

Lab 8: Masauso Lungu

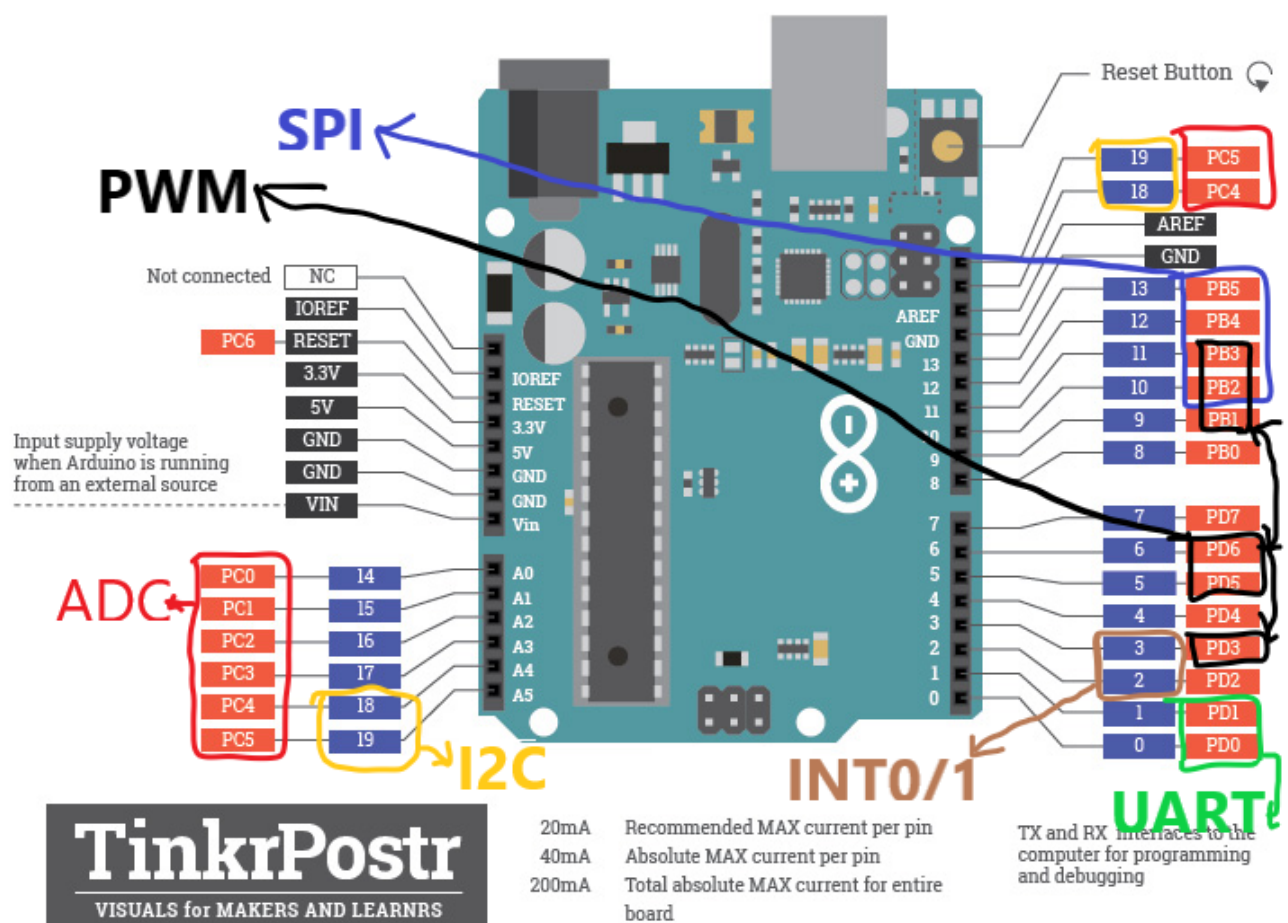
Link to my GitHub repository:

<https://github.com/Masauso-L/Digital-electronis-2/tree/main/Labs/08-i2c>

Arduino Uno pinout

1. In the picture of the Arduino Uno board, mark the pins that can be used for the following functions:

- PWM generators from Timer0, Timer1, Timer2 => Arduino pin 3, 5, 6, 9, 10, 11
- analog channels for ADC => ADC are connected to PC0 to PC5 (arduino pins A0 to A5)
- UART pins => PD0 and PD1 (arduino pin 0 and 1)
- I2C pins => PC4 and PC5 (Arduino pin A4[SQA] and A5[SCL])
- SPI pins => PB2 to PB5 (arduino pin 10 to 13)
- external interrupt pins INT0, INT1 = INT0=>PD2 and INT1=>PD3 (Arduino pin 2 and 3)



I2C

1. Code listing of Timer1 overflow interrupt service routine for scanning I2C devices and rendering a clear table on the UART. Always use syntax highlighting and meaningful comments:

```

/*****
 * Function: Timer/Counter1 overflow interrupt
 * Purpose:  Update Finite State Machine and test I2C slave addresses
 *           between 8 and 119.
 *****/
ISR(TIMER1_OVF_vect)
{
    static state_t state = STATE_IDLE; // Current state of the FSM
    static uint8_t addr = 7;           // I2C slave address
    uint8_t result = 1;                // ACK result from the bus
    char uart_string[] = "00"; // String for converting numbers by itoa()

    // FSM
    switch (state)
    {
        // Increment I2C slave address
        case STATE_IDLE:
            addr++;
            // If slave address is between 8 and 119 then move to SEND state
            if (addr > 7 && addr < 120)
            {
                state = STATE_SEND;
            }
            if(addr > 120)
            {
                uart_puts_P("\r\nScan I2C-bus for devices: \r\n");
                addr = 0;
            }

            break;

        // Transmit I2C slave address and get result
        case STATE_SEND:
            // I2C address frame:
            // +-----+-----+
            // |          from Master          | from Slave |
            // +-----+-----+
            // | 7  6  5  4  3  2  1  0 |   ACK   |
            // |a6 a5 a4 a3 a2 a1 a0 R/W|  result  |
            // +-----+-----+
            result = twi_start((addr<<1) + TWI_WRITE);
            twi_stop();
            /* Test result from I2C bus. If it is 0 then move to ACK state,
             * otherwise move to IDLE */
            if (result == 0)
            {
                state = STATE_ACK;
            }
            else
            {
                state = STATE_IDLE;
            }
    }
}

```

```

        break;

// A module connected to the bus was found
case STATE_ACK:
    // Send info about active I2C slave to UART and move to IDLE

    uart_puts("I2C device was found at address: ");
    itoa(addr, uart_string, 10);
    uart_puts(uart_string);
    uart_puts("\r\n");


    state = STATE_IDLE;

    break;

// If something unexpected happens then move to IDLE
default:
    state = STATE_IDLE;
    break;
}
}

```

2. (Hand-drawn) picture of I2C signals when reading checksum (only 1 byte) from DHT12 sensor. Indicate which specific moments control the data line master and which slave.

 your figure

Meteo station

Consider an application for temperature and humidity measurement and display. Use combine sensor DHT12, real time clock DS3231, LCD, and one LED. Application display time in hours:minutes:seconds at LCD, measures both temperature and humidity values once per minut, display both values on LCD, and when the temperature is too high, the LED starts blinking.

1. FSM state diagram picture of meteo station. The image can be drawn on a computer or by hand. Concise name of individual states and describe the transitions between them.

