USING A LED PANEL TO DETERMINE COLOR BLINDNESS

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It is an independent research work of a student of the eleventh grade of Tallinn Secondary School of Science, 70 hours in length, defended on May 23, 2024. Research work is generally supervised by an in-school supervisor who monitors the course and process of the work and gives advice to the student if necessary. Whenever possible, professional supervisors from the university, who also help determine the topic, are involved in the research work.

BACKGROUND

Statistically, color blindness occurs in 8% of men and about 1% of women, which means that there are currently about 300,000,000 colorblind people in the world. Interestingly, color blindness occurs in about 11% of men in Scandinavian countries. Classically, color blindness is detected with the so-called Ishihara tests. Red-green daltonism, which occurs in 99% of color-blind people, was studied more thoroughly in this research work. [1]

HYPOTHESIS

Different levels of color blindness can be detected with a feedback RGB-LED keyboard by measuring the test subject's reaction time when detecting patterns generated by a pre-planned or pseudo-random number generator.

TEST EQUIPMENT

The keypad is programmed with Arduino Uno microcontroller board.[2] There are digitally controlled RGB addressable LEDs with a WS2812 control IC from SparcFun Electronics inside the keyboard.

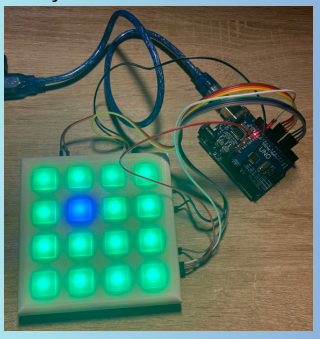

Figure 2. LED keypad for detecting color blindness.

RESULTS

Using the Arduino IDE, the reaction time is recorded in the window of the serial monitor, from where the obtained data is saved for subsequent analysis. The keyboard also gives immediate feedback to the test subject. Thus the test subject will know right away whether he was able to identify the correct pattern or not.

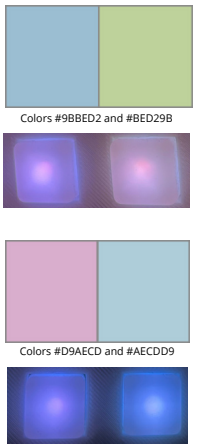

Figure 1. Different color codes printed and visible on LED-s. Left – base color, right – color badly differentiable by color-blind test subject.

On Figure 1 are presented a few of the color combinations that our test subject found the most difficult to differentiate between. It is important to note that the colors look different on the LED panel than on the paper. For that reason I also made pictures of the actual LED panel with the same color combinations.

POSSIBILITIES FOR USE

In the future, the LED panel can be used by medical professionals to detect color blindness. The program does not feel like a medical test, it is more like a game, which can make the test subjects feel more relaxed and therefore give better results. It can be especially useful for children, because children might find it difficult to interact with strangers in an unfamiliar environment, so this way they can feel calmer and get better results.
The color blindness test can also be used as a game.

FUTURE DEVELOPMENTS

By testing the LED panel on different colorblind people, it would be possible to find multiple color variations which are the most difficult to differentiate. It would make the panel more efficient and better at detecting color blindness.
By automatically measuring the difference between the time during which the test subject identifies the correct patterns, the panel could find different combinations with which the test subject has the most difficulties with.

SUMMARY

It is possible to use LED panels as a method to detect different types and levels of color blindness, but it is important to note that all types of LED lights can give off different color variations. Due this, color codes on different LED-platform should be calibrated using professional tools.

[1] Colour blind awareness 2024, Colour blind[awareness website, https://www.colourblindawareness.org/
[2] Raid K., Sell R. *Arduino projektid alustajale*. Tallinn, Robolabor.ee, 2017