|  |
| --- |
|  |
| **Digit** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **DP** |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| 3 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| 4 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 5 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 6 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

Rozdíl mezi displayi se společnou katodou a anodou je v řízení, kdy v případě zapojení se společnou anodou je display aktivní v případě že je na jeho výstup přivedena úroveň low, u zapojení se společnou katodou je to naopak.

**Segment.c**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*

\* Seven-segment display library for AVR-GCC.

\* ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2

\*

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/\* Includes ----------------------------------------------------------\*/

#define *F\_CPU* 16000000

#include <util/delay.h>

#include "gpio.h"

#include "segment.h"

/\* Function definitions ----------------------------------------------\*/

void SEG\_init(void)

{

/\* Configuration of SSD signals \*/

GPIO\_config\_output(&DDRD, SEGMENT\_LATCH);

GPIO\_config\_output(&DDRD, SEGMENT\_CLK);

GPIO\_config\_output(&DDRB, SEGMENT\_DATA);

}

/\* Variables ---------------------------------------------------------\*/

// Active-low digits 0 to 9

*uint8\_t* segment\_value[] = {

// abcdefgDP

0b00000011, // Digit 0

0b10011111, // Digit 1

0b00100101, // Digit 2

0b00001101, // Digit 3

0b10011001, // Digit 4

0b01001001, // Digit 5

0b01000001, // Digit 6

0b00011111, // Digit 7

0b00000001, // Digit 8

0b00001001}; // Digit 9

// Active-high position 0 to 3

*uint8\_t* segment\_position[] = {

// p3p2p1p0....

0b00010000, // Position 0

0b00100000, // Position 1

0b01000000, // Position 2

0b10000000}; // Position 3

/\*--------------------------------------------------------------------\*/

void SEG\_update\_shift\_regs(*uint8\_t* segments, *uint8\_t* position)

{

*uint8\_t* bit\_number;

segments = segment\_value[segments]; // 0, 1, ..., 9

position = segment\_position[position];

// Pull LATCH, CLK, and DATA low

GPIO\_write\_low(&PORTD,SEGMENT\_LATCH);

GPIO\_write\_low(&PORTD,SEGMENT\_CLK);

GPIO\_write\_low(&PORTB,SEGMENT\_DATA);

// Wait 1 us

*\_delay\_us*(1);

// Loop through the 1st byte (segments)

// a b c d e f g DP (active low values)

for (bit\_number = 0; bit\_number < 8; bit\_number++)

{

// Output DATA value (bit 0 of "segments")

if(segments & 1)

{

GPIO\_write\_high(&PORTB,SEGMENT\_DATA);

}else

{

GPIO\_write\_low(&PORTB,SEGMENT\_DATA);

}

// Wait 1 us

*\_delay\_us*(1);

// Pull CLK high

GPIO\_write\_high(&PORTD,SEGMENT\_CLK);

// Wait 1 us

*\_delay\_us*(1);

// Pull CLK low

GPIO\_write\_low(&PORTD,SEGMENT\_CLK);

// Shift "segments"

segments = segments >> 1;

}

// Loop through the 2nd byte (position)

// p3 p2 p1 p0 . . . . (active high values)

for (bit\_number = 0; bit\_number < 8; bit\_number++)

{

// Output DATA value (bit 0 of "position")

if(position & 1)

{

GPIO\_write\_high(&PORTB,SEGMENT\_DATA);

}else

{

GPIO\_write\_low(&PORTB,SEGMENT\_DATA);

}

// Wait 1 us

*\_delay\_us*(1);

// Pull CLK high

GPIO\_write\_high(&PORTD,SEGMENT\_CLK);

// Wait 1 us

*\_delay\_us*(1);

// Pull CLK low

GPIO\_write\_low(&PORTD,SEGMENT\_CLK);

// Shift "position"

position = position >> 1;

}

// Pull LATCH high

GPIO\_write\_high(&PORTD,SEGMENT\_LATCH);

// Wait 1 us

*\_delay\_us*(1);

}

/\*--------------------------------------------------------------------\*/

/\* SEG\_clear \*/

/\*--------------------------------------------------------------------\*/

/\* SEG\_clk\_2us \*/

**Main.c**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*

\* Decimal counter with 7-segment output.

\* ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2

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/\* Includes ----------------------------------------------------------\*/

#include <avr/io.h> // AVR device-specific IO definitions

#include <avr/interrupt.h> // Interrupts standard C library for AVR-GCC

#include "timer.h" // Timer library for AVR-GCC

#include "segment.h" // Seven-segment display library for AVR-GCC

/\* Function definitions ----------------------------------------------\*/

/\*\*

\* Main function where the program execution begins. Display decimal

\* counter values on SSD (Seven-segment display) when 16-bit

\* Timer/Counter1 overflows.

\*/

*uint8\_t* singles=0;

*uint8\_t* deciamals=0;

int main(void)

{

// Configure SSD signals

SEG\_init();

/\* Configure 16-bit Timer/Counter1

\* Set prescaler and enable overflow interrupt \*/

TIM1\_overflow\_262ms();

TIM1\_overflow\_interrupt\_enable();

/\* Configure 8-bit Timer/Counter0

\* Set prescaler and enable overflow interrupt \*/

TIM0\_overflow\_4m();

TIM0\_overflow\_interrupt\_enable();

// Enables interrupts by setting the global interrupt mask

sei();

// Infinite loop

while(1)

{

/\* Empty loop. All subsequent operations are performed exclusively

\* inside interrupt service routines ISRs \*/

}

// Will never reach this

return 0;

}

/\* Interrupt service routines ----------------------------------------\*/

/\*\*

\* ISR starts when Timer/Counter1 overflows. Increment decimal counter

\* value and display it on SSD.

\*/

ISR(TIMER1\_OVF\_vect) // routine for counting upto 59 from 00

{

if(singles > 8)

{

if(deciamals<5)

{

deciamals++;

}

else

{

deciamals=0;

}

singles=0;

}

else

singles++;

}

ISR(TIMER0\_OVF\_vect) // routine for displaying numbers on 4 SSDs

{

static *uint8\_t* pos=0;

if(pos==0)

{

SEG\_update\_shift\_regs(singles, pos);

pos=1;

}else

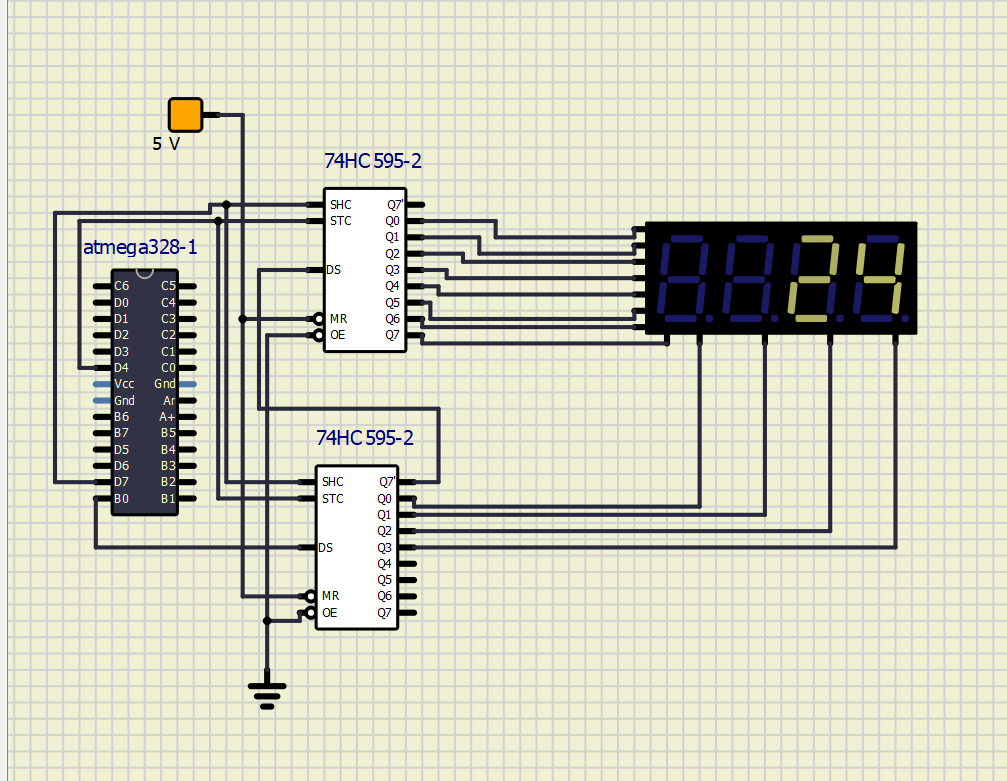
{

SEG\_update\_shift\_regs(deciamals, pos);

pos=0;

}

}



**Snake lookup table**

*uint8\_t* segment\_value[] = {

// Snake

0b11011111, // segment lower right

0b11101111, // segment lower

0b11110111, // segment lower left

0b11111011, // Segment upper left

0b01111111, // Segment upper

0b10111111 // Segment upper right

};

**Snake**

/\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*

\* Snake with 7-segment output.

\* ATmega328P (Arduino Uno), 16 MHz, AVR 8-bit Toolchain 3.6.2

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/\* Includes ----------------------------------------------------------\*/

#include <avr/io.h> // AVR device-specific IO definitions

#include <avr/interrupt.h> // Interrupts standard C library for AVR-GCC

#include "timer.h" // Timer library for AVR-GCC

#include "segment.h" // Seven-segment display library for AVR-GCC

/\* Function definitions ----------------------------------------------\*/

/\*\*

\* Main function where the program execution begins. Display decimal

\* counter values on SSD (Seven-segment display) when 16-bit

\* Timer/Counter1 overflows.

\*/

*uint8\_t* value=0;

int main(void)

{

// Configure SSD signals

SEG\_init();

/\* Configure 16-bit Timer/Counter1

\* Set prescaler and enable overflow interrupt \*/

TIM1\_overflow\_262ms();

TIM1\_overflow\_interrupt\_enable();

// Enables interrupts by setting the global interrupt mask

sei();

// Infinite loop

while(1)

{

/\* Empty loop. All subsequent operations are performed exclusively

\* inside interrupt service routines ISRs \*/

}

// Will never reach this

return 0;

}

/\* Interrupt service routines ----------------------------------------\*/

/\*\*

\* ISR starts when Timer/Counter1 overflows. Increment decimal counter

\* value and display it on SSD.

\*/

ISR(TIMER1\_OVF\_vect) // routine for moving snake around 7 segment display

{

if(value<5)

{

SEG\_update\_shift\_regs(++value, 0);

}

else

{

value=0;

SEG\_update\_shift\_regs(value, 0);

}

}