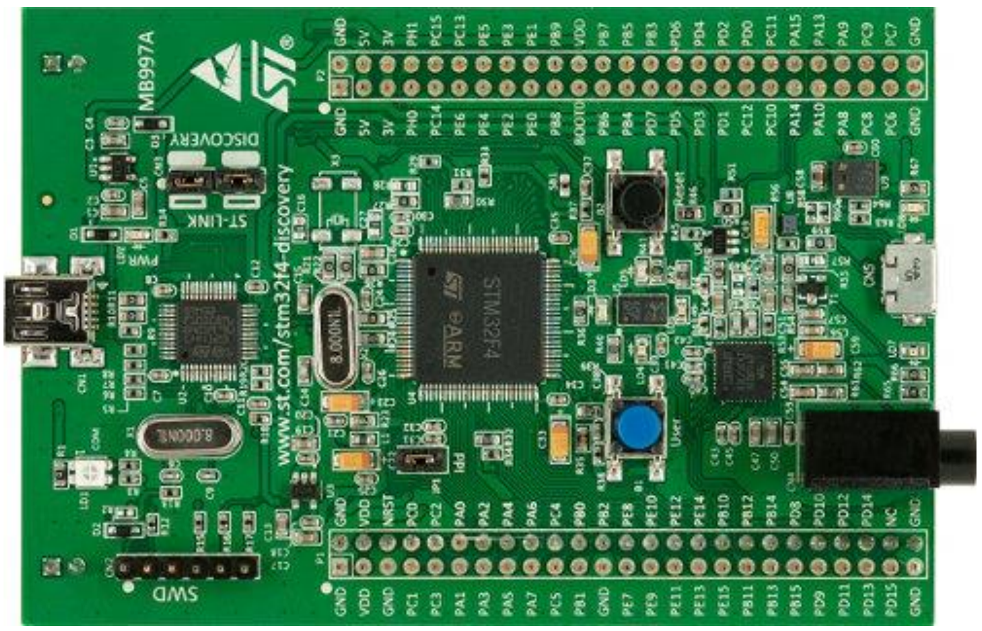
Integrating STM32F4xx Standard Peripheral Library with MikroC Pro for ARM

STM32F4xx series micros are far more advanced than anything else similar in the market. Apart from being fast 32-bit MCUs, STM32F4s have rich hardware peripheral support with DSP engine bonus. In terms of capabilities versus price tag, STM32F4s are all-square-winners. In recent times there's a surge in the STM32 user community. STM32 Discovery boards are proliferating like never before. In several occasions recently, I received tangible amounts of queries from readers regarding integration of STM32F4xx Standard Peripheral Library (SPL) with MikroC Pro for ARM and so even though it is not one of my mainstream posts on STM32 ARMs, I felt that I should address this topic. Previously I showed how to port STM32F1xx SPL for STM32F1xx series devices with MikroC. This post will not be different from the former one – only minute changes. I suggest readers to read the earlier post first before reading this one.



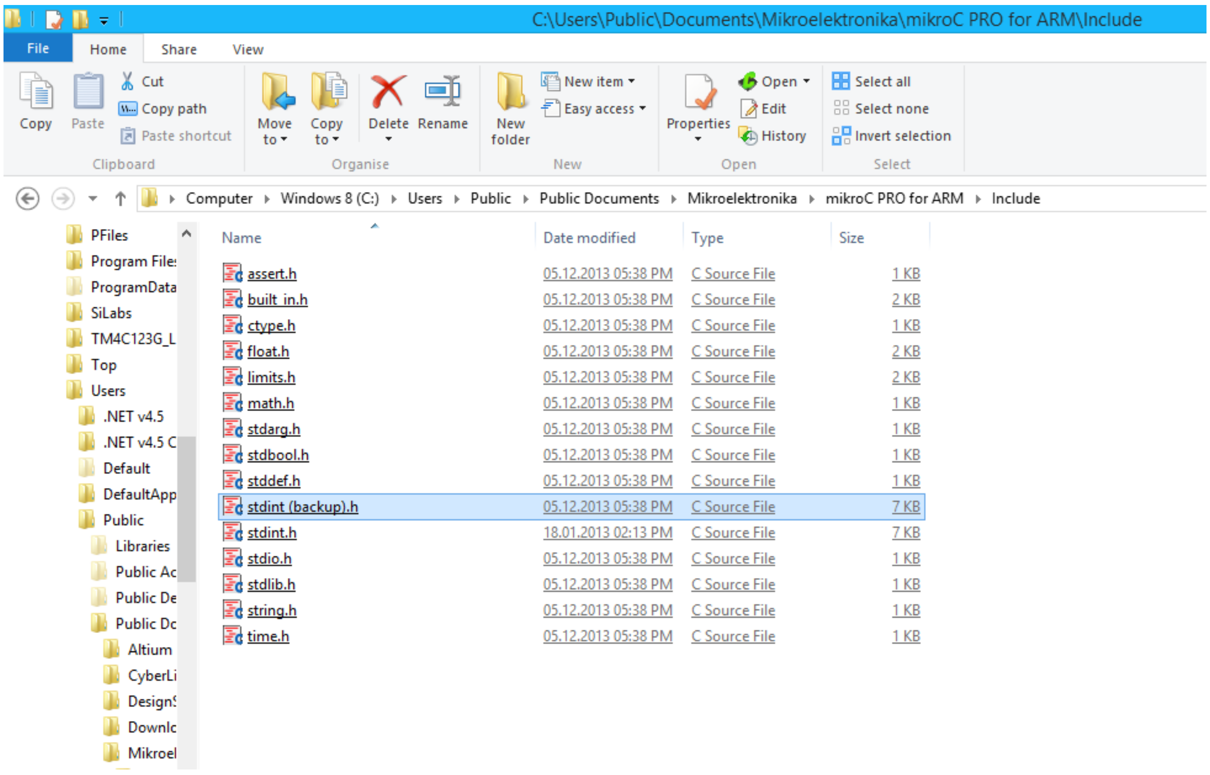
At present MikroC compiler is one of the few compilers that hasn't yet officially provided any support for SPL integration. Hopefully they will add this support in the future but the way MikroC addresses a solution is different from other compilers. MikroC has a really awesome IDE and a rich library base support while SPL gives its user more control over on a chip's hardware. Like I said before together these become a doubled-edge sword.

Tools Needed

Firstly you'll need MikroC Pro for ARM. The compiler has a demo version that provides an 8k code limit, enough for first-hand ARM experience. You'll need a STM32F4xx board. I used a STM32F407VG Discovery. This board from ST Microelectronics (https://www.st.com) is somewhat the flagship Discovery board of the STM32F4 series and it is very popular. Finally you'll need STM32F4xxx SPL which I included in my example. The files in them are modified to work with MikroC environment.

Things to do

Firstly we need to prepare our MikroC PRO for ARM compiler for linking the SPL. I'm assuming that the compiler is preinstalled. First go to the compiler's installation folder and locate the *include* folder. In my case, it is: *C:\Users\Public\Documents\Mikroelektronika\mikroC PRO for ARM\Include*. In this folder, there's a file named *stdint.h.* Rename it to *stdint (backup).h* and copy the new *stdint.h* file from the supplied folder to this location. If you already did so during my previous post or upgraded to MikroC Pro for ARM version 4.15 (the latest release at the time of this writing), then skip this part.

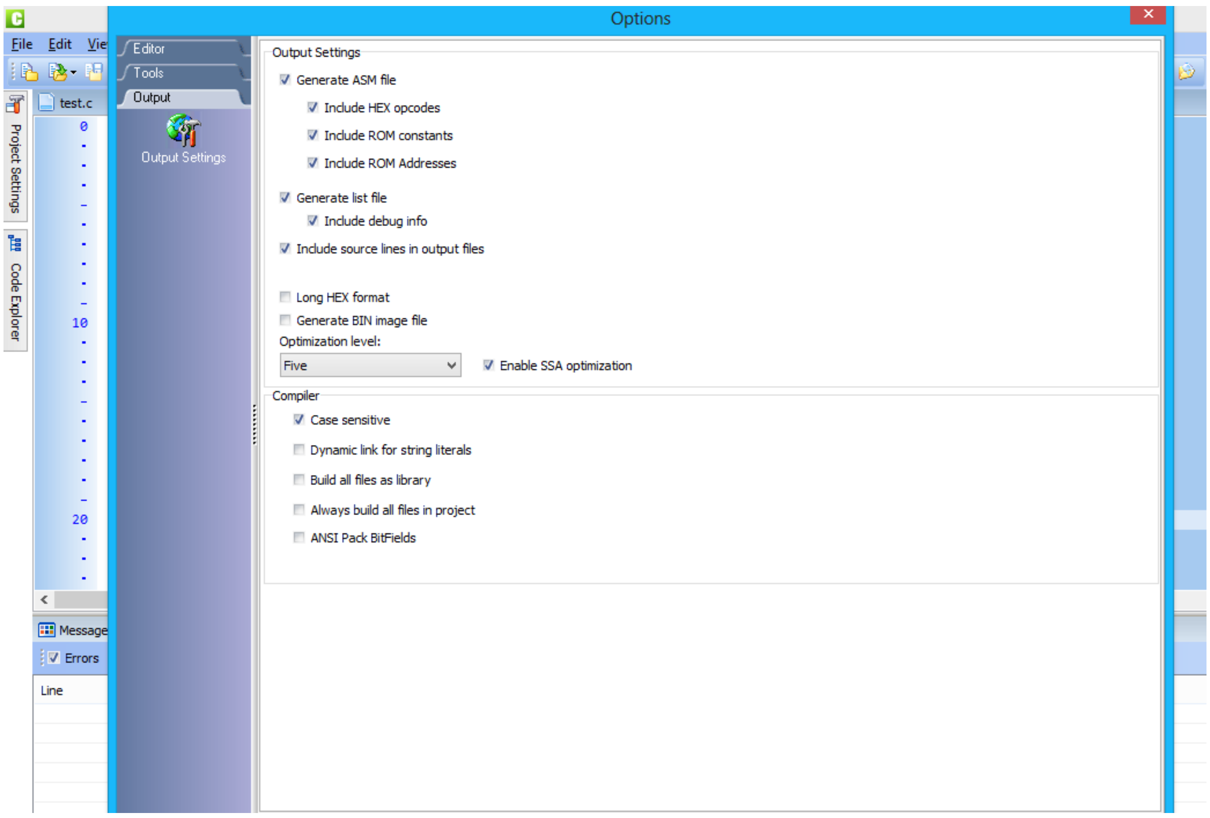


Name	Date modified	Type	Size
assert.h	05.12.2013 05:38 PM	C Source File	1 KB
built_in.h	05.12.2013 05:38 PM	C Source File	2 KB
ctype.h	05.12.2013 05:38 PM	C Source File	1 KB
float.h	05.12.2013 05:38 PM	C Source File	2 KB
limits.h	05.12.2013 05:38 PM	C Source File	2 KB
math.h	05.12.2013 05:38 PM	C Source File	1 KB
stdarg.h	05.12.2013 05:38 PM	C Source File	1 KB
stdbool.h	05.12.2013 05:38 PM	C Source File	1 KB
stddef.h	05.12.2013 05:38 PM	C Source File	1 KB
stdint (backup).h	05.12.2013 05:38 PM	C Source File	7 KB
stdint.h	18.01.2013 02:13 PM	C Source File	7 KB
stdio.h	05.12.2013 05:38 PM	C Source File	1 KB
stdlib.h	05.12.2013 05:38 PM	C Source File	1 KB
string.h	05.12.2013 05:38 PM	C Source File	1 KB
time.h	05.12.2013 05:38 PM	C Source File	1 KB

Next we have to change some options of the compiler. Launch the compiler and the follow as shown below:

Tools >> **Options** >> **Output Settings**

Check *Case sensitive*. Apply and close this window. Again skip this part if you already did so earlier.



Options

Output Settings

- ✓ Generate ASM file
  - ✓ Include HEX opcodes
  - ✓ Include ROM constants
  - ✓ Include ROM Addresses
- ✓ Generate list file
  - ✓ Include debug info
- ✓ Include source lines in output files
- ☐ Long HEX format
- ☐ Generate BIN image file

Optimization level: Five ✓ Enable SSA optimization

Compiler

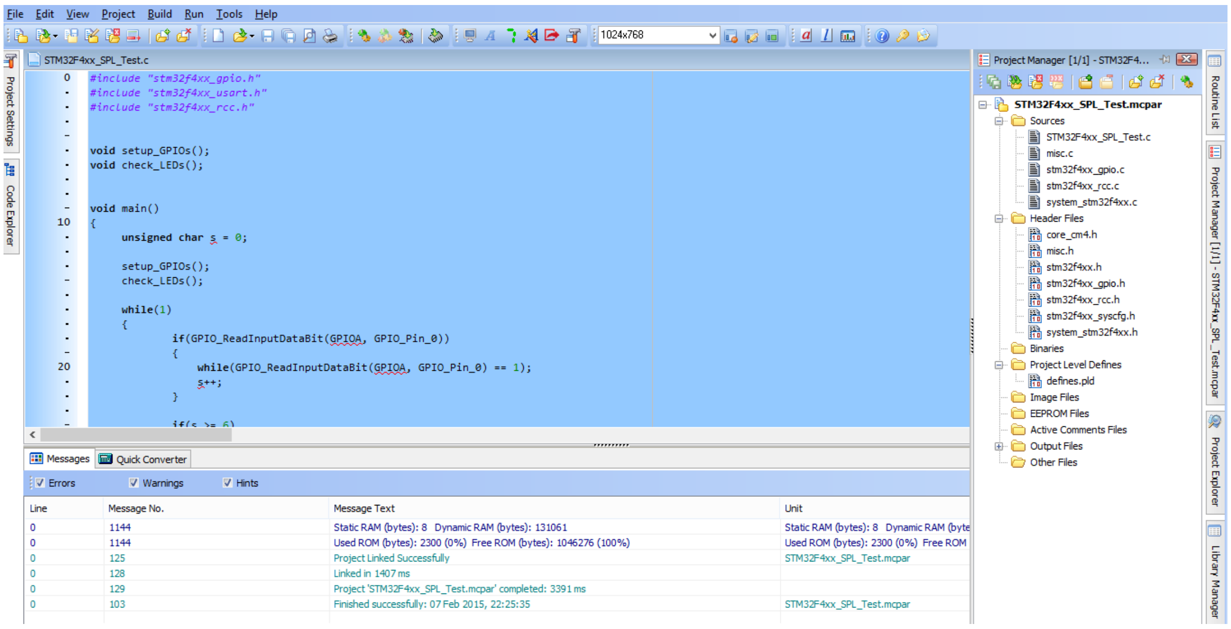
- ✓ Case sensitive
- ☐ Dynamic link for string literals
- ☐ Build all files as library
- ☐ Always build all files in project
- ☐ ANSI Pack BitFields

Be cautious from now on with regards to naming and letter cases because the compiler is now sensitive to this or otherwise you'll be doomed in the abyss of programming misfortune. Just a simple but useful tip - Compile your code few often after some edits or modifications. This will greatly help you to debug tiny mistakes in a small frame of coding window.

Finally keep the SPL in secured location. Whenever you code a new project with the SPL, copy it from this location and use it with the project. This will make sure that the original SPL copy is not accidentally modified.

Coding with SPL

The example code is just another blinking code example as it will suffice. I'm not going to tell you how to create a new project in MikroC. I presume it is known to you. Create a new project and using the ***Project Manager*** add all the source and header files from the SPL folder. You can simply add the header and source files of only the required peripherals or you can add all if you are not sure which one stand for which. The former approach takes less compilation time than the latter. Additionally add the ***defines.pld*** Project Level Definition file. Now you are ready to code with the SPL.



```
#include "stm32f4xx_gpio.h"
#include "stm32f4xx_usart.h"
#include "stm32f4xx_rcc.h"


void setup_GPIOs();
void check_LEDs();


void main()
{
    unsigned char s = 0;

    setup_GPIOs();
    check_LEDs();

    while(1)
    {
            if(GPIO_ReadInputDataBit(GPIOA, GPIO_Pin_0))
            {
               while(GPIO_ReadInputDataBit(GPIOA, GPIO_Pin_0) == 1);
               s++;
            }

            if(s >= 6)
```

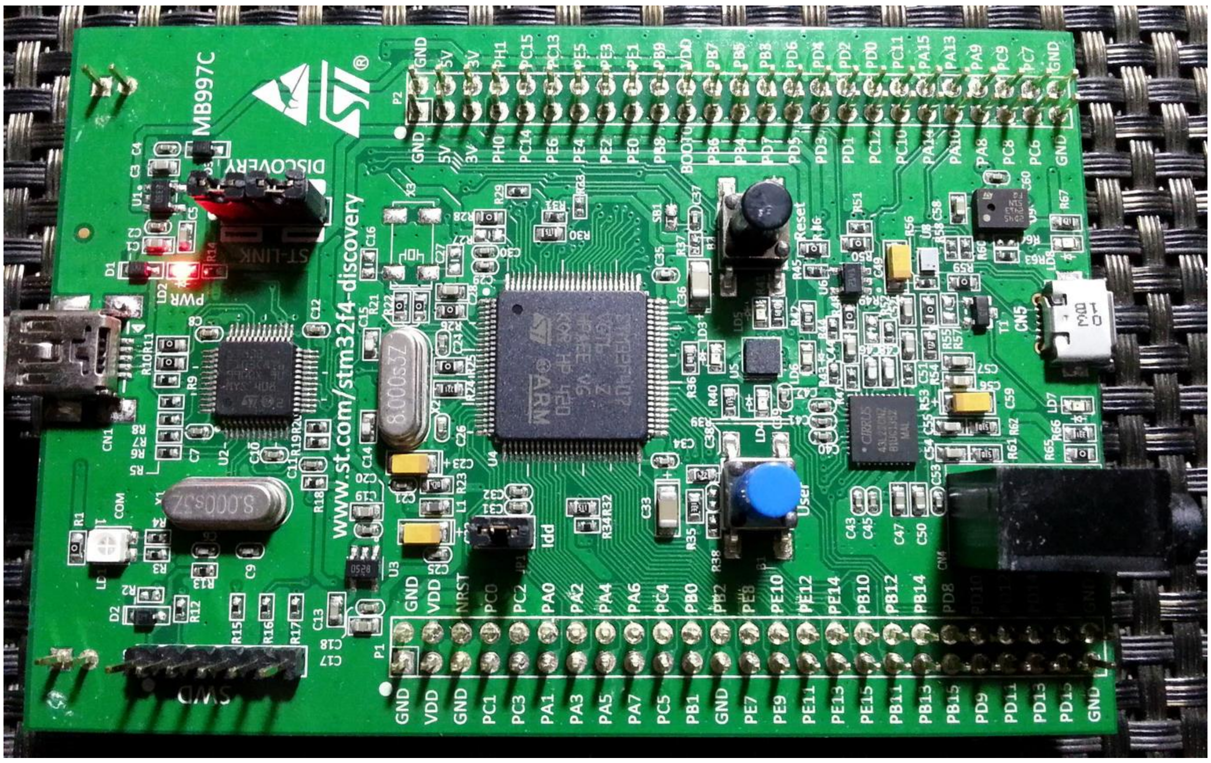
Line	Message No.	Message Text	Unit
0	1144	Static RAM (bytes): 8 Dynamic RAM (bytes): 131061	Static RAM (bytes): 8 Dynamic RAM (byte
0	1144	Used ROM (bytes): 2300 (0%) Free ROM (bytes): 1046276 (100%)	Used ROM (bytes): 2300 (0%) Free ROM
0	125	Project Linked Successfully	STM32F4xx_SPL_Test.mcpar
0	128	Linked in 1407 ms	
0	129	Project 'STM32F4xx_SPL_Test.mcpar' completed: 3391 ms	
0	103	Finished successfully: 07 Feb 2015, 22:25:35	STM32F4xx_SPL_Test.mcpar

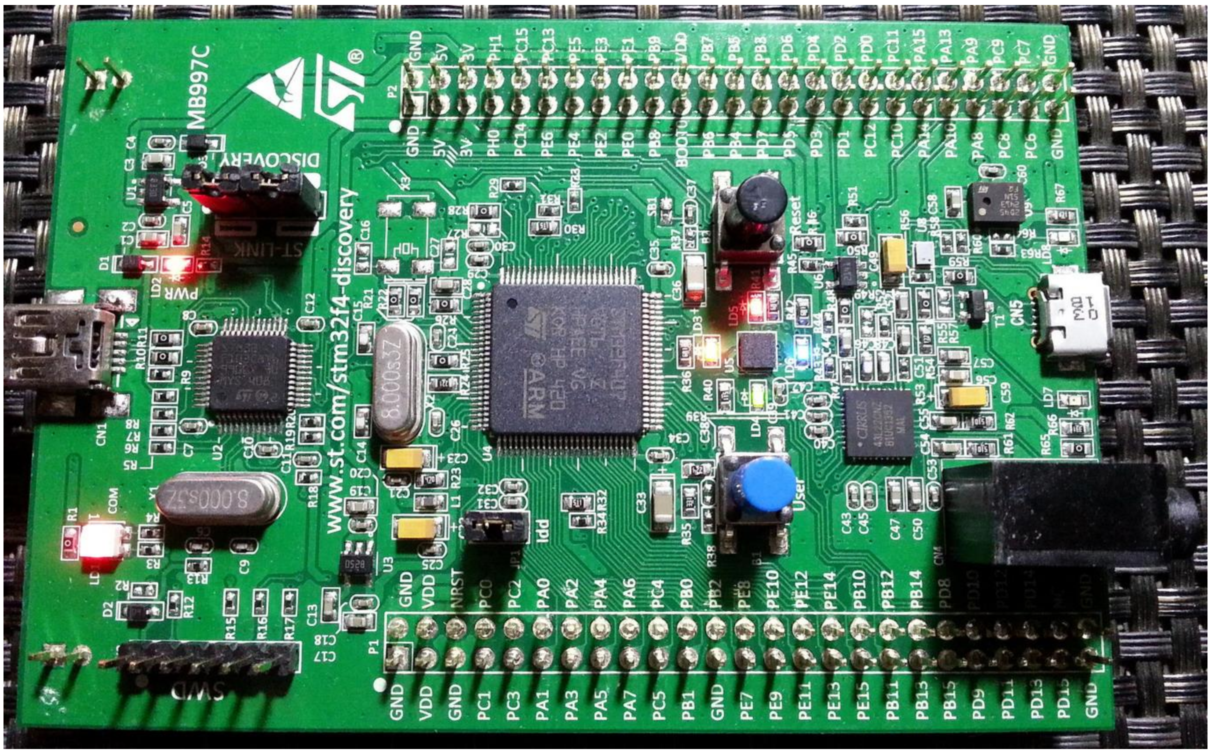
Please be noted that since the SPL is not yet officially integrated by MikroElektronika, you'll notice red error markers under various parts of a code with SPL. This is not unusual and not an error. So no worries.

Code:

```
#include "stm32f4xx_gpio.h"
#include "stm32f4xx_usart.h"
#include "stm32f4xx_rcc.h"

void setup_GPIOs();
void check_LEDs();

void main()
{
    unsigned char s = 0;

    setup_GPIOs();
    check_LEDs();

    while(1)
    {
           if(GPIO_ReadInputDataBit(GPIOA, GPIO_Pin_0))
           {
              while(GPIO_ReadInputDataBit(GPIOA, GPIO_Pin_0) == 1);
              s++;
           }

           if(s >= 6)
           {
              s = 0;
           }
```

```
            switch(s)
            {
                case 1:
                {
                     GPIO_SetBits(GPIOD, GPIO_Pin_12);
                     break;
                }
                case 2:
                {
                     GPIO_SetBits(GPIOD, GPIO_Pin_13);
                     break;
                }
                case 3:
                {
                     GPIO_SetBits(GPIOD, GPIO_Pin_14);
                     break;
                }
                case 4:
                {
                     GPIO_SetBits(GPIOD, GPIO_Pin_15);
                     break;
                }
                case 5:
                {
                     GPIO_SetBits(GPIOD, GPIO_Pin_12);
                     GPIO_SetBits(GPIOD, GPIO_Pin_13);
                     GPIO_SetBits(GPIOD, GPIO_Pin_14);
                     GPIO_SetBits(GPIOD, GPIO_Pin_15);
                     break;
                }
                default:
                {
                    break;
                }
            }
            Delay_ms(90);

            GPIO_ResetBits(GPIOD, GPIO_Pin_12);
            GPIO_ResetBits(GPIOD, GPIO_Pin_13);
            GPIO_ResetBits(GPIOD, GPIO_Pin_14);
            GPIO_ResetBits(GPIOD, GPIO_Pin_15);
            Delay_ms(90);
     }
}

void setup_GPIOs()
{
  GPIO_InitTypeDef GPIO_InitStructure;

  RCC_AHB1PeriphClockCmd(RCC_AHB1Periph_GPIOA, ENABLE);
  RCC_AHB1PeriphClockCmd(RCC_AHB1Periph_GPIOD, ENABLE);

  GPIO_InitStructure.GPIO_Pin = GPIO_Pin_0;
  GPIO_InitStructure.GPIO_Mode = GPIO_Mode_IN;
  GPIO_InitStructure.GPIO_Speed = GPIO_Speed_50MHz;
  GPIO_InitStructure.GPIO_OType = GPIO_OType_PP;
  GPIO_InitStructure.GPIO_PuPd = GPIO_PuPd_DOWN;
  GPIO_Init(GPIOA, &GPIO_InitStructure);

  GPIO_InitStructure.GPIO_Pin = (GPIO_Pin_12 | GPIO_Pin_13 | GPIO_Pin_14 | GPIO_Pin_15);
  GPIO_InitStructure.GPIO_Mode = GPIO_Mode_OUT;
  GPIO_InitStructure.GPIO_Speed = GPIO_Speed_2MHz;
  GPIO_InitStructure.GPIO_OType = GPIO_OType_PP;
  GPIO_InitStructure.GPIO_PuPd = GPIO_PuPd_NOPULL;
  GPIO_Init(GPIOD, &GPIO_InitStructure);
}

void check_LEDs()
{
   GPIO_SetBits(GPIOD, (GPIO_Pin_12 | GPIO_Pin_13 | GPIO_Pin_14 | GPIO_Pin_15));
   Delay_ms(900);
   GPIO_ResetBits(GPIOD, (GPIO_Pin_12 | GPIO_Pin_13 | GPIO_Pin_14 | GPIO_Pin_15));
}
```





Demo video link: https://www.youtube.com/watch?v=ngk-4Lm11yU.

Personally I haven't made myself dependent on SPL so far and I believe in raw level coding-learning. SPL allows textbook entry in STM32 arena. No wonder it makes coding easy but the adverse effect of it in my eyes is the fact that its users will spend less time with reference manuals and datasheet. This in turn will affect them in acquiring solid learning of internal hardware peripherals and their working principles. If SPL is to make life easy this way then why not use MikroC libraries. Those are even more easy to use. Sometimes libraries are lifesavers while sometimes they are curse. Sometimes you would not like to reinvent the "wheel" but you would certainly like to make a vehicle with it and that my friend worth more than anything else. At this point I don't want to debate further in this matter. I leave this choice to users.

Happy coding.

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