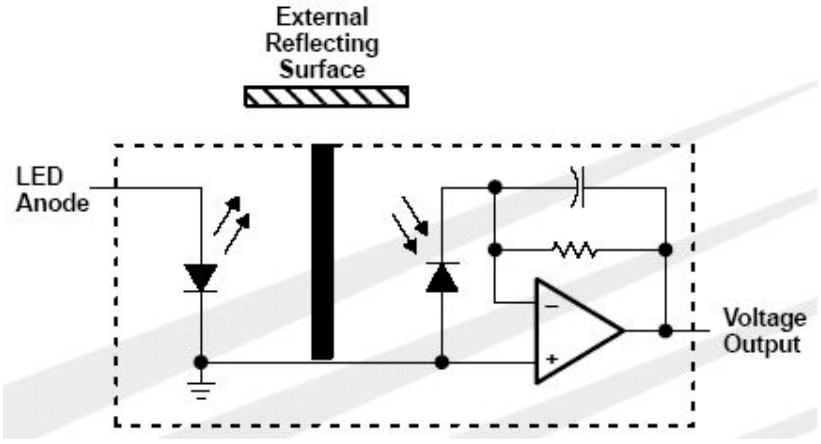
Project Number: eZ2964

The aim of creation of this device is to help blind people, or people with a problem of daltonism, who differ colors with difficulties or wrongly. This device analyzes the color of a surface. When it determines the color, it pronounces by the speaker.

The device is portable and consists of the next important parts:

1. Three color sensors (TRS17xx), using primary colors (red, green, blue) and three LEDs (for lightening of a surface) placing inside the same IC.

When reflecting light varies, then voltage changes at the output of (TRS17xx), because every color reflects specific ray. See the Functional Block Diadram below:



2. Using external A/D Converter AD7417AR (with I2C protocol) the ZiLOG MCU eZ80F91 is converting analog voltage from the outputs TRS17xx in digital hexadecimal number. Then, using an algorithm (Equation 1), it calculates and at the end of the process play the voice (that it is storied in FLASH memory in Text format).

The device calculates the battery voltage. When the battery is low it pronounces the message “recharge battery”.

There are 38 texts of the names of colors in this device. These texts are in English language. This device has an opportunity for more quantity of colors 255 with small change in codes or more from >255 if used >8bit register.

$$\left|\overrightarrow{AB}\right| = \sqrt{\left|R_a - R_b\right|^2 + \left|G_a - G_b\right|^2 + \left|B_a - B_b\right|^2} \quad \text{(Equation 1)}$$

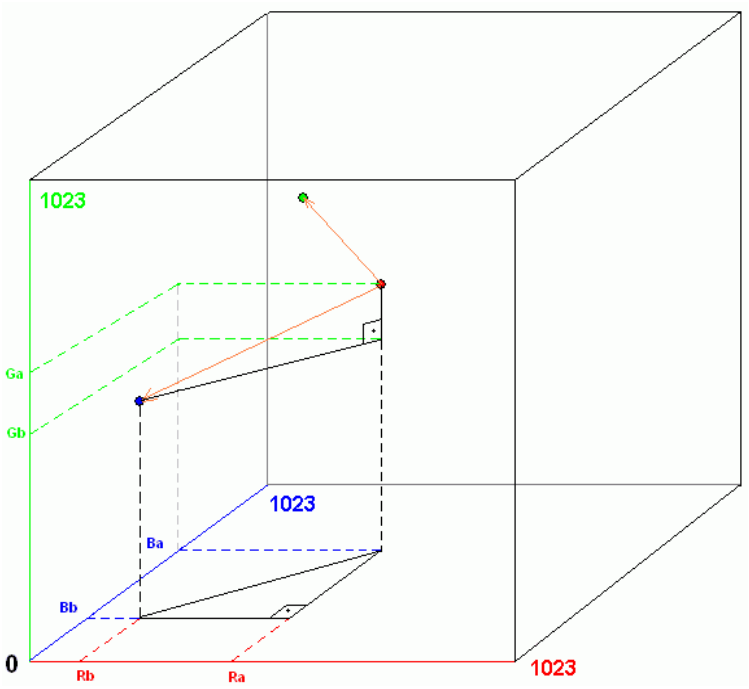


Fig.5

To detect the correct color it is utilizing above-stated algorithm and original database of 38 colors (storied in external 24LC64 EEPROM). That vector with most small value in the indicated (Fig.5) is between points of green and red dots. The color that we need to recognize from surface is the most eligible to the color applicable to the green dot.

3. Have used DC/DC Converter LM2662, that doubles the input voltage, two 5V regulator with maximum current output 100mA each.
4. One Text-to-Speech IC WTS701E from Winbond with SPI protocol. This (TTS) processor convert ASCII text to a natural sounding voice. A unique

feature of the chip is that it does not use speech synthesis, but instead uses real human voices. This eliminates the synthetic sound quality found in other TTS processors. This level of performance is unprecedented in a low-resource, single-chip embedded environment.

5. Audio Filters and one audio amplifier LM386, to provide maximum volume (gain 20) to the speaker.
6. Rechargeable batteries (4) of 1,2V (NiMH) with capacity “C” 1200mAh.

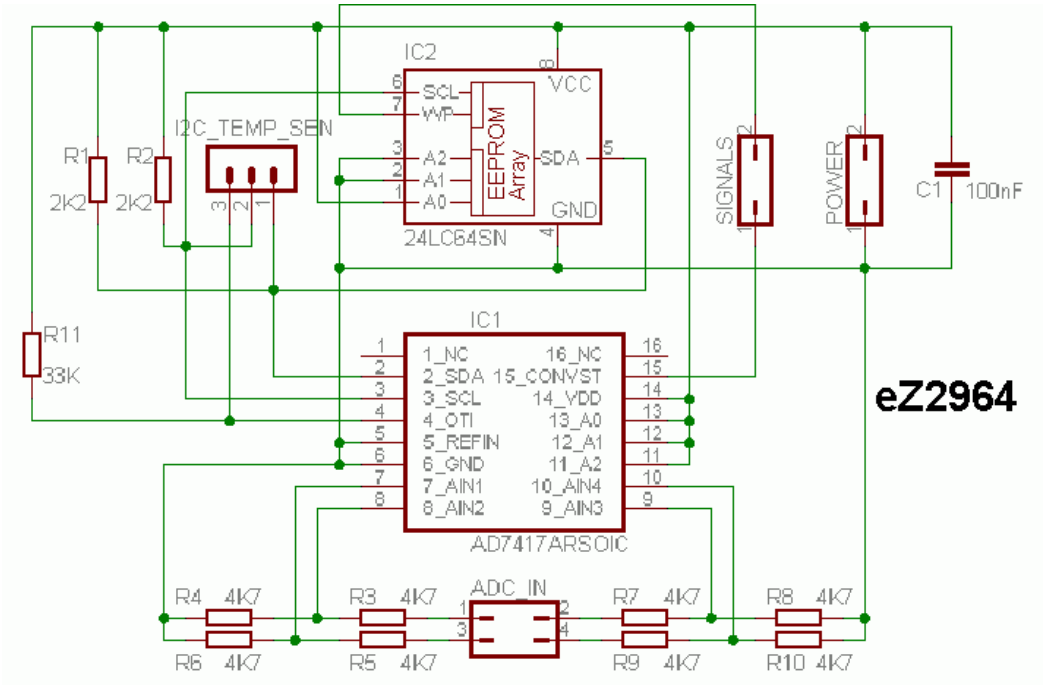
For more information see Block Diagram Schematics.

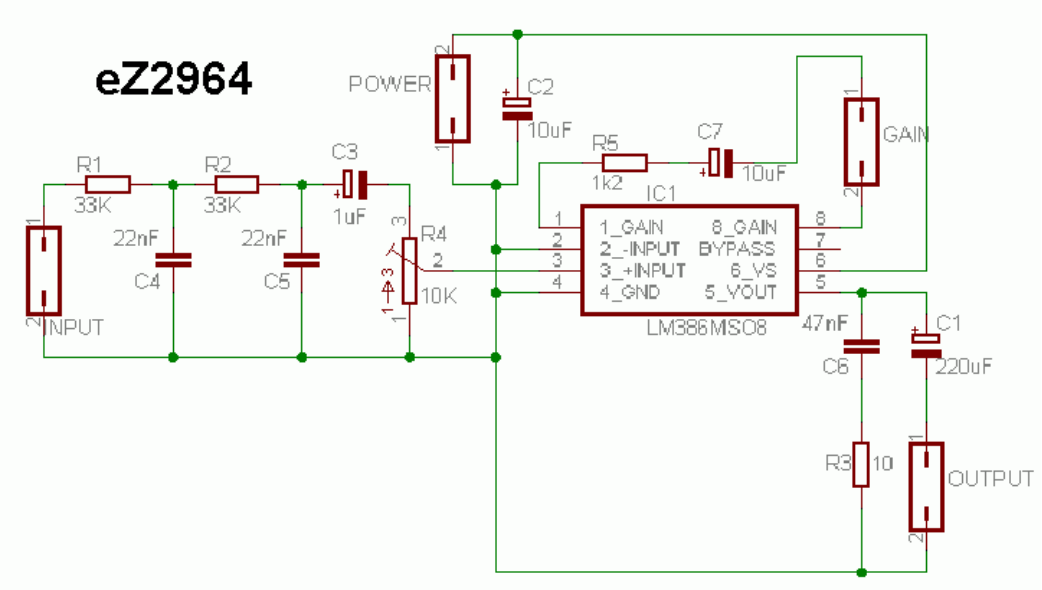
First it was programmed FLASH memory with a code “one”, after executing of a code “one” the result stored in 24LC64 EEPROM (it is library of original colors). After that FLASH memory it was programmed with code “two”.

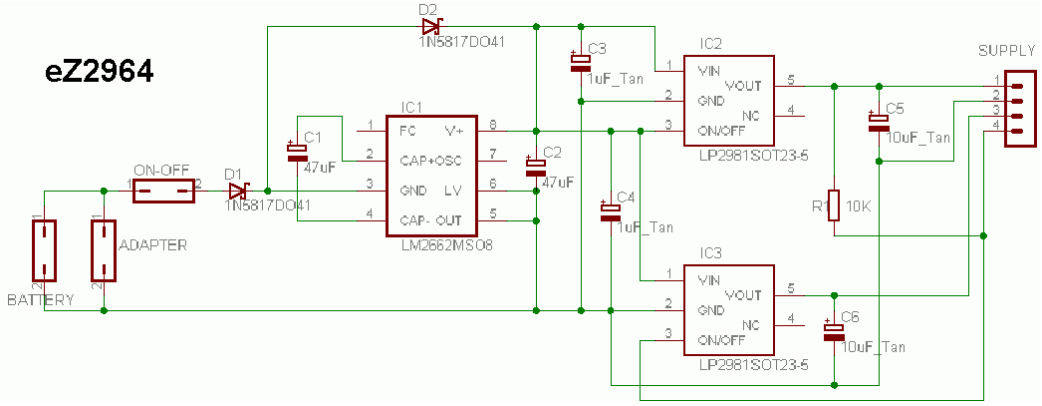
Two codes compiled in hex files with the program ZDS II - eZ80Acclaim! 4.8.0

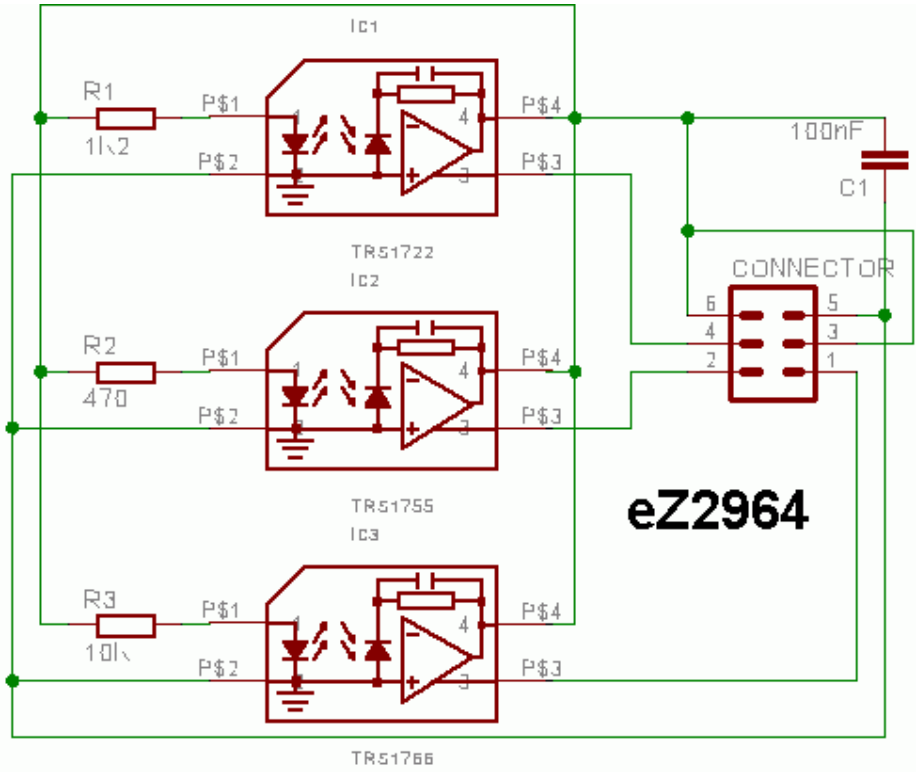
A lot of people with these problems are waiting from society to solve it. I would be very proud if my project could help this people in their lives.

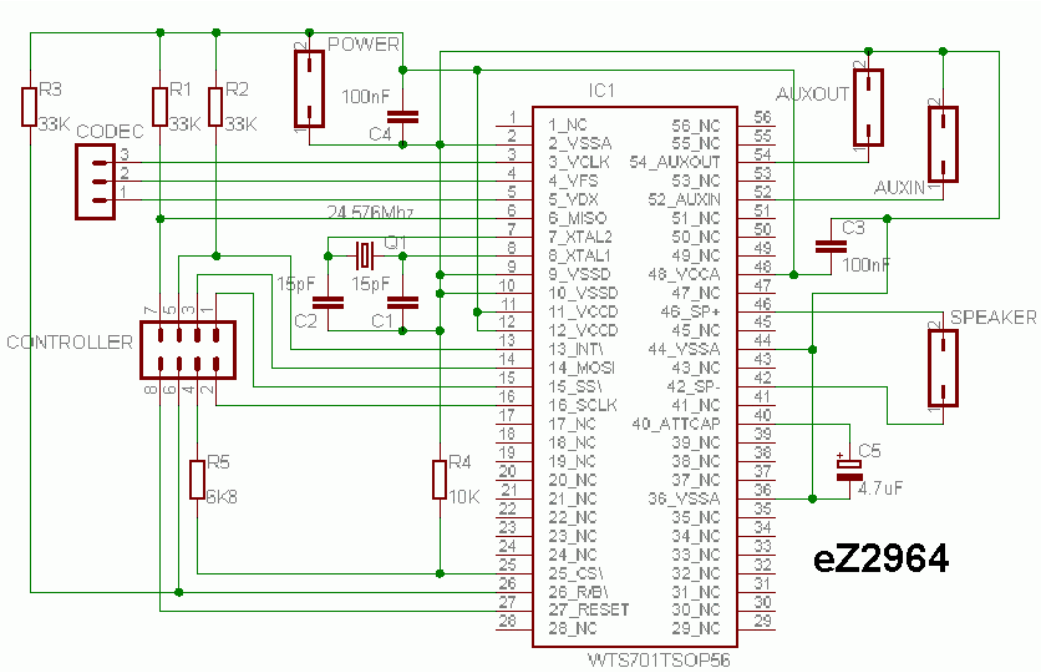

eZ2964

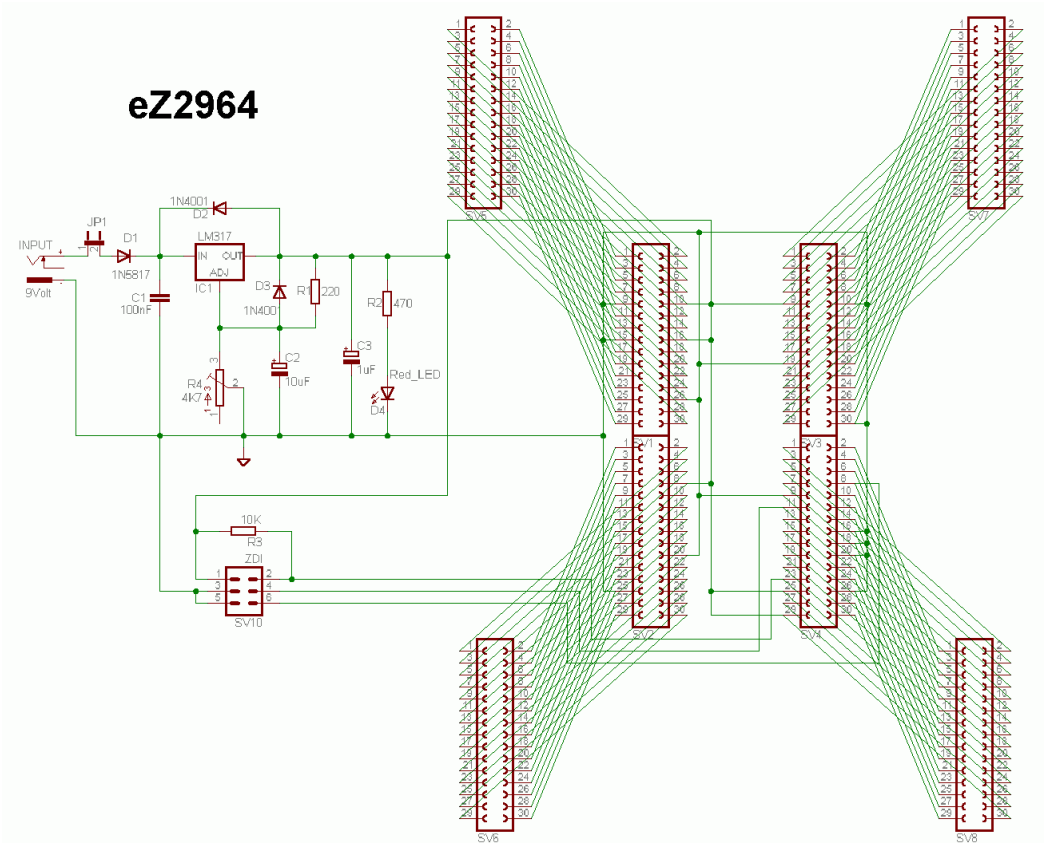

IC2
SCL
WP
A2
A1
A0
VCC
SDA
GND
EEPROM Array
24LC64SN
I2C_TEMP_SEN
R1
2K2
R2
2K2
SIGNALS
POWER
C1
100nF
R11
33K
IC1
1_NC
2_SDA
3_SCL
4_OTI
5_REFIN
6_GND
7_AIN1
8_AIN2
16_NC
15_CONVST
14_VDD
13_A0
12_A1
11_A2
10_AIN4
9_AIN3
AD7417ARSOIC
eZ2964
R4 4K7
R6 4K7
R3 4K7
R5 4K7
ADC_IN
R7 4K7
R9 4K7
R8 4K7
R10 4K7


eZ2964
POWER
C2
10uF
R1
33K
R2
33K
C3
1uF
22nF
C4
22nF
C5
R4
10K
INPUT
R5
1k2
C7
10uF
GAIN
IC1
1_GAIN
2_-INPUT
3_+INPUT
4_GND
8_GAIN
BYPASS
6_VS
5_VOUT
LM386MSO8
47nF
C6
C1
220uF
R3
10
OUTPUT


eZ2964
D2
1N5817DO41
C3
1uF_Tan
IC2
VIN
VOUT
GND
NC
ON/OFF
LP2981SOT23-5
SUPPLY
C5
10uF_Tan
IC1
FC
V+
CAP+
OSC
GND
LV
CAP-
OUT
LM2662MSO8
C1
47uF
C2
47uF
ON-OFF
D1
1N5817DO41
C4
1uF_Tan
R1
10K
ADAPTER
BATTERY
IC3
VIN
VOUT
GND
NC
ON/OFF
LP2981SOT23-5
C6
10uF_Tan


IC1
R1
1k2
P$1
P$2
P$4
P$3
TRS1722
IC2
R2
470
TRS1755
IC3
R3
10k
TRS1766
100nF
C1
CONNECTOR
6
5
4
3
2
1
eZ2964


POWER
100nF
C4
R3
33K
R1
33K
R2
33K
CODEC
IC1
AUXOUT
AUXIN
24.576Mhz
Q1
15pF
15pF
C2
C1
C3
100nF
CONTROLLER
SPEAKER
R5
6K8
R4
10K
C5
4.7uF
eZ2964
WTS701TSOP56


eZ2964
INPUT
9Volt
JP1
D1
1N5817
1N4001
D2
LM317
IN
OUT
ADJ
IC1
C1
100nF
D3
1N400
R1
220
R2
470
C2
10uF
C3
1uF
Red_LED
D4
R4
4K7
10K
R3
ZDI
SV10
SV1
SV2
SV3
SV4
SV5
SV6
SV7
SV8