

Project:

Color Detector with real human voice pronouncing.

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 from the speaker.

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

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.



TRS1722

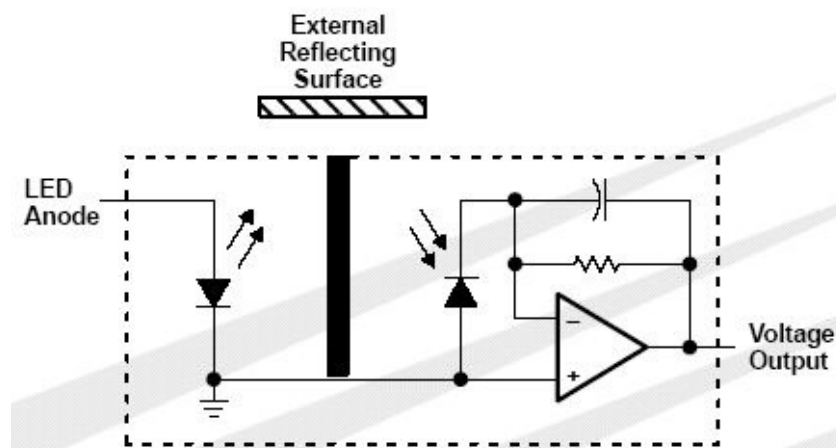


TRS1755



TRS1766

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



2. Using the internal 3 channel 10bit resolution A/D converter of RENESAS MCU R8C/13, it convert the 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 pronounces the voice (that it is storied in FLASH memory in Text format).

There are 40 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.

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

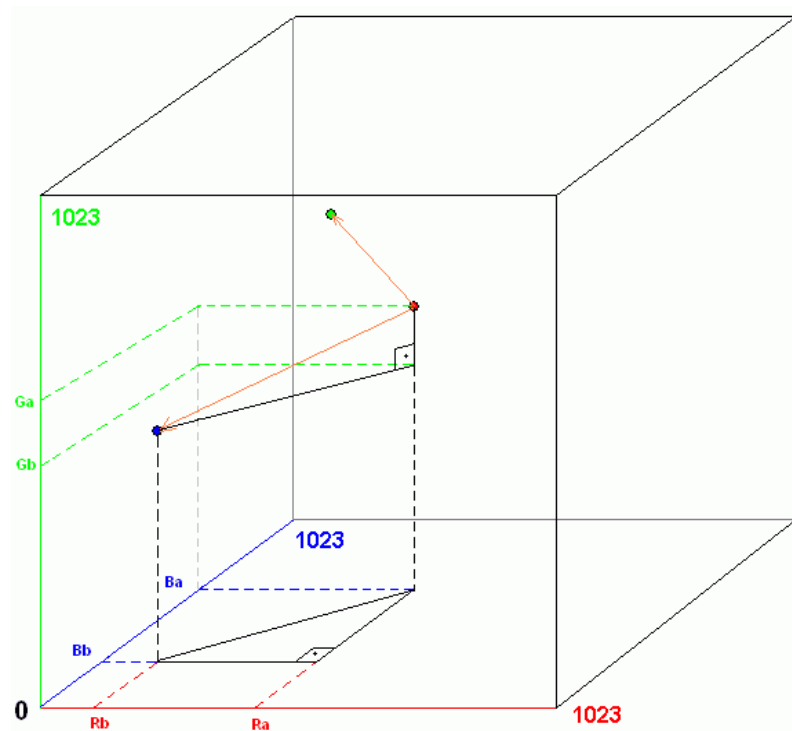


Fig.5

To detect the correct color it is utilizing above-stated algorithm using original database of 40 colors (storied in internal Data FLASH). 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 LP2981 (5V) and one LP2981 (3,3V) regulator with maximum current output 100mA each.
4. One Text-to-Speech IC WTS701E from Winbond with SPI protocol operated in 3,3V.
5. Audio Filters and one audio amplifier LM386, provided maximum volume (gain 20) to the speaker > 0,5Watt.
6. Rechargeable batteries (4) of 1,2V (NiMH) with capacity “C” 1200mAh.

For detailed information look in **Block Diagram** και **Schematics**.

First it was programmed FLASH memory with the “M1615_Color_Detector.mot” file, after executing of a code in “Store mode” the result stored in Data FLASH (it is library of original colors). After that we can use the “Detect mode” for detect the color.

How is code in ‘C’ is working?

Logic of “Store mode” is in uploading the colors to Data FLASH Memory. These colors will be used as library. This is the prototype color. I use in the device 40 colors. All colors upload to Data FLASH Memory, when we press button, after 1/2 second we can upload the color of surface to the Memory. To upload these colors we put sensors TRS17xx to the proper color interface and press a button, before that we have put switch in “Store mode” state of cause.

After pressing the button the device switch ON a proper IC like as second LP2981 regulator, which is gives a power to color sensors TRS17xx.

Logic of “Detect mode” is to recognize the surface color. We turn the switch in “Detect mode” state and press the button, then we begin the A/D converting. The device calculates the battery voltage first. When the battery is low it pronounces the message “Please recharge the battery”. For calculate the **mathematic algorithm** we use the stored Data FLASH memory values (for all colors) and the values after A/D converting. The smallest value will correspond to the prototype color. To pronounce the voice of this color we use WTS701E IC. This (TTS) processor converts 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). To send the text to WTS701E we use SPI Protocol.

References:

- 1) TRS1722, TRS1755 and TRS1766 REFLECTIVE LIGHT SENSORS,
Datasheet: <http://www.taosinc.com/images/product/document/trs17xx-e14.pdf>
- 2) LM2662 Switched Capacitor Voltage Converter, Datasheet:
<http://www.national.com/ds.cgi/LM/LM2662.pdf>
- 3) LP2981 Micropower 100mA Ultra Low-Dropout Regulator in SOT-23,
Datasheet: <http://www.national.com/ds.cgi/LP/LP2981.pdf>
- 4) WTS701E Text-To-Speech Single-Chip Text-To-Speech Processor:
 - Datasheet: <http://www.winbond-usa.com/products/tts/datasheets/wts701.pdf>
 - User's Manual: http://www.winbond-usa.com/products/tts/datasheets/wts701_ef.pdf

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