ETP2 MOODLIGHT

Documentation extra features

SoE ZHAW

[redacted]

ET-Project 2

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Dozent
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ET16a

Table of Content

1. Introduction

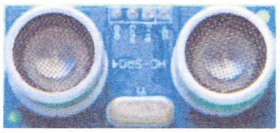
In this documentation, we describe the hardware part of the extra features of the pyramid moodlight. You can reproduce the hardware part of the extra features. Mainly there are two of them. First there is an ultrasonic sensor, which is used to measure the distance between an object and the moodlight itself. If you change the distance, the light gets darker or brighter. The second feature is a microphone. A clap switch is programmed, based on the audio signal of the microphone.

2. Extra Features Component

The used components are electronic kits. Because of this, the main hardware functionality is on the sensor itself. If you want to use them, you only have to connect a power supply and process the data at the output of the sensor. The kits are sold by the online store play-zone.ch.

No.	Product Name	Article Number	Company	Price
1	Ultrasonic Sensor HC-SR04	HCSR04	Play-Zone	12.50.-
2	Microphone Amplifier MAX4466	P00001893	Play-Zone	7.90.-

2.1. Movement-Sensor



The functionality of this sensor is simple. With a falling edge at the trigger input, the sensor expels an ultrasonic sound. At the same time the echo output is set to 5V and stays high until the reflected ultrasonic sounds are back at the sensor. If the Sensor receives nothing, the output stays 20ms high. With the information of the speed of the sound you are able to process the measured pulse and calculate the distance to the object. The Trigger is realised at a normal GPIO pin of the microcontroller as well as the connection with the echo pin.

PIN	Description	Type
VCC	Supply voltage 5V	Supply
GND	Power supply ground. All voltages are referenced to GND.	GND
ECHO	Distance encrypted in a PWM signal.	TTL PWM-output Signal
Trigger	Trigger pulse to start de measurement.	10µs TTL-Impulse

2.2. Clap-Sensor

The clap sensor is just a microphone with an on board rail to rail OP. The circuit also has an adjustable gain, which can be useful to adjust the microphone. To process the data, we simply connected the output signal to an ADC input of the microcontroller.

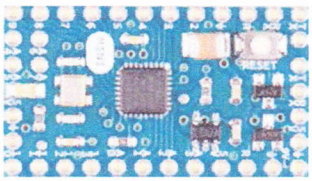
PIN	Description	Type
VCC	Supply voltage 5V	Supply
GND	Power supply ground. All voltages are referenced to GND.	GND
OUT	Output signal of the microphone	Analog Output 0-5V (2.5V DC-Offset)

3. Microcontroller connection

For the Microcontroller, an Arduino Mini is used. It basically consists of an Atmega 328P microcontroller, a reset button, a 5V voltage regulator and a quartz. It is powered by 9 Volts and the generated 5 Volts are used for both extra features (Movement-Sensor and Clap-Sensor). The Arduino can simply be plugged on the PCB board with pin headers.

Arduino Mini:

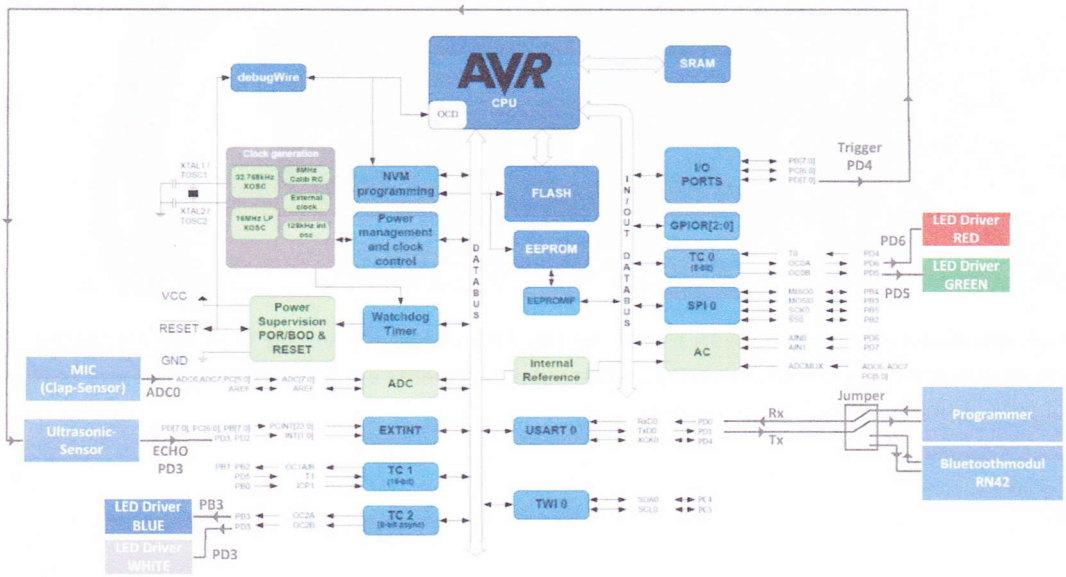
Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage	7-9 V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	8 (of which 4 are broken out onto pins)
DC Current per I/O Pin	40 mA



The Arduino board can be ordered on the official homepage of Arduino:
https://store.arduino.cc/usa/arduino-mini-05

However, the firmware was written with the Atmel IDE but this part is not described in this documentation.

The extra features were connected to the arduino board as follows:

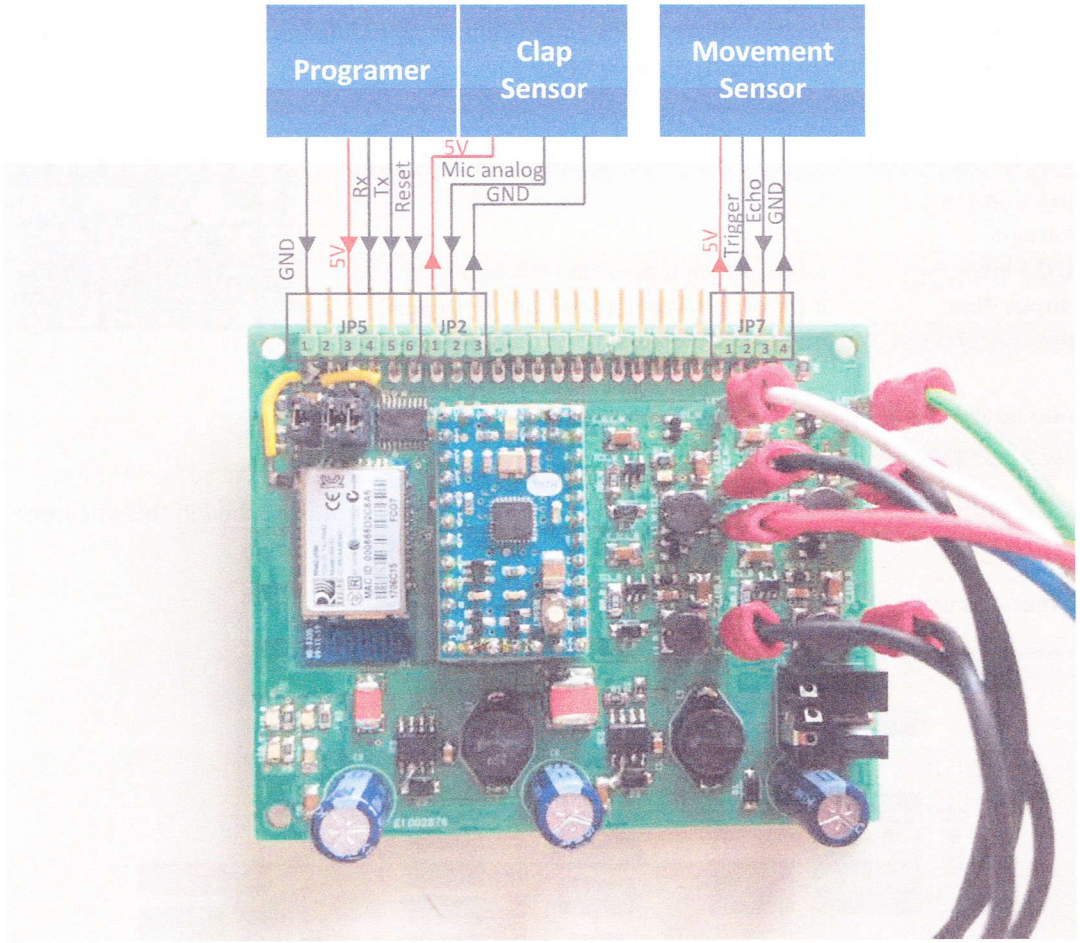


PCB Header Pin	Arduino Header Pin	uC Pin	Description	Usage
JP5.4	Rx	PD0	UART RX	Programmer/ Bluetoothmodul RN42
JP5.5	Tx	PD1	UART TX	Programmer/ Bluetoothmodul RN42
JP7.3	IO2	PD3	Echo	Ultrasonic Sensor
JP7.2	IO4	PD4	Trigger	Ultrasonic Sensor
JP2.2	ADC0	PC0	Mic analog output	Clap-Sensor

You also see how the features are connected to the PCB board in the next chapter or in the schematic in the appendix.

4. PCB connection

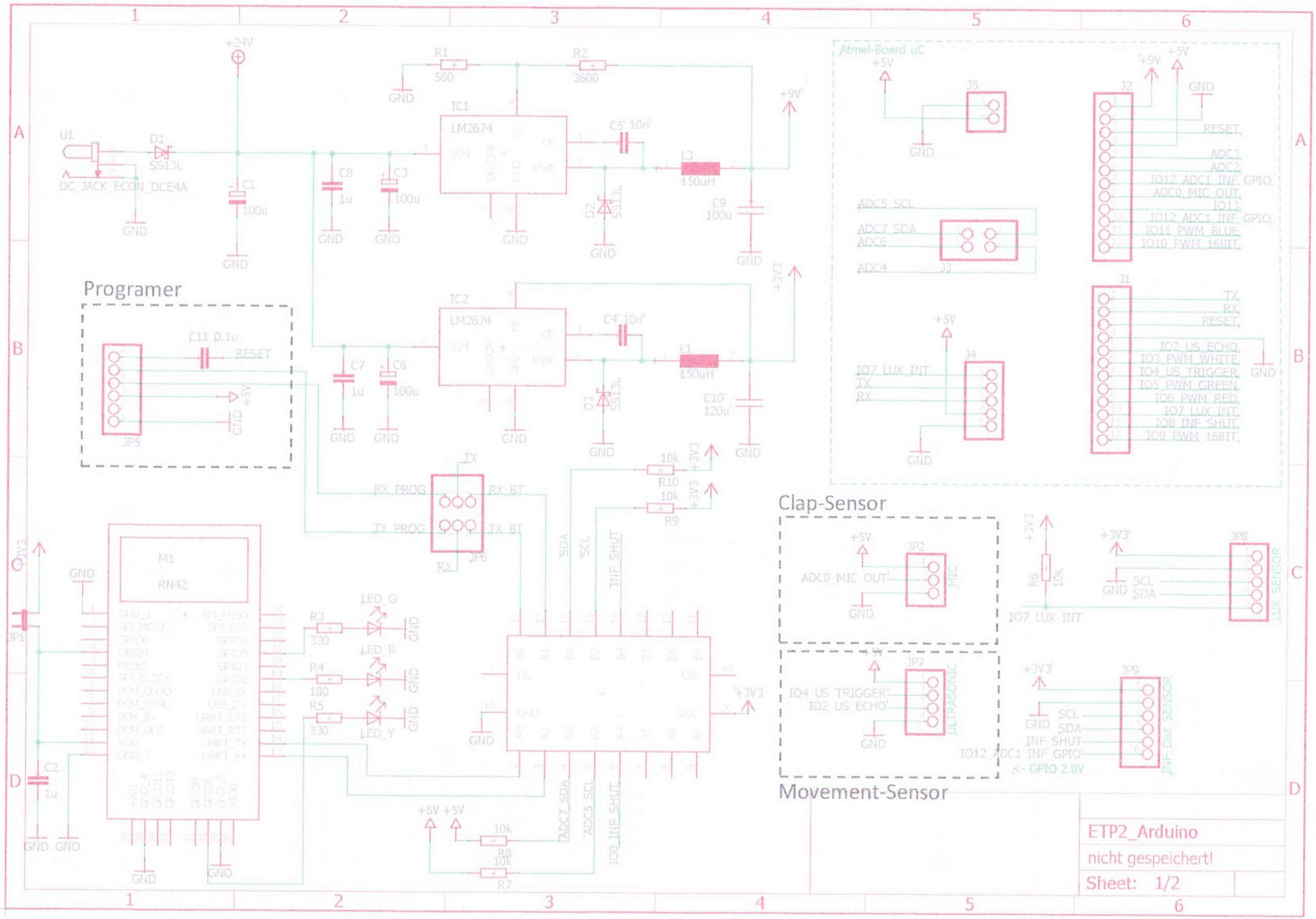
The extra features are connected to the PCB board as follows:

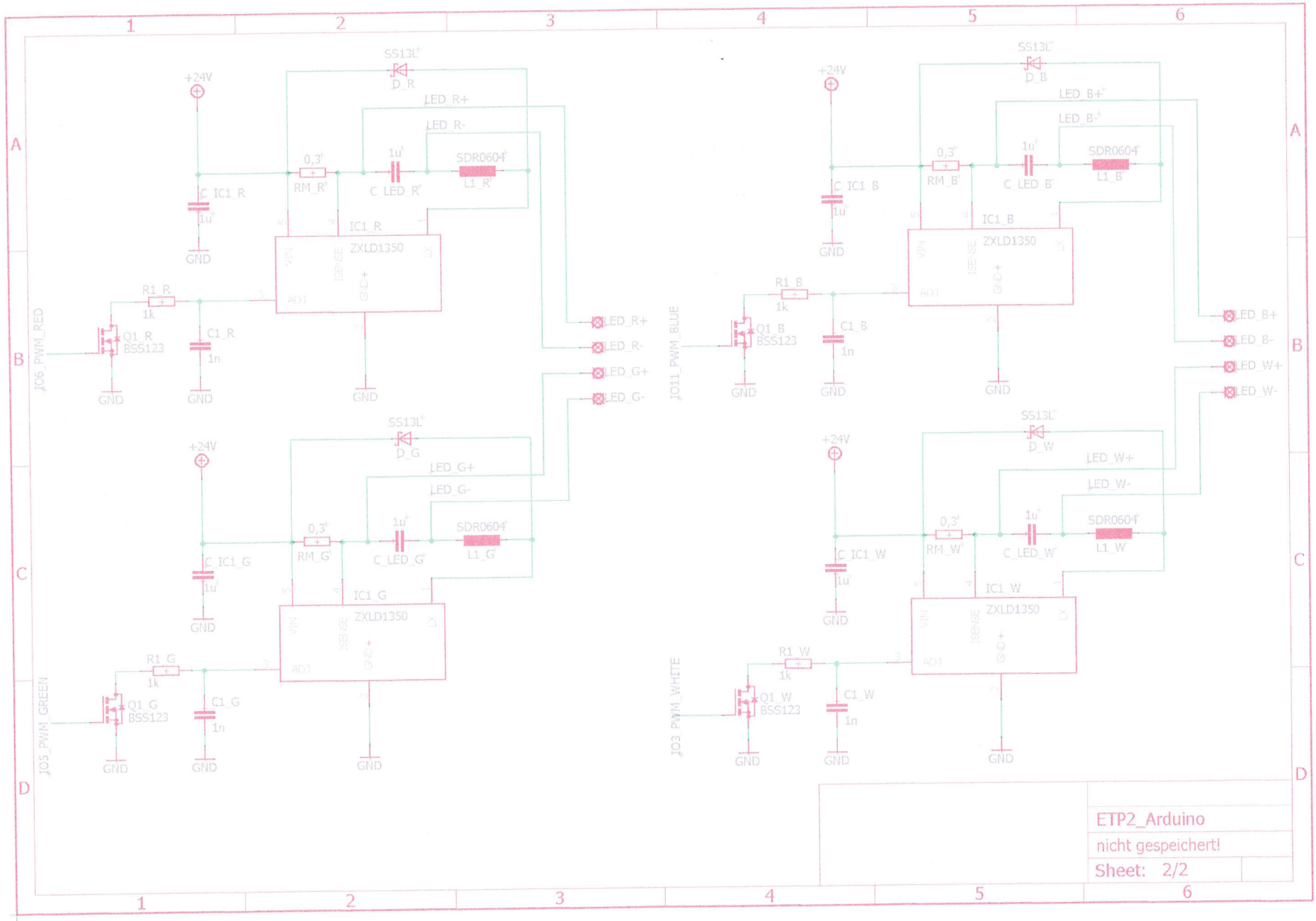


The signals are directly connected with the uC on the Arduino board, where they are processed. The exact schematics are in the attachment. No additional components were needed for the extra features. All the work is done by the microcontroller.

5. Attachment

5.1.Schematics of the PCB




SS13L
D_R
+24V
LED_R+
LED_R-
0,3
RM_R
1u
C_LED_R
SDR0604
L1_R
C_IC1_R
1u
GND
IC1_R
ZXLD1350
VIN
ISENSE
GND
DX
ADJ
R1_R
1k
IO6_PWM_RED
Q1_R
BSS123
C1_R
1n
LED_R+
LED_R-
LED_G+
LED_G-
SS13L
D_G
+24V
LED_G+
LED_G-
0,3
RM_G
1u
C_LED_G
SDR0604
L1_G
C_IC1_G
1u
GND
IC1_G
ZXLD1350
R1_G
1k
IO5_PWM_GREEN
Q1_G
BSS123
C1_G
1n
SS13L
D_B
+24V
LED_B+
LED_B-
0,3
RM_B
1u
C_LED_B
SDR0604
L1_B
C_IC1_B
1u
GND
IC1_B
ZXLD1350
R1_B
1k
IO11_PWM_BLUE
Q1_B
BSS123
C1_B
1n
LED_B+
LED_B-
LED_W+
LED_W-
SS13L
D_W
+24V
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LED_W-
0,3
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C_LED_W
SDR0604
L1_W
C_IC1_W
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IO3_PWM_WHITE
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ETP2_Arduino
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