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Colour Recogniser (Cfinder) for Visually Disabled People

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ABSTRACT

This project presented an innovative product on colour recognisers for visually impaired people. The colour recogniser consists of three components; first is a microcontroller, second is a colour sensor and third is a pair of speakers. The colour sensor reads the colour of the desired surface or object and sends the reading values to the microcontroller. The microcontroller processes the information and produces the colour audio output through the speaker based on the recognised colour. It is designed to be user-friendly, and easy to carry everywhere as mobility friendly device and help visually impaired people to solve their difficulties to match the colour for everyday life.

Keywords: *Colour Sensor; Microcontroller; Recogniser*

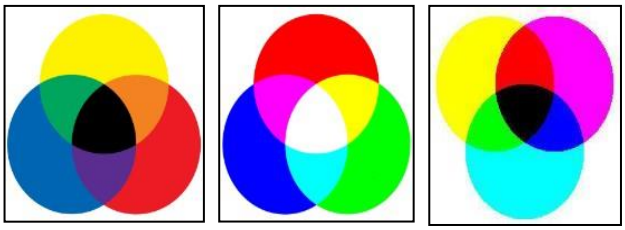
Introduction

Mostly, visually disable people face difficulties in recognising colours for everyday life. This comprises of activity to find colour of cloth, colour of food and surrounding items near them. Prior to this, there are many methods develop to solve this problem like Braille sticker with colour code embedded, help from other person and device that can produce audio output from a colour sensor data. Basically, the third method can be divided into two senses which are reflective sensing and transmissive sensing.

The aim of this project is to develop the colour recogniser for visually disabled people. Therefore, this device should be simple, user friendly, practical, and affordable to those with visual disability. The objective of this study was achieved by, firstly studying the behaviour of disabled people especially for colour recognition, so it helped in choosing the suitable mechatronics design for colour detection, then prototyping by fabricating the mechatronic design for colour detection and after all of that a validation and evaluation process was carried on 12 primary colours.

Methodology

In this project three colour system were used as shown in Fig. 1. There is additive colour system, subtractive colour system and cyan, magenta, yellow and blue (CMYK) colour system are the three colour systems available. For RGB model, the light primaries are red, green and blue. When combining, red and green light rays produce yellow, blue and green produce cyan, red and blue produce magenta. If Red, green and blue mix it will create white (light). This system applies only to devices employing light such as computer monitor.



RYB model *RGB model* *CMYK model*

Fig. 1. Colour System

Next, there is a subtractive colour system: red, yellow, and blue as the basic primary colour. These primaries are the pure colours which cannot be created by mixing any other colours. Secondary colour is the result of mixing any of the two primaries colour. Tertiary colours result from mixing the secondary colour. In subtractive colour theory, all colours mix to form black colour. Lastly, there is CMYK colour system which means cyan, magenta, yellow and black colour system. These four colours are used as primary colour. The CMYK colour system is use in printing industry. When this primary colour is combined, the result is grey [6].

Designing this device should be followed by several stages in both concept development and design process. Those stages will carry on the overall progress in organised and structured ways. Firstly, generating a concept that is unique and original. Secondly, the product design specification should be organised to make the component selection process easier. Third, proceed to construct both functional decomposition and morphological charts. Fourth, concept visualisation for design. For the concept visualisation process, three designs are managed to be produced. Finally, evaluating the concept process by choosing a suitable design. After finishing the design selection, we can proceed to design development. The design development process involves both hardware and software of the design. Completely all hardware and software then, the prototype was done and shown in Fig. 2.

Fig. 2. Finalised design

Results and Discussion

The validation test of the device was performed using the device itself and the serial monitor of Arduino environment software. During that test, the room condition with a moderate light source from the environment up to 550 lux. Several data are acquired from this test, and the data is processed as shown in Fig. 3. This data shows the performance of the device.

The validation of the device was performed to ensure the device is working properly in determining the type of colour correctly. Validation test was carried out using 12 standard colours: red, orange, yellow, green-yellow, green, green-cyan, cyan, blue-cyan, blue, blue-magenta, magenta, and red magenta. These colours are chosen because of the specification of the devices utilised all this colour.

Enough information was collected regarding the trend of colour sensor; however, there is a slight difference between device sensor data and colour wheel data. For example, for orange colour, by comparing the standard colour wheel with the graph trends the result is

found that the red component is more dominant than the green component. Also, for the cyan both results show the same that the blue component will be dominant and green component will be second place dominant. The result for magenta shows that the red component will be dominant and blue component will be second place dominant which is the results of both standard wheel and the graph trends. Comparing the result of graph trends of blue-magenta with the standard colour wheel, the comparison shows that both colour are the same level.

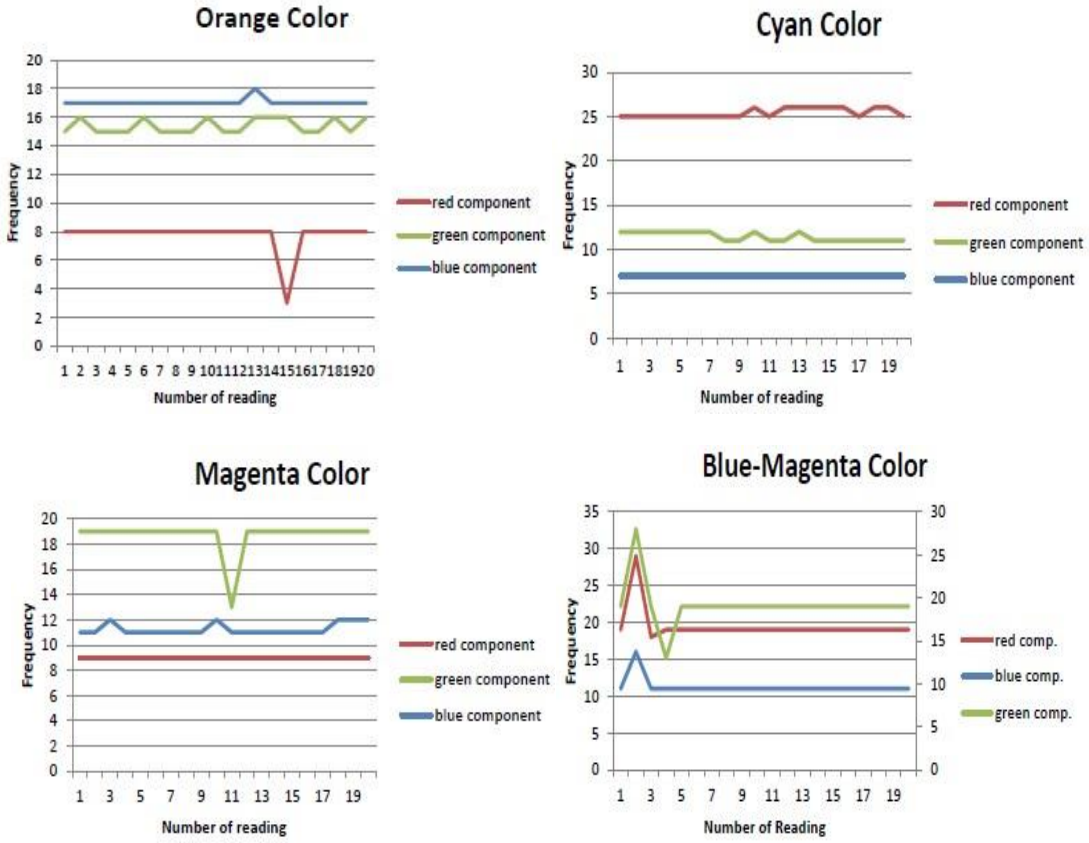


Fig. 3. Frequency against number of readings for orange, cyan, magenta and blue-magenta colours.

According to the graph trend for red colour, the red component will be lower to green and blue component because the dominant colour which is red component will be filtered out. So, the concept is similar to colour wheel data where dominance colour will be higher than another component. This is the same with green and blue colours where their corresponding component, green and blue components, will be lower.

After all, there are additive colours which are yellow, yellow-green, green-cyan, blue-cyan and bluemagenta, Additive colour is combination between 2 primary colour consist of red, green and blue. For example, we focus on yellow colour. For yellow colour, according to standard colour wheel the dominant colour component will be red component and the second-place 2 dominant will be green. So, it is comparable with graph trends of yellow colour, which shows the red component will be dominant than the green component.

Conclusion

The device is beneficial and useful to assist people with visual disability to determine type of colour in their surrounding object. The design of the device is very user friendly, practical and cost effective. The size of device also is acceptable to hold by human hand. Colour recogniser was successfully developed with medium accuracy and available at affordable price. Also, this device was fabricated using 3D printing and contains electronic circuit. Then, validation of the colour recogniser has proved the ability of colour recogniser. Lastly, this device will be useful for visually disabled people and can help them to solve their everyday problem.

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