Link to My Github

Data Type	Number of Bits	Range	Description
uint8_t	8	0, 1, ..., 255	Unsigned 8-bit integer
int8_t	8	-128 .. 127	Signed
uint16_t	16	0 .. 65,535	Unsigned
int16_t	16	-32,768 .. 32,767	Signed
float	32	-3.4e+38, ..., 3.4e+38	Single-precision floating-point
void	X	x	X

1-

GPIO Library

A function definition means the specification of the function name, the return type, the parameters and the complete function body - the actual function. So it is the complete description of the function.

A function declaration gives information to the compiler about a function name and how to call the function. A compiler reads and translates the source code from top to bottom. If he comes across a word – for example a function name - that he is not yet familiar with at one point in the source text, an error message will be given. It is therefore necessary to make functions known before they are used.

```
uint8_t GPIO_read(volatile uint8_t *reg_name, uint8_t pin_num)

{

        if (bit_is_clear(PIND,pin_num))

        {

                return 1;// if pressed it returns the value 1

         }

        else

        {

         return 0; // if the button is not pressed it returns the value 0

        }

}
```

```
                                gpio.c
                    ***********************************************/

/* Includes ------------------------------------------------------------
*/
#include "gpio.h"


/* Function definitions -----------------------------------------------
*/
void GPIO_config_output(volatile uint8_t *reg_name, uint8_t pin_num)
{
    *reg_name = *reg_name | (1<<pin_num);
}
```

```
/*-------------------------------------------------------------------
*/
/* GPIO_config_input_nopull */

/*-------------------------------------------------------------------
*/
void GPIO_config_input_pullup(volatile uint8_t *reg_name, uint8_t
pin_num)
{
    *reg_name = *reg_name & ~(1<<pin_num);  // Data Direction Register
    *reg_name++;                    // Change pointer to Data
Register(if we increment the pointer then the pointer point the PORT
register)
    *reg_name = *reg_name | (1<<pin_num);   // Data Register
}

void GPIO_config_input_nopull(volatile uint8_t *reg_name, uint8_t
pin_num)
{
  *reg_name = *reg_name & ~(1<<pin_num);  // Data Direction Register
  *reg_name++;                    // Change pointer to Data
Register(if we increment the pointer then the pointer point the PORT
register)
  *reg_name = *reg_name & ~ (1<<pin_num);   // Data Register
}
/*-------------------------------------------------------------------
*/
void GPIO_write_low(volatile uint8_t *reg_name, uint8_t pin_num)
{
    *reg_name = *reg_name & ~(1<<pin_num);// Clear bit (and not)
}

/*-------------------------------------------------------------------
*/
/* GPIO_write_high */
void GPIO_write_high (volatile uint8_t *reg_name, uint8_t pin_num)
{
      *reg_name = *reg_name | (1<<pin_num);// Set bit
}

/*-------------------------------------------------------------------
*/
/* GPIO_toggle */

void GPIO_toggle (volatile uint8_t *reg_name, uint8_t pin_num)
{
 *reg_name = *reg_name ^ (1<<pin_num);//Toggle bit(XOR)
}
/*-------------------------------------------------------------------
*/
/* GPIO_read */
```

```
uint8_t GPIO_read(volatile uint8_t *reg_name, uint8_t pin_num)
{


       if (bit_is_clear(PIND,pin_num))
      {

          return 1;// if pressed it returns the value 1
      }
      else
      {
            return 0; // if the button is not pressed it returns the
value 0
      }
}
```

```
#ifndef GPIO_H
#define GPIO_H

/************************************************************************
**
 *
 * GPIO library for AVR-GCC.
 * ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2
 *
 * Copyright (c) 2019-2020 Tomas Fryza
 * Dept. of Radio Electronics, Brno University of Technology, Czechia
 * This work is licensed under the terms of the MIT license.
 *

************************************************************************
/

/**
 * @file  gpio.h
```

```
 * @brief GPIO library for AVR-GCC.
 *
 * @details
 * The library contains functions for controlling AVRs' gpio pin(s).
 *
 * @note
 * Based on AVR Libc Reference Manual. Tested on ATmega328P (Arduino
Uno),
 * 16 MHz, AVR 8-bit Toolchain 3.6.2.
 *
 * @copyright (c) 2019-2020 Tomas Fryza
 * Dept. of Radio Electronics, Brno University of Technology, Czechia
 * This work is licensed under the terms of the MIT license.
 */

/* Includes ------------------------------------------------------------
*/
#include <avr/io.h>

/* Function prototypes -------------------------------------------------
*/
/**
 * @brief Configure one output pin in Data Direction Register.
 * @param reg_name - Address of Data Direction Register, such as
&DDRA,
 *                   &DDRB, ...
 * @param pin_num - Pin designation in the interval 0 to 7
 */

void GPIO_config_output(volatile uint8_t *reg_name, uint8_t pin_num);

/* GPIO_config_input_nopull */
void GPIO_config_input_nopull(volatile uint8_t *reg_name, uint8_t
pin_num);


void GPIO_config_input_pullup(volatile uint8_t *reg_name, uint8_t
pin_num);

void GPIO_write_low(volatile uint8_t *reg_name, uint8_t pin_num);

/* GPIO_write_high */
void GPIO_write_high (volatile uint8_t *reg_name, uint8_t pin_num);



/* GPIO_toggle */

void GPIO_toggle (volatile uint8_t *reg_name, uint8_t pin_num);

/* GPIO_READ */
```

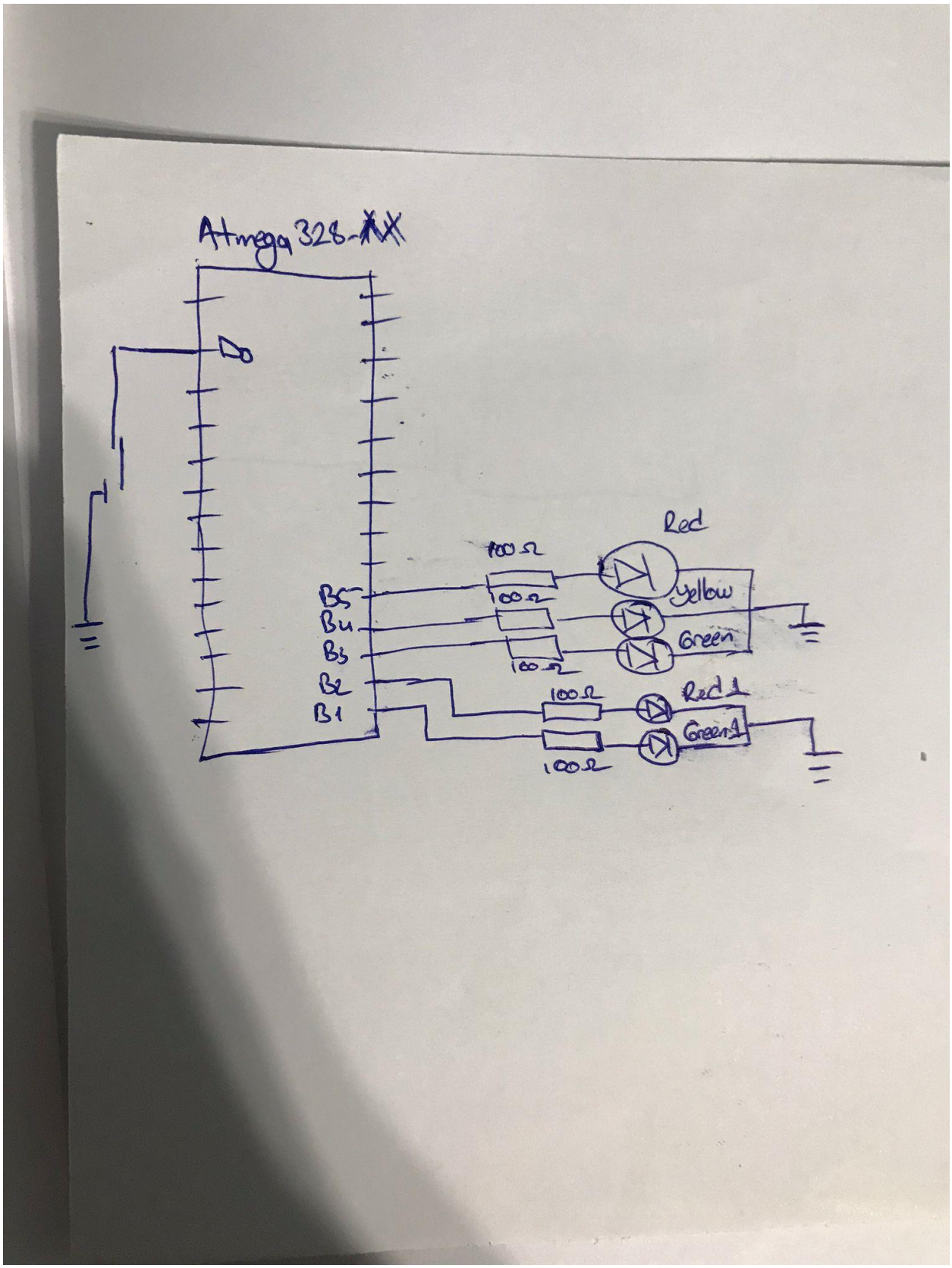
```
uint8_t GPIO_read(volatile uint8_t *reg_name, uint8_t pin_num);

#endif
```

main.c

```
*************************************************/
/* Defines -----------------------------------------------------------
*/
#define LED_GREEN   PB5     // AVR pin where green LED is connected
#define LED_RED   PC0       // AVR pin where red LED is connected
#define BIN PD0
#define BLINK_DELAY 500
#ifndef F_CPU
#define F_CPU 16000000      // CPU frequency in Hz required for delay
#endif

/* Includes ----------------------------------------------------------
*/
#include <util/delay.h>     // Functions for busy-wait delay loops
#include <avr/io.h>         // AVR device-specific IO definitions
#include "gpio.h"           // GPIO library for AVR-GCC
uint8_t perform=0;

/* Function definitions ----------------------------------------------
*/
/**
 * Main function where the program execution begins. Toggle two LEDs
 * when a push button is pressed. Functions from user-defined GPIO
 * library is used instead of low-level logic operations.
 */
```

```
int main(void)
{
    /* GREEN LED */
    GPIO_config_output(&DDRB, LED_GREEN);
    GPIO_write_high(&PORTB, LED_GREEN); // Turn on Led, because
active-high Led


    /* second LED */
       GPIO_config_output(&DDRC, LED_RED);
       GPIO_write_high(&PORTC, LED_RED); // Turn off Led, because
active-low Led


    /* push button */

      GPIO_config_input_pullup(&DDRD,BIN);



    // Infinite loop

    while (1)
    {
        // Pause several milliseconds
        _delay_ms(BLINK_DELAY);

                        perform=GPIO_read(&PORTD,BIN); // assign the
function to the "perform"

                if (perform==1)
                {
                      GPIO_toggle(&PORTB,LED_GREEN);
                      GPIO_toggle(&PORTC,LED_RED);

                }

      }
    // Will never reach this
    return 0;
}
```

3-


Atmega328-XX
100Ω
100Ω
100Ω
100Ω
100Ω
Red
yellow
Green
Red 1
Green 1
B5
B4
B3
B2
B1