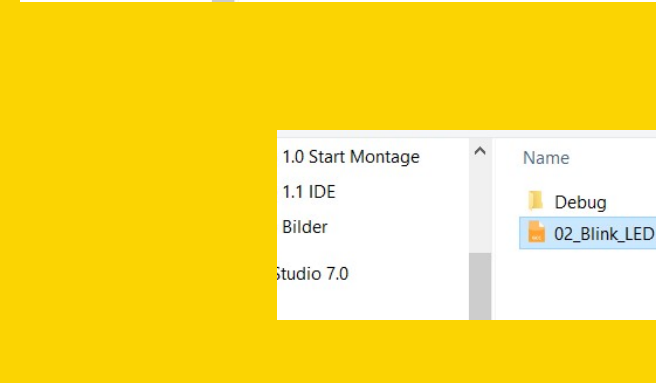
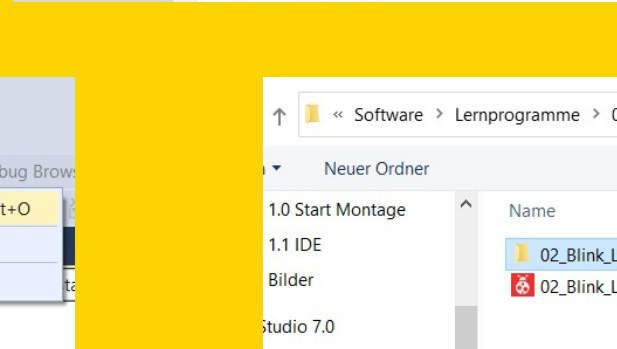


Montage und Programmierung  
eines Roboters für  
**ROBOCUP JUNIOR RESCUE**  
mit Elegoo Car Kit  
Teil 2.1: Hello World.2

Von Charlotte und Andreas

## Doppelklick: 02\_Blink\_LED



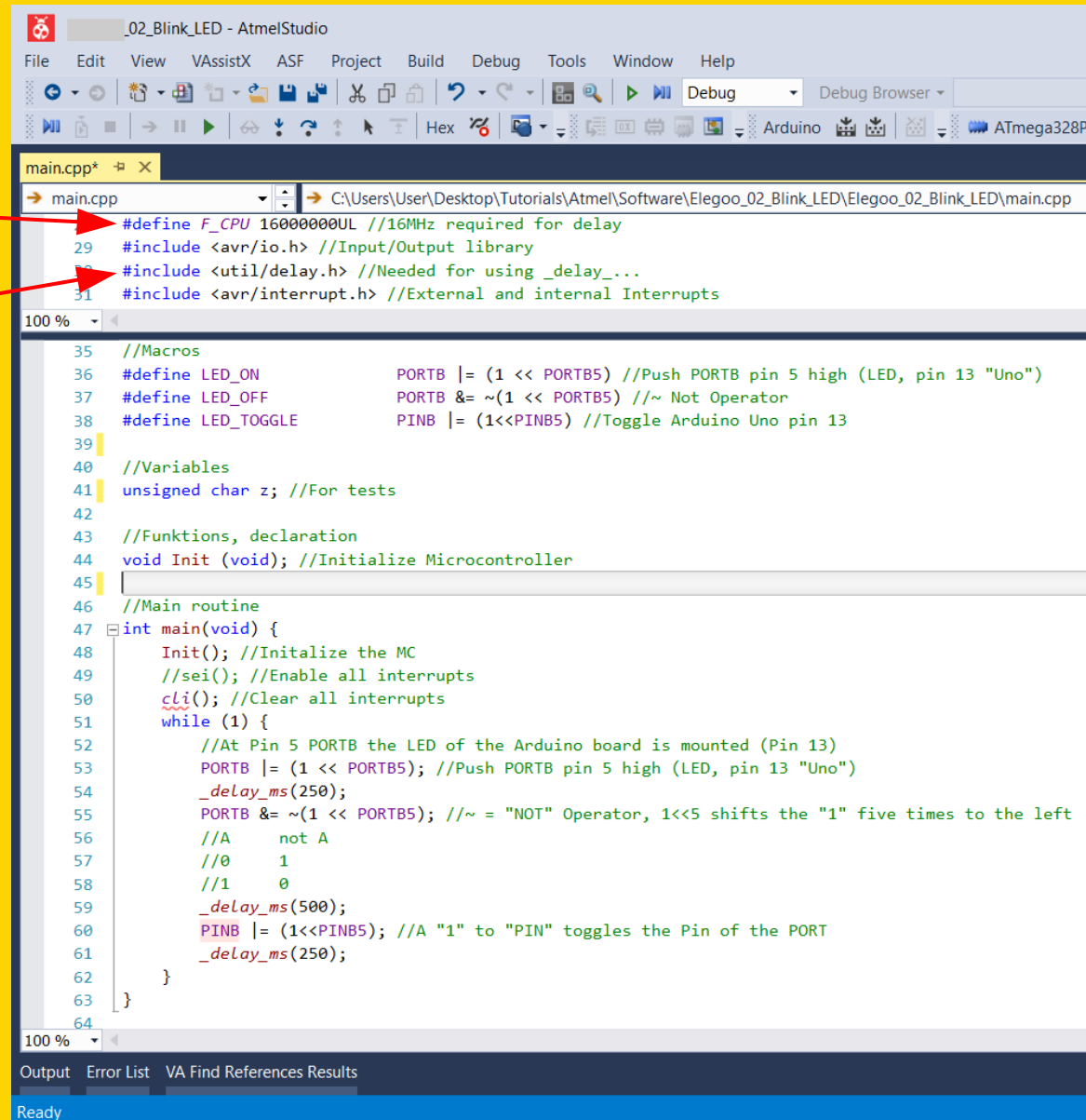
**Arbeitstakt** des Mikrocontrollers  
16MHz (MegaHertz)

**Bibliothek** (Librarie) einbinden, in der die  
Funktion delay beschrieben wird.

**Syntax:**

`_delay_ms(Zeit in Millisekunden);`

`_delay_us(Zeit in Mikrosekunden);`



```
main.cpp* - AtmelStudio
File Edit View VAssistX ASF Project Build Debug Tools Window Help
Debug
main.cpp
C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED\main.cpp
#define F_CPU 16000000UL //16MHz required for delay
#include <avr/io.h> //Input/Output library
#include <util/delay.h> //Needed for using _delay...
#include <avr/interrupt.h> //External and internal Interrupts

//Macros
#define LED_ON PORTB |= (1 << PORTB5) //Push PORTB pin 5 high (LED, pin 13 "Uno")
#define LED_OFF PORTB &= ~(1 << PORTB5) //~ Not Operator
#define LED_TOGGLE PINB |= (1<<PINB5) //Toggle Arduino Uno pin 13

//Variables
unsigned char z; //For tests

//Funktionen, declaration
void Init (void); //Initialize Microcontroller

//Main routine
int main(void) {
    Init(); //Initalize the MC
    //sei(); //Enable all interrupts
    cli(); //Clear all interrupts
    while (1) {
        //At Pin 5 PORTB the LED of the Arduino board is mounted (Pin 13)
        PORTB |= (1 << PORTB5); //Push PORTB pin 5 high (LED, pin 13 "Uno")
        _delay_ms(250);
        PORTB &= ~(1 << PORTB5); //~ = "NOT" Operator, 1<<5 shifts the "1" five times to the left
        //A not A
        //0 1
        //1 0
        _delay_ms(500);
        PINB |= (1<<PINB5); //A "1" to "PIN" toggles the Pin of the PORT
        _delay_ms(250);
    }
}
```

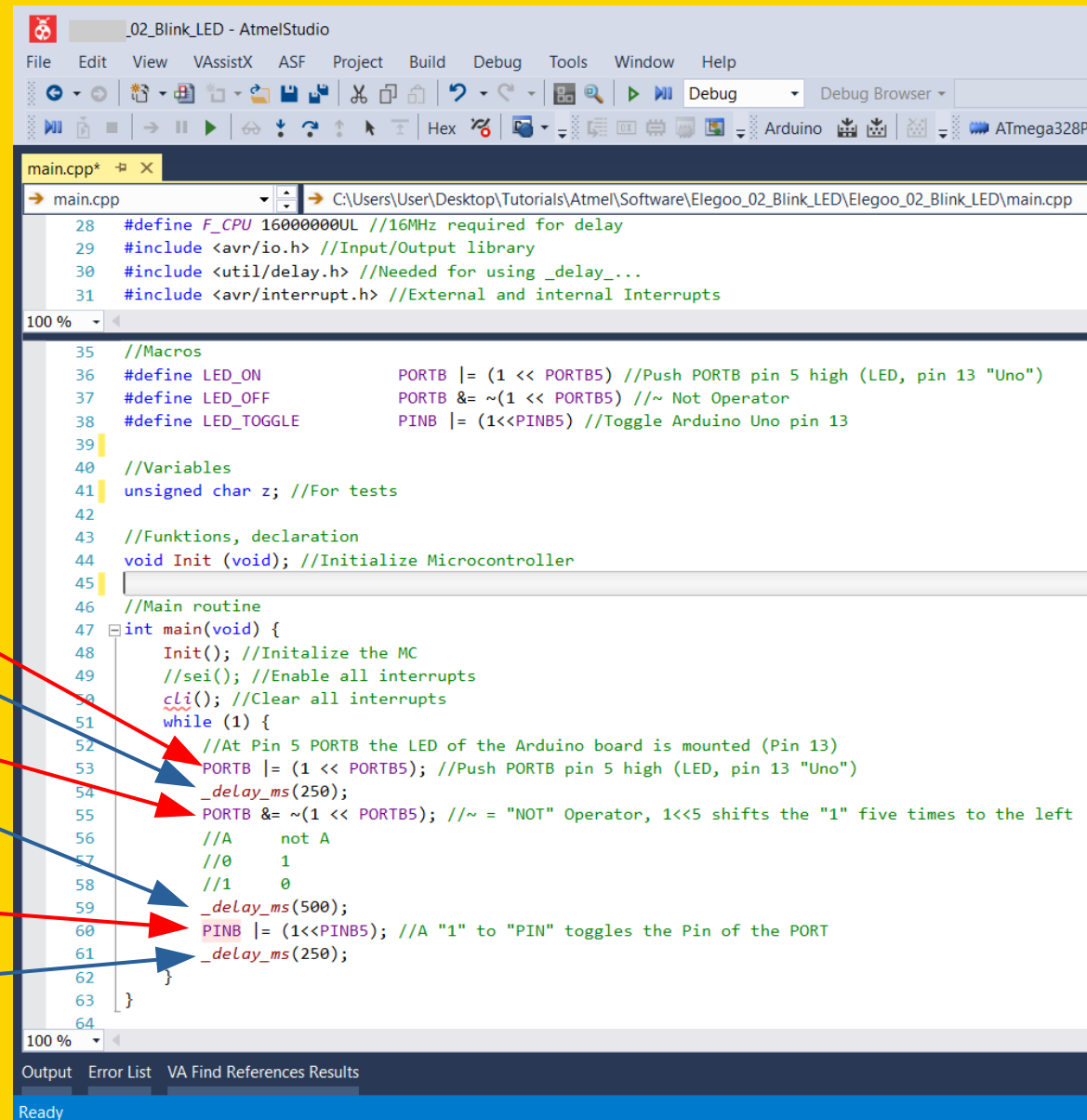
# LED blinkt

500 Millisekunden eingeschaltet  
500 Millisekunden ausgeschaltet

LED einschalten  
Warten, nix tun, im Kreis drehen.

LED ausschalten  
Warten, nix tun, im Kreis drehen.

LED toggeln:  
Wenn an, dann aus.  
Wenn aus, dann an.  
Warten, nix tun, im Kreis drehen.



```
main.cpp* - AtmelStudio
File Edit View VAssistX ASF Project Build Debug Tools Window Help
Debug Debug Browser
main.cpp C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED\main.cpp
28 #define F_CPU 16000000UL //16MHz required for delay
29 #include <avr/io.h> //Input/Output library
30 #include <util/delay.h> //Needed for using _delay_...
31 #include <avr/interrupt.h> //External and internal Interrupts
100 %
35 //Macros
36 #define LED_ON PORTB |= (1 << PORTB5) //Push PORTB pin 5 high (LED, pin 13 "Uno")
37 #define LED_OFF PORTB &= ~(1 << PORTB5) //~ Not Operator
38 #define LED_TOGGLE PINB |= (1<<PINB5) //Toggle Arduino Uno pin 13
39
40 //Variables
41 unsigned char z; //For tests
42
43 //Funktionen, declaration
44 void Init (void); //Initialize Microcontroller
45
46 //Main routine
47 int main(void) {
48     Init(); //Initalize the MC
49     //sei(); //Enable all interrupts
50     cli(); //Clear all interrupts
51     while (1) {
52         //At Pin 5 PORTB the LED of the Arduino board is mounted (Pin 13)
53         PORTB |= (1 << PORTB5); //Push PORTB pin 5 high (LED, pin 13 "Uno")
54         _delay_ms(250);
55         PORTB &= ~(1 << PORTB5); //~ = "NOT" Operator, 1<<5 shifts the "1" five times to the left
56         //A not A
57         //0 1
58         //1 0
59         _delay_ms(500);
60         PINB |= (1<<PINB5); //A "1" to "PIN" toggles the Pin of the PORT
61         _delay_ms(250);
62     }
63 }
100 %
Output Error List VA Find References Results
Ready
```

AtmelStudio - \_02\_Blink\_LED

File Edit View VAssistX ASF Project Build Debug Tools Window Help

Debug Browser

main.cpp

```
28 #define F_CPU 16000000UL //16MHz required for delay
29 #include <avr/io.h> //Input/Output library
30 #include <util/delay.h> //Needed for using _delay_...
31 #include <avr/interrupt.h> //External and internal Interrupts

35 //Macros
36 #define LED_ON PORTB |= (1 << PORTB5) //Push PORTB pin 5 high (LED, pin 13)
37 #define LED_OFF PORTB &= ~(1 << PORTB5) //~ Not Operator
38 #define LED_TOGGLE PINB |= (1<<PINB5) //Toggle Arduino Uno pin 13
39
40 //Variables
41 unsigned char z; //For tests
42
43 //Funktionen, declaration
44 void Init (void); //Initialize Microcontroller
45
46 //Main routine
47 int main(void) {
48     Init(); //Initialize the MC
49 }
```

100 %

Output

Show output from: Build

```
using RunOutputFileVerifyTask Task from assembly C:\Program Files (x86)\Atmel\Studio7.0\Extensions\
Task "RunOutputFileVerifyTask"
Program Memory Usage : 216 bytes 0,7 % Full
Data Memory Usage : 0 bytes 0,0 % Full
Warning: Memory Usage estimation may not be accurate if there are sections other than .text
Done executing task "RunOutputFileVerifyTask".
Done building target "CoreBuild" in project "Elegoo_02_Blink_LED.cppproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)' != '') was evaluated as ( '' !
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio7.0\Vs\Avr.common.targets" from project "C:\Use
Done building target "Build" in project "Elegoo_02_Blink_LED.cppproj".
Done building project "Elegoo_02_Blink_LED.cppproj".

Build succeeded.
===== Build: 1 succeeded or up-to-date, 0 failed, 0 skipped =====
```

Output Error List VA Find References Results

Build succeeded

Compilieren

AtmelStudio - \_02\_Blink\_LED

File Edit View VAssistX ASF Project Build Debug Tools Window Help

Debug Browser

main.cpp

```
28 #define F_CPU 16000000UL //16MHz required for delay
29 #include <avr/io.h> //Input/Output library
30 #include <util/delay.h> //Needed for using _delay_...
31 #include <avr/interrupt.h> //External and internal Interrupts

35 //Macros
36 #define LED_ON PORTB |= (1 << PORTB5) //Push PORTB pin 5 high (LED, pin 13)
37 #define LED_OFF PORTB &= ~(1 << PORTB5) //~ Not Operator
38 #define LED_TOGGLE PINB |= (1<<PINB5) //Toggle Arduino Uno pin 13
39
40 //Variables
41 unsigned char z; //For tests
42
43 //Funktionen, declaration
44 void Init (void); //Initialize Microcontroller
45
46 //Main routine
47 int main(void) {
48     Init(); //Initialize the MC
49 }
```

100 %

Output

Show output from: Arduino

```
avrdude.exe: 216 bytes of flash written
avrdude.exe: verifying flash memory against C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED
avrdude.exe: load data flash data from input file C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED
avrdude.exe: input file C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED
avrdude.exe: reading on-chip flash data:

Reading | ##### | 100% 0.03s

avrdude.exe: verifying ...
avrdude.exe: 216 bytes of flash verified

avrdude.exe done. Thank you.
```

Output Error List VA Find References Results

Ready

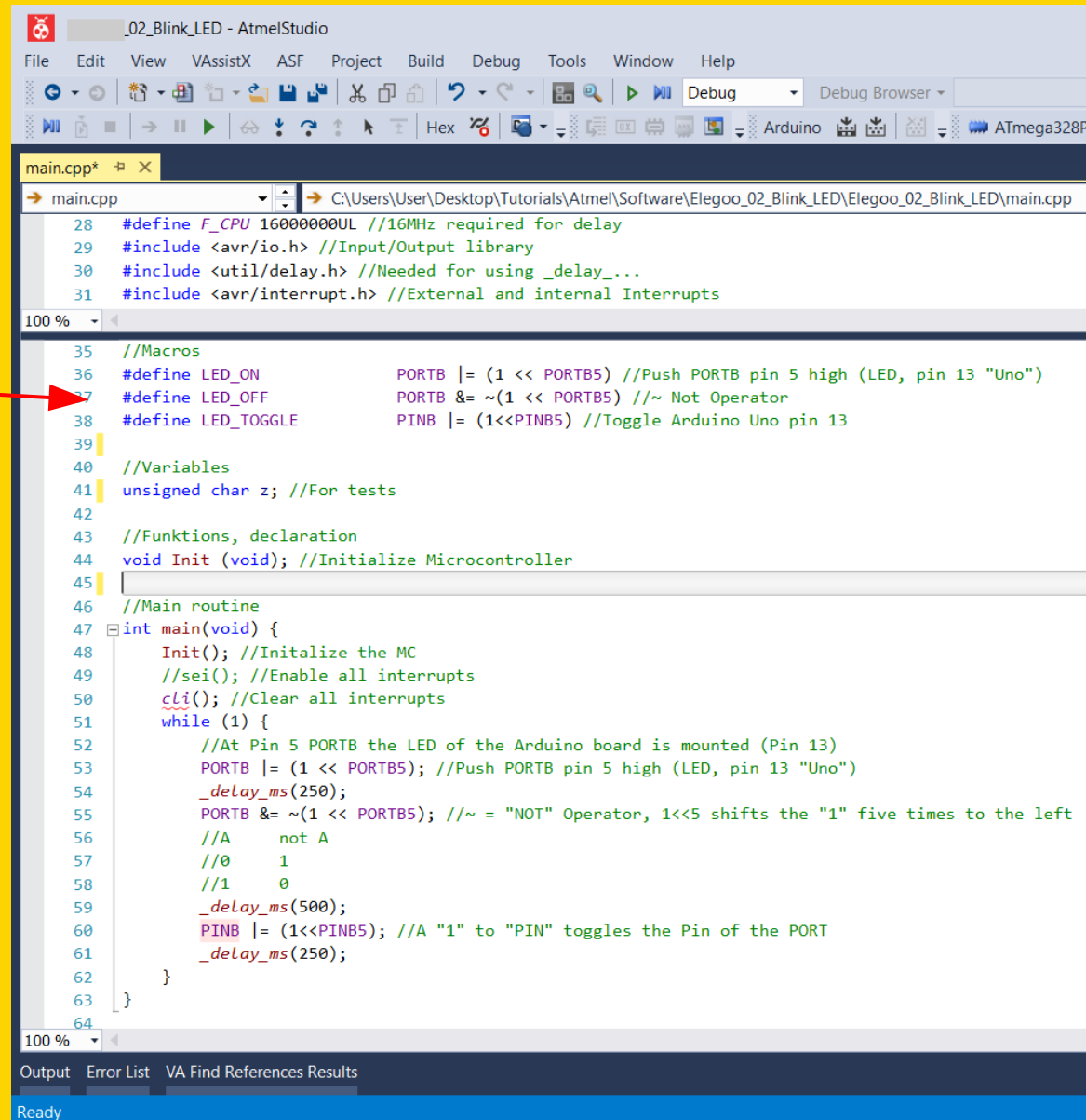
Flashen

## Macros (Definitionen):

Ausdrücke die wir uns leichter merken können, geben wir eine Bedeutung, die der Compiler für uns ersetzt.

### 1. Aufgabe:

```
61     _delay_ms(250);
62 }
63 }
64
65 //Aufgabe: Schreibt das Programm um:
66 //Die LED soll 300ms an sein und 300ms aus.
67 //Es ist egal, wie ihr die Aufgabe löst.
68 //Hinweis: Es ist möglich, das Programm mit 2 Zeilen zu programmieren...
69
70 //Initialize the Microcontroller
71 void Init (void) {
72     //Port settings (in brackets: pin of the arduino uno board, see above)
```



```
_02_Blink_LED - AtmelStudio
File Edit View VAssistX ASF Project Build Debug Tools Window Help
Debug
main.cpp*
main.cpp C:\Users\User\Desktop\Tutorials\Atmel\Software\Elegoo_02_Blink_LED\Elegoo_02_Blink_LED\main.cpp
28 #define F_CPU 16000000UL //16MHz required for delay
29 #include <avr/io.h> //Input/Output library
30 #include <util/delay.h> //Needed for using _delay_...
31 #include <avr/interrupt.h> //External and internal Interrupts
100 %
35 //Macros
36 #define LED_ON PORTB |= (1 << PORTB5) //Push PORTB pin 5 high (LED, pin 13 "Uno")
37 #define LED_OFF PORTB &= ~(1 << PORTB5) //~ Not Operator
38 #define LED_TOGGLE PINB |= (1<<PINB5) //Toggle Arduino Uno pin 13
39
40 //Variables
41 unsigned char z; //For tests
42
43 //Funktionen, declaration
44 void Init (void); //Initialize Microcontroller
45
46 //Main routine
47 int main(void) {
48     Init(); //Initalize the MC
49     //sei(); //Enable all interrupts
50     cli(); //Clear all interrupts
51     while (1) {
52         //At Pin 5 PORTB the LED of the Arduino board is mounted (Pin 13)
53         PORTB |= (1 << PORTB5); //Push PORTB pin 5 high (LED, pin 13 "Uno")
54         _delay_ms(250);
55         PORTB &= ~(1 << PORTB5); //~ = "NOT" Operator, 1<<5 shifts the "1" five times to the left
56         //A not A
57         //0 1
58         //1 0
59         _delay_ms(500);
60         PINB |= (1<<PINB5); //A "1" to "PIN" toggles the Pin of the PORT
61         _delay_ms(250);
62     }
63 }
100 %
Output Error List VA Find References Results
Ready
```

Montage und Programmierung  
eines Roboters für  
**ROBOCUP JUNIOR RESCUE**  
mit Elegoo Car Kit  
Teil 2.2: Interrupt

Von Charlotte und Andreas