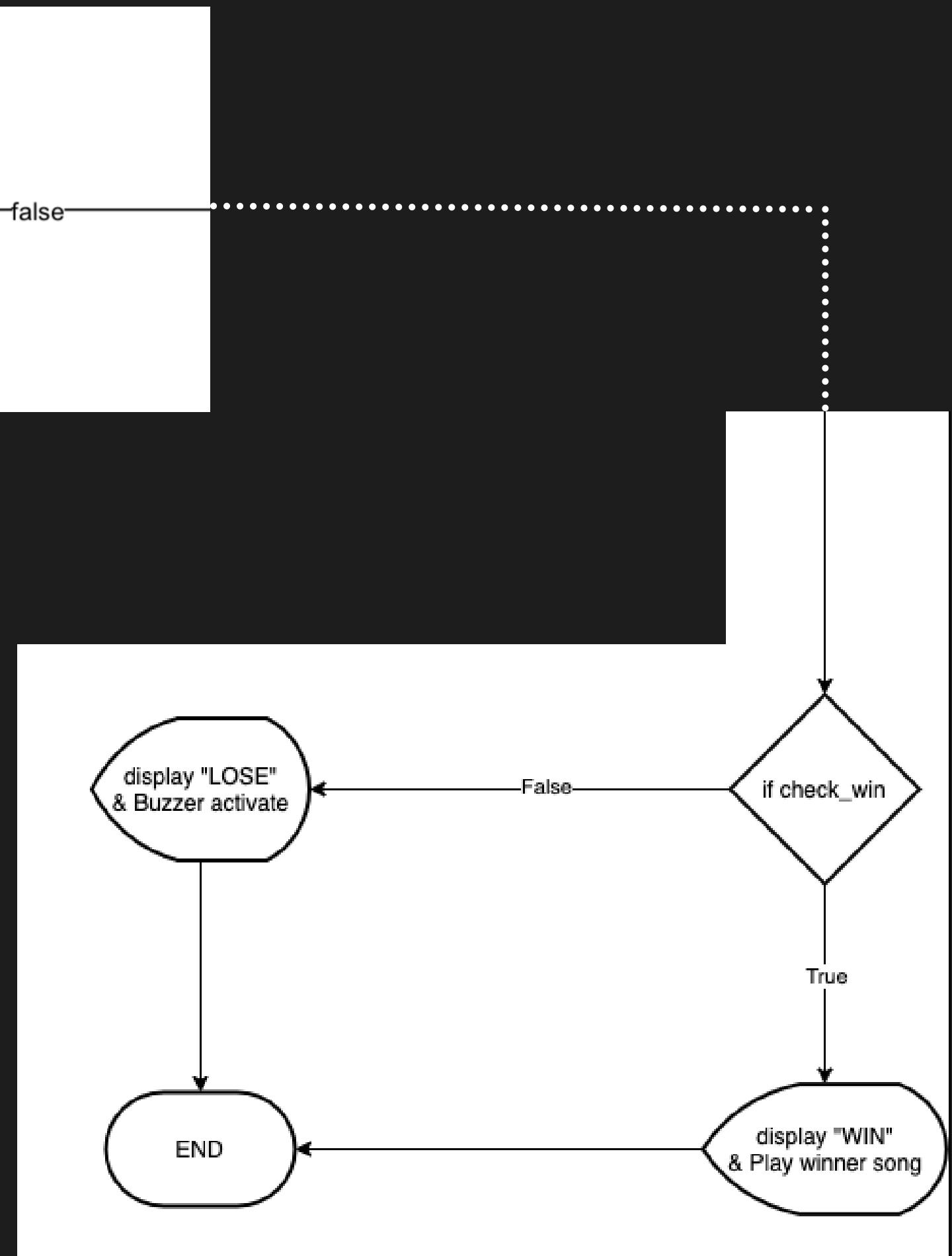






Coding flowchart

Coding flowchart



Gantt chart and operating table



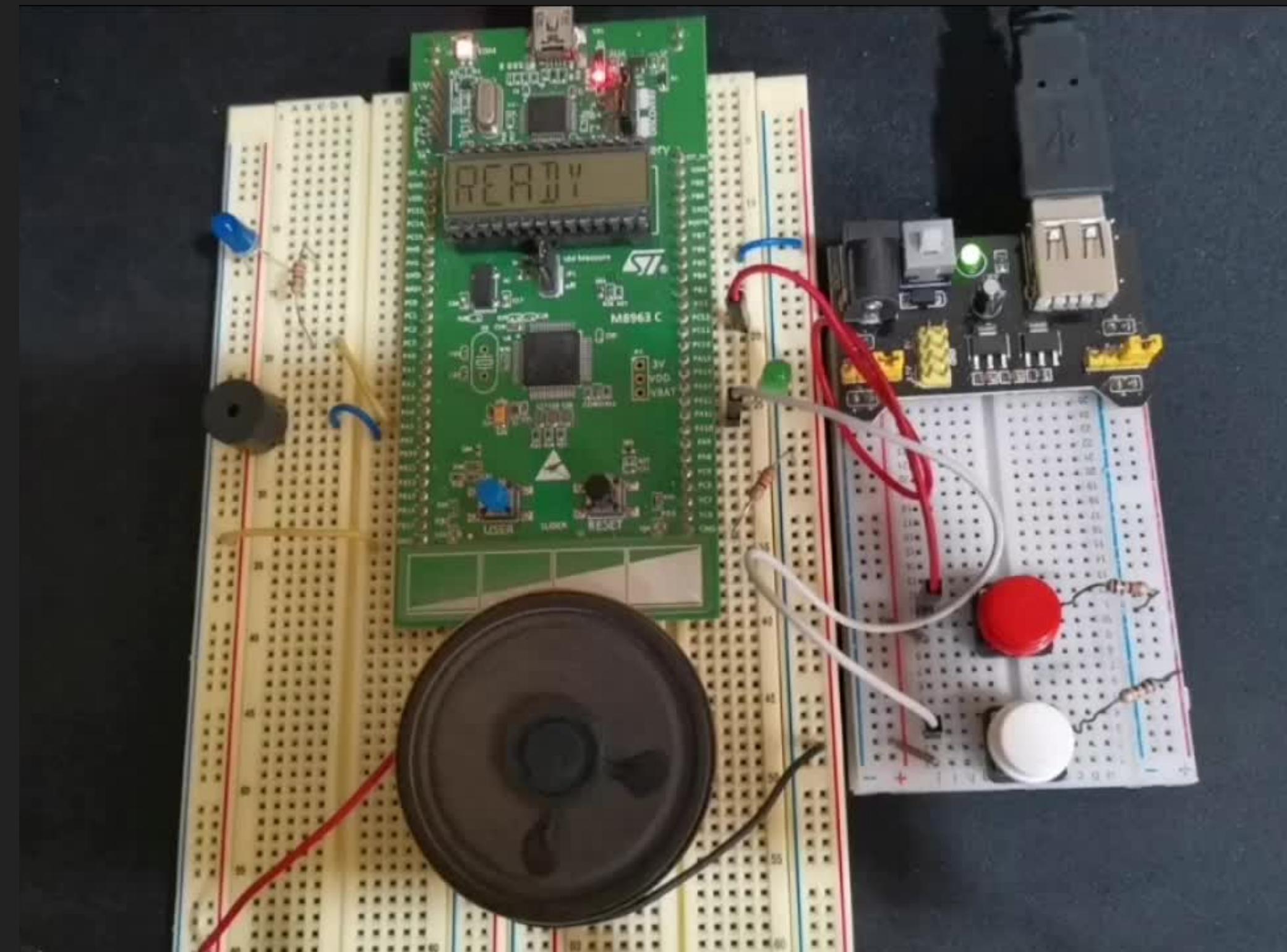
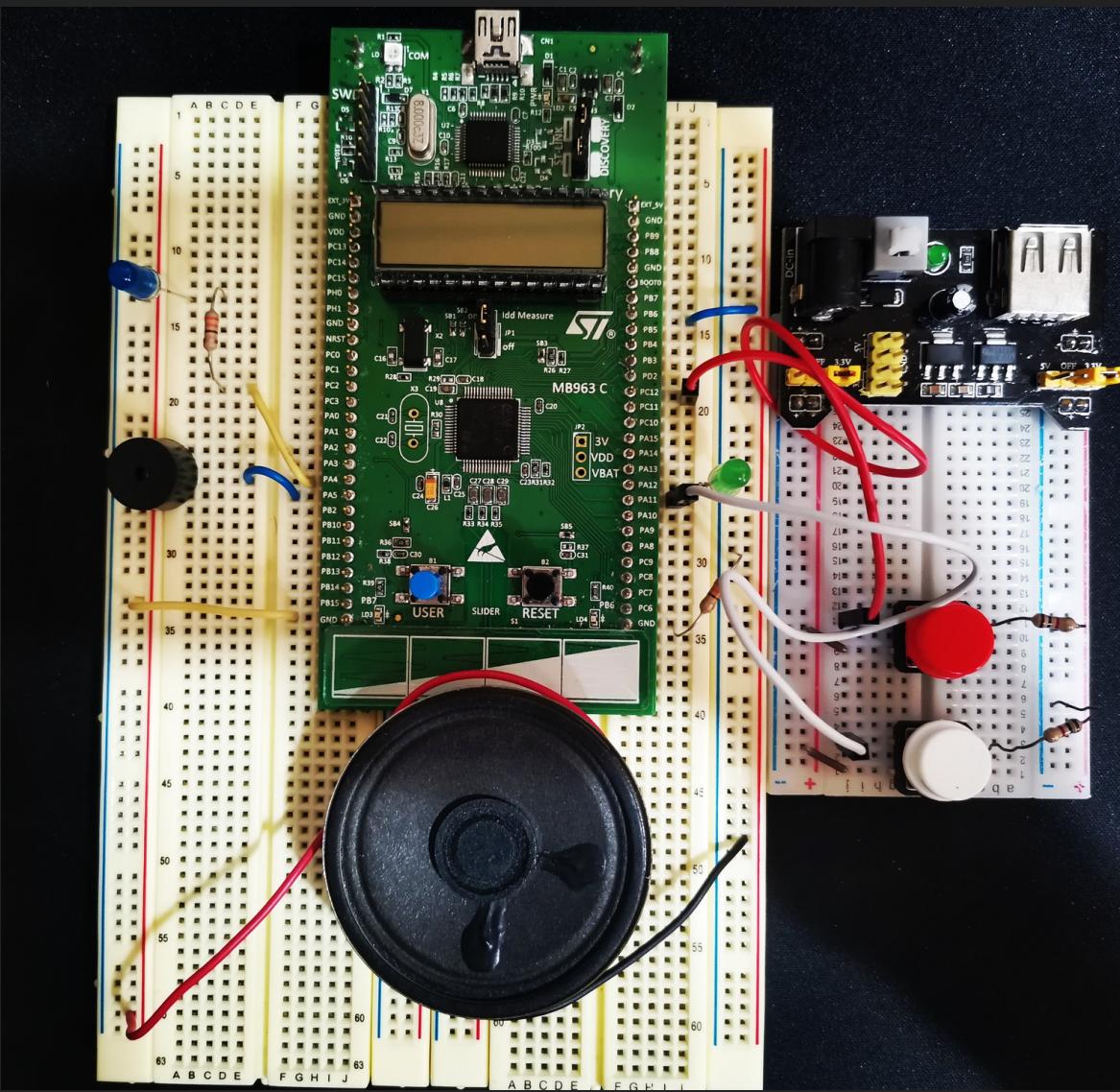
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| Project Plan | | | | | | | | | | |
|-----------------------------------|----------------|----------|---|---------|---|---|---|----------|---|--|
| Task | Responsibility | December | | January | | | | February | | |
| | | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | |
| Requirement & planning | Team member | ■ | | | | | | | | |
| | | | ■ | | | | | | | |
| Specification | Leader, HW, SW | | | ■ | | | | | | |
| | Testing team | | ■ | | ■ | | | | | |
| Architectural design | Hardware team | | | ■ | | | | | | |
| | | | ■ | | ■ | | | | | |
| Detailed design | Software team | | | | ■ | | | | | |
| | | | | | ■ | | | | | |
| Coding | Software team | | | | ■ | ■ | ■ | | | |
| | | | | | ■ | ■ | ■ | ■ | ■ | |
| Unit testing | Testing team | | | | | | | ■ | ■ | |
| | | | | | | | | ■ | ■ | |
| Integration testing | Testing team | | | | | | | | ■ | |
| | | | | | | | | | ■ | |
| System testing | Testing team | | | | | | | | ■ | |
| | | | | | | | | | ■ | |
| Acceptance testing | Testing team | | | | | | | | ■ | |
| | | | | | | | | | ■ | |
| Presentation | Marketing | | | | | | | ■ | ■ | |
| | | | | | | | | ■ | ■ | |

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DEMO VIDEO

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Count 24 game

...

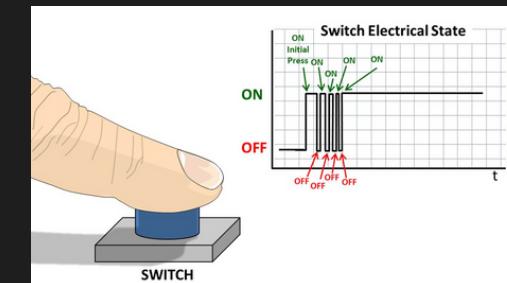
Problem and solution

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random Number

- random Number generator (RNG) : rand()
- SRAND(time(0)) ➔ SRAND(++i)

Switch Bouncing



soundtrack problem



Problem and solution

p

SOUNDTRACK PROBLEM

24



Soundtrack can play only once per game loop #5

[Open](#) pichayakorn opened this issue 2 days ago · 0 comments

pichayakorn commented 2 days ago · edited

30f3772

s08_speaker_conf.c

```
...
LL_TIM_ClearFlag_UPDATE(TIM2);
LL_TIM_EnableIT_UPDATE(TIM2);

/* Interrupt Configure */
NVIC_SetPriority(TIM2 IRQn, 3);
NVIC_EnableIRQ(TIM2 IRQn);

NVIC_SetPriority(TIM4 IRQn, 4);
NVIC_EnableIRQ(TIM4 IRQn);
LL_TIM_EnableIT_CC1(TIM4);

/* Start Output Compare in PWM Mode */
//LL_TIM_CC_EnableChannel(TIM4, LL_TIM_CHANNEL_CH1);
//LL_TIM_EnableCounter(TIM4);

//LL_TIM_EnableCounter(TIM2);
}

void TIM2_IRQHandler(void) {
    if (LL_TIM_IsActiveFlag_CC1(TIM2) == SET) {
        LL_TIM_ClearFlag_CC1(TIM2);
        if (cur != sizeof(sheetNote)/sizeof(sheetNote[0]) - 1) {
            UPDATE_Keynote(sheetNote[++cur]);
        } else {
            LL_TIM_OC_SetCompareCH1(TIM4, 0); // 0% duty
            RESET_SOUNDTRACK();
    }
}
```

Owner Tip ...

Assignees pichayakorn

Labels bug

Projects Coding In progress

Milestone No milestone

Linked pull requests Successfully merging a pull request may close this issue. None yet

Notifications Unsubscribe Customize

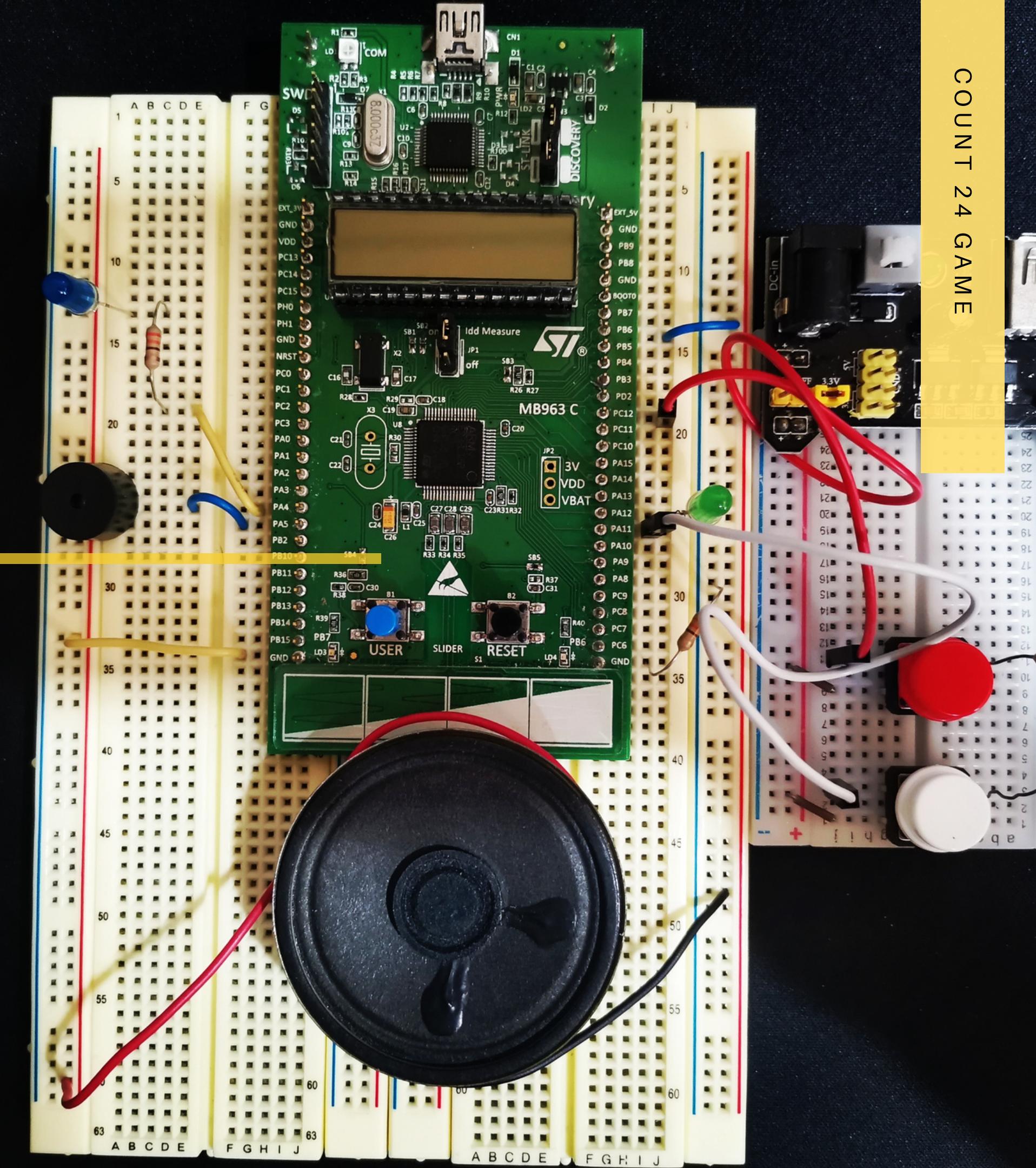
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Conclusion

Conclusion and Recommendation

เรียนรู้พื้นฐานและนำไปประยุกต์ใช้งาน

8





Thank you