

Microcontrollers

WS2022/23

Lab Report 1

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Degree program:	Mechatronic System Engineering
Kit Number:	HSRW MCUOWN
Actual Submission date:	-
Rework submission date:	
Submission Date:	

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Task 1:

```
Command Prompt
Device code: 0x75
Device code: 0x76
Device code: 0x77
Device code: 0x78
Device code: 0x79
Device code: 0x7a
Device code: 0x7b
Device code: 0x7c
Device code: 0x7d
Device code: 0x7e
Device code: 0x7f

avrdude: AVR device initialized and ready to accept instructions

Reading | ##### | 100% 0.08s

avrdude: Device signature = 0x1e930f
avrdude: NOTE: FLASH memory has been specified, an erase cycle will be performed
        To disable this feature, specify the -D option.
avrdude: erasing chip
avrdude: reading input file "program.hex"
avrdude: can't open input file program.hex: No such file or directory
avrdude: write to file 'program.hex' failed

avrdude: safemode: Fuses OK

avrdude done. Thank you.
```

The 2 green LEDs next to the red LED next to the power input flicker.

Task 2:

Arrangement :

- Pin B4 → Key1
- Pin B5 → Key 2
- Pin B0 → Red LED
- Pin B1 → Yellow LED
- Pin B2 → Green LED
- Pin C0 → poti 1 (potentiometer)
- Pin C3 → Sounder/ Summer

Make flash 1:

Press Key 1 → all LEDs turn on

Press Key 2 → all LEDs turn off

Make flash 2:

LEDs behave in a traffic signal manner where red LED lights up for the longest followed by yellow and green LEDs.

Make flash 3:

2 different sounds are produced by the sounder by pressing the keys and the sound stop with the release of the keys.

Make flash 4:

Press Key 1 → a tune is played

Make flash 5:

Press Key 1 → message displayed on the screen "Hello nice world. I am the atmel Mega88PA microcontroller."

Make flash 6:

Turn Potentiometer (poti 1) → sound produced within the frequency range of 1Hz to 1024Hz.

The two most impressive programs in my opinion were make flash 6 and make flash 2.

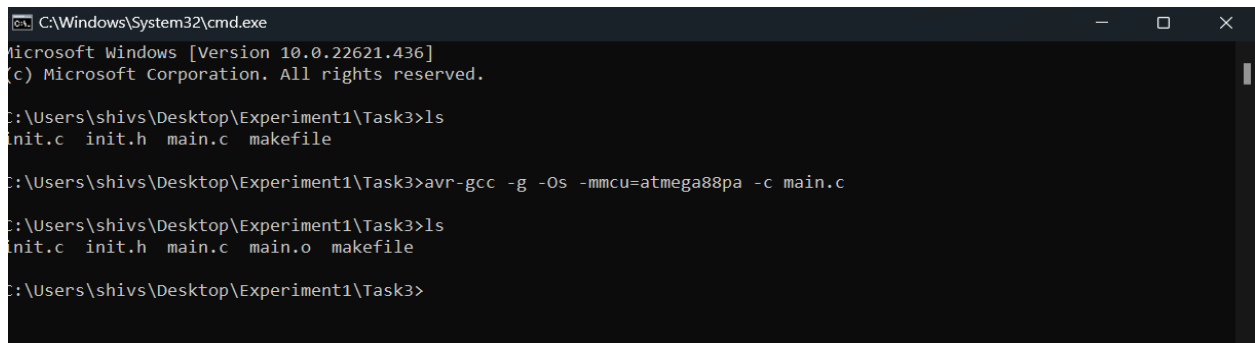
Task 3:

Arrangement :

- Pin D2 → Key1
- Pin D3 → Key 2
- Pin B1 → Red LED

A file “main.o” was created after the execution of the code:

```
avr-gcc -g -Os -mmcu=atmega88pa -c main.c
```



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22621.436]
(c) Microsoft Corporation. All rights reserved.

C:\Users\shivs\Desktop\Experiment1\Task3>ls
init.c  init.h  main.c  makefile

C:\Users\shivs\Desktop\Experiment1\Task3>avr-gcc -g -Os -mmcu=atmega88pa -c main.c

C:\Users\shivs\Desktop\Experiment1\Task3>ls
init.c  init.h  main.c  main.o  makefile

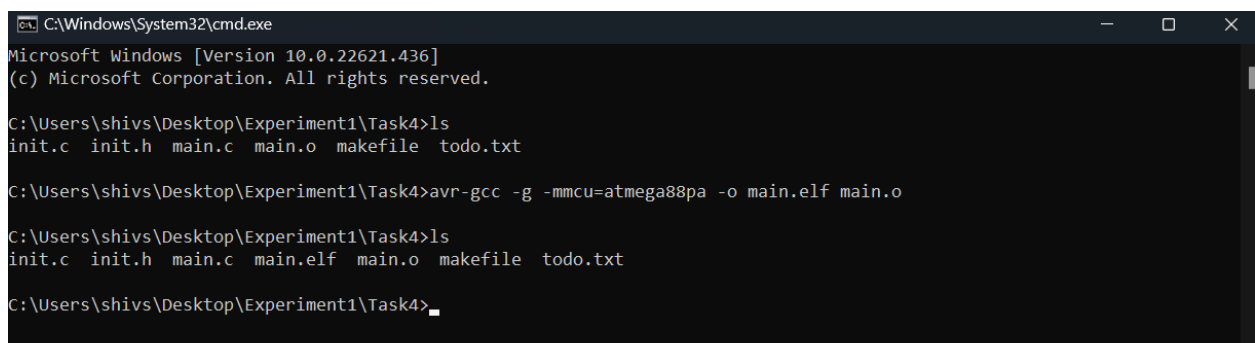
C:\Users\shivs\Desktop\Experiment1\Task3>
```

Before the execution

Task 4:

A file “main.elf” was created after the execution of the code:

```
avr-gcc -g -mmcu=atmega88pa -o main.elf main.o
```



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22621.436]
(c) Microsoft Corporation. All rights reserved.

C:\Users\shivs\Desktop\Experiment1\Task4>ls
init.c  init.h  main.c  main.o  makefile  todo.txt

C:\Users\shivs\Desktop\Experiment1\Task4>avr-gcc -g -mmcu=atmega88pa -o main.elf main.o

C:\Users\shivs\Desktop\Experiment1\Task4>ls
init.c  init.h  main.c  main.elf  main.o  makefile  todo.txt

C:\Users\shivs\Desktop\Experiment1\Task4>
```

After the execution

Task 5:

A file “main.hex” was created after the execution of the code:

```
avr-objcopy -j .text -j .data -O ihex main.elf main.hex
```

```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.22621.436]
(c) Microsoft Corporation. All rights reserved.

C:\Users\shivs\Desktop\Experiment1\Task5>ls
init.c  init.h  main.c  main.elf  main.o  makefile  todo.txt

C:\Users\shivs\Desktop\Experiment1\Task5>avr-objcopy -j .text -j .data -O ihex main.elf main.hex

C:\Users\shivs\Desktop\Experiment1\Task5>ls
init.c  init.h  main.c  main.elf  main.hex  main.o  makefile  todo.txt

C:\Users\shivs\Desktop\Experiment1\Task5>_
```

Command Prompt

```
C:\Users\shivs\Desktop\Experiment1\Task5\main.hex - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
main.hex
1  :10000001CC023C022C021C020C01FC01EC01DC0F4
2  :100010001CC01BC01AC019C018C017C016C015C01C
3  :1000200014C013C012C011C010C00FC00EC00DC04C
4  :100030000CC00BC032373539340011241FBECFEF4E
5  :10004000D4E0DEBFCDBF02D00EC0DAF52985398B5
6  :100050005A9A5B9A219A4A9904C04B9902C0299AEC
7  :0A006000FACF2998F8CF894FFCFEB
8  :0000001FF
9
Intel HEX bina length : 316 lines : 9 Ln : 1 Col : 1 Pos : 1 Windows (CR LF) UTF-8 INS
```

Hex File

Task 6:

The source code divides into 2 files:

- Main
- Init for i/o initialisation

Task 7:

Arrangement :

- Pin D3 → Key1
- Pin D2 → Key 2
- Pin B1 → Red LED
- Pin B2 → Yellow LED
- Pin B3 → Green LED

NAND:

```
if ((~PIND & (1 << PD2)) && (~PIND & (1 << PD3)))  
    PORTB &= ~(1 << PB1);  
else  
    PORTB |= (1 << PB1);
```

AND:

```
if ((~PIND & (1 << PD2)) && (~PIND & (1 << PD3)))  
    PORTB |= (1 << PB2);  
else  
    PORTB &= ~(1 << PB2);
```

XOR:

```
if (!((~PIND & (1 << PD2))) != (!(~PIND & (1 << PD3))))  
    PORTB |= (1 << PB3);  
else  
    PORTB &= ~(1 << PB3);
```

Task 9:

Arrangement :

- Pin B4 → Key1
- Pin B2 → Red LED

When key 1 is pressed the red led lights up but when the key is let go the red led switches off.

Task 10:

Arrangement :

- Pin B0 → Key1
- Pin B1 → Red LED

A delay function is added within the while loop in this task as compared to the last task.

Task 11:

Arrangement :

- Pin D2 → Key1
- Pin B1 → Red LED

LED is on when the code is executed and with the press and hold of the key the brightness increases but returns back to its initial state once the key is released.

Task 12:

Arrangement :

- Pin C3 → poti 1 (potentiometer)
- Pin B1 → Red LED
- Pin B2 → Yellow LED
- Pin B3 → Green LED

Red, yellow and green LEDs light up ranging from lowest to highest voltage value received by the potentiometer after converting them from analog to digital, respectively.

Task 13:

Arrangement :

- Pin C3 → photo sensor
- Pin B1 → Red LED
- Pin B2 → Yellow LED
- Pin B3 → Green LED

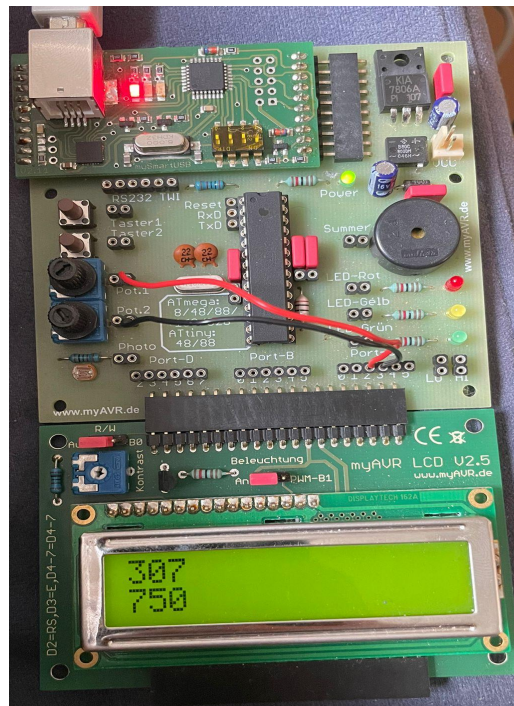
When executed the program converts the analog values received by the photo sensor to digital values using ADC and depending on the intensity each LED is turned on, green turning on at the highest intensity and red at the lowest. A torch was necessary to turn the green LED on. Covering via paper or hand was enough to turn the red LED on.

Task 14 :

Arrangement :

- Pin C3 → poti 1 (potentiometer)
- Pin C2 → poti 2 (potentiometer)

It shows different values of potentiometers.



Output