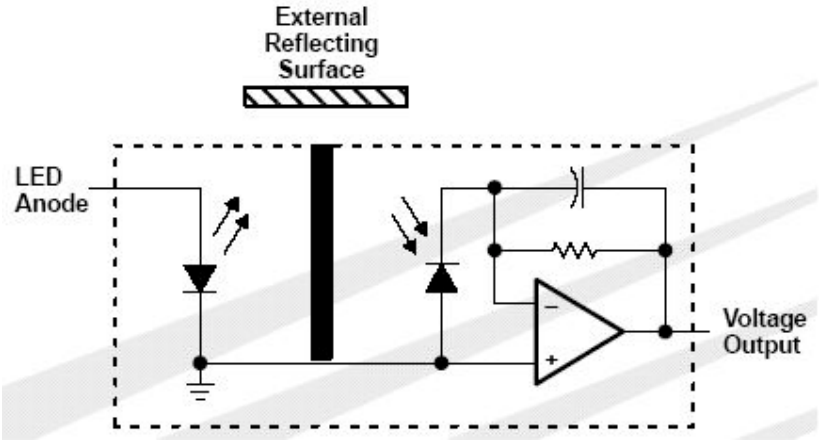
Project number: AR1813

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.

The device 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 the internal 3 channel of 10bit resolution A/D converter by Philips ARM LPC2138, 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.

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

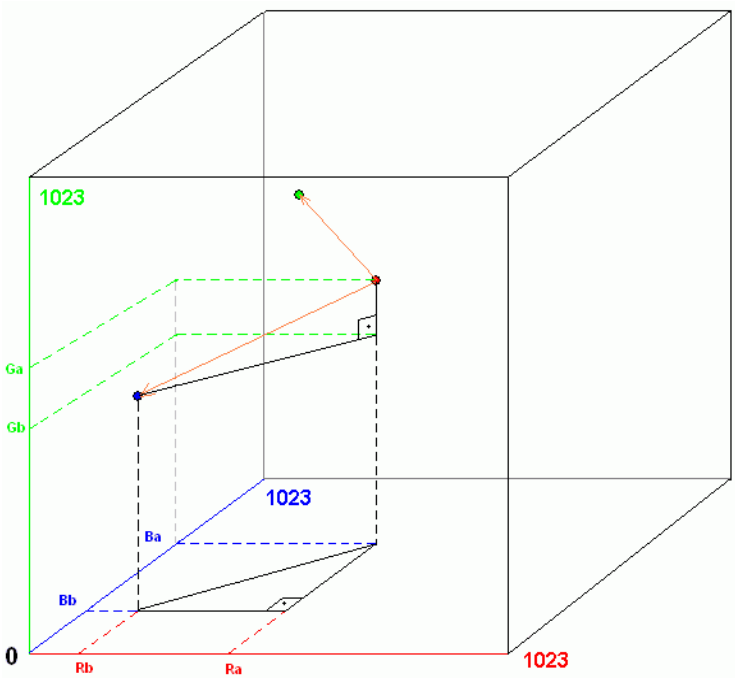
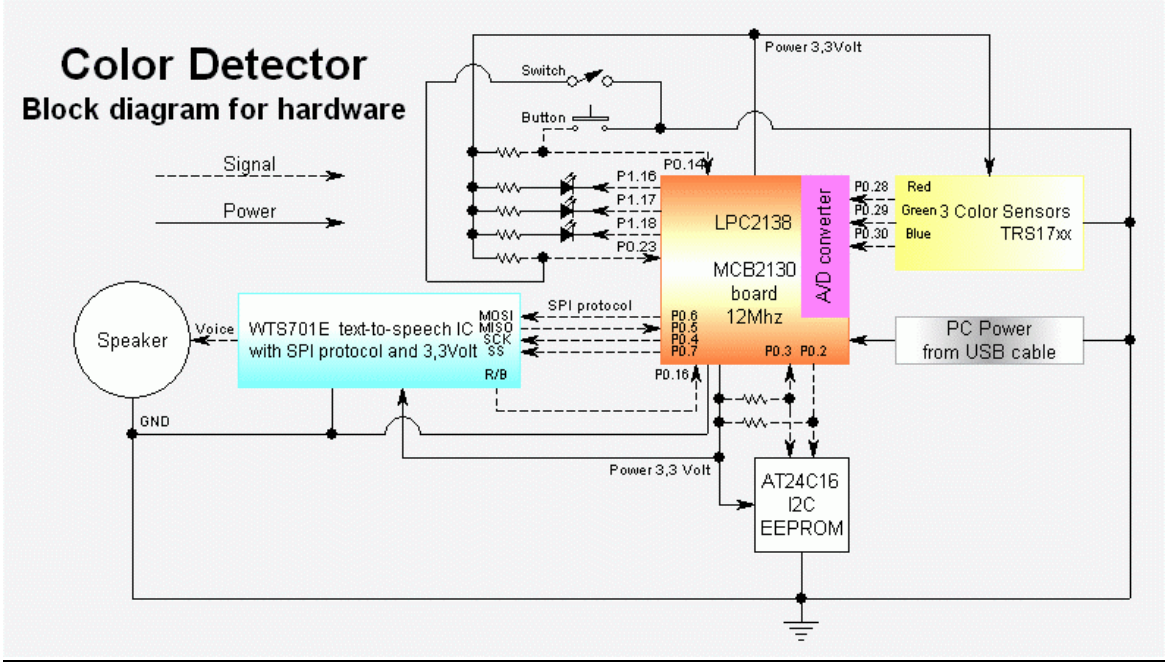


Fig.3

To detect the correct color it is utilizing above-stated algorithm using original database of 40 colors (storied in external EEPROM AT24C16). That vector with most small value in the indicated (Fig.3) 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. One Text-to-Speech IC WTS701E from Winbond with SPI protocol operated in 3,3V.

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



When we have uploaded to LPC2138 FLASH memory the “AR1813.hex” file, then we must execute first the device in “Store mode” to save the colors of surface in EEPROM AT24C16, after that we can use the “Detect mode” for detect the color.

How code in ‘C’ is working?

Logic of “Store mode” is in uploading the colors to EEPROM Memory. These colors will be used as library. This is the prototype colors. I use in the device 40 colors. All colors is uploaded to EEPROM Memory when we press button, after 1 second we can upload the next color of surface to the Memory. To upload these colors we put sensors TRS17xx to the proper color interface and press a button.

Logic of “Detect mode” is to recognize the surface color. We turn the switch in “Detect mode” state and press the button, then is begining the A/D converting. For calculate the **mathematic algorithm** we use in stored EEPROM 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.) 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) 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