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VISION TO COLOUR BLIND

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Introduction:

Colour blind people aren't blind its just that they aren't able to distinguish between Red, Green and Blue colour properly. There are three types of colour blindness red-green, blue-yellow and complete colour blindness. In red-green and blue-yellow blindness human being are unable to differentiate both colour if kept together. In total colour blindness people don't experience colour at all and the clearness of their vision may also be affected.

Problem statement:

Everyone in this world aren't God gifted with proper vision of colour. In India it is very common over 10 million cases are found with this problem (According to the research done by Apollo Hospitals). Create a fully workable project to conquer this problem.

Solution:

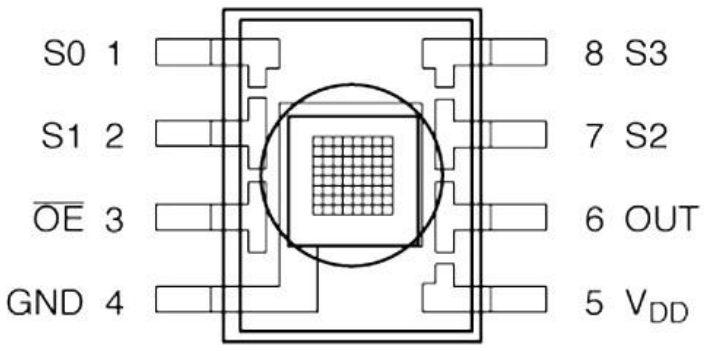
The solution for this real-life issue is really simple and easy that we found. We decided to make a device which would basically get the wavelength or the frequency of the colour. So, for this we found a sensor known as TCS3200/3210. The following sensors had only small difference which was of no of photodiodes for each colour. In TCS3200 there are 16 photodiodes for each colour which gives more accurate output as compared to 8 photodiodes in TCS3210. Using TCS3200 and Arduino we made a compact solution for the above problem.

TCS3200 working:

Programmable colour light to frequency converter that combines configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit.

Frequency directly proportional to irradiance.

In the TCS3200, the light-to-frequency converter reads an 8 x 8 array of photodiodes in which it has sixteen photodiodes of blue filters, 16 photodiodes of green filters, 16 photodiodes of red filters, and 16 photodiodes are clear with no filters.



TCS3200 Color Sensor Pinout

The four types (colours) of photodiodes are interdigitated to minimize the effect of non-uniformity of incident irradiance. All photodiodes of the same colour are connected parallelly. Pins S2 and S3 are used to select which group of photodiodes (red, green, blue, clear) are active. Photodiodes are 110µm x 110µm in size and have 134-µm centres.

Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
GND	4		Power supply ground. All voltages are referenced to GND.
$\overline{OE}$	3	I	Enable for f_o (active low).
OUT	6	O	Output frequency (f_o).
S0, S1	1, 2	I	Output frequency scaling selection inputs.
S2, S3	7, 8	I	Photodiode type selection inputs.
V_{DD}	5		Supply voltage

Table 1. Selectable Options

S0	S1	OUTPUT FREQUENCY SCALING (f_o)
L	L	Power down
L	H	2%
H	L	20%
H	H	100%

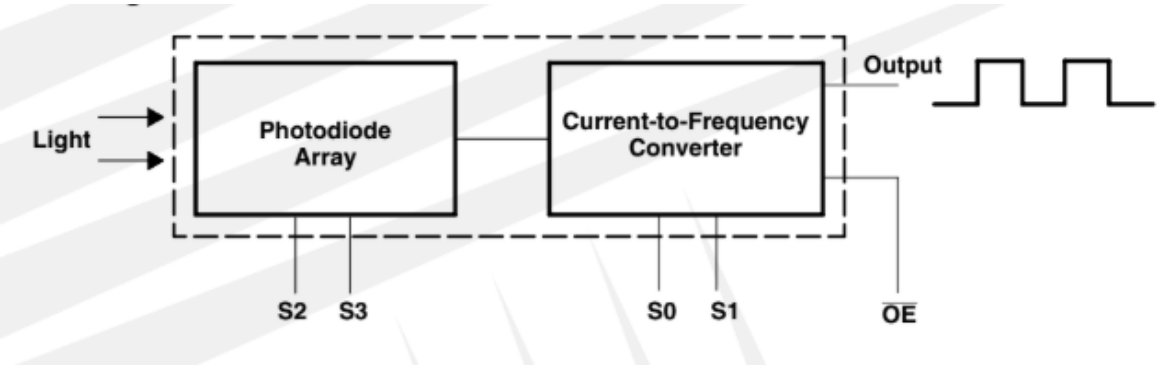
S2	S3	PHOTODIODE TYPE
L	L	Red
L	H	Blue
H	L	Clear (no filter)
H	H	Green

The intensity of each colour has a different frequency. The Arduino used here has the fixed output frequency to 100% by applying HIGH to S0 and S1 pins of the colour sensor. The S2 and S3 pins of the colour sensor will select the type of colour diode active.

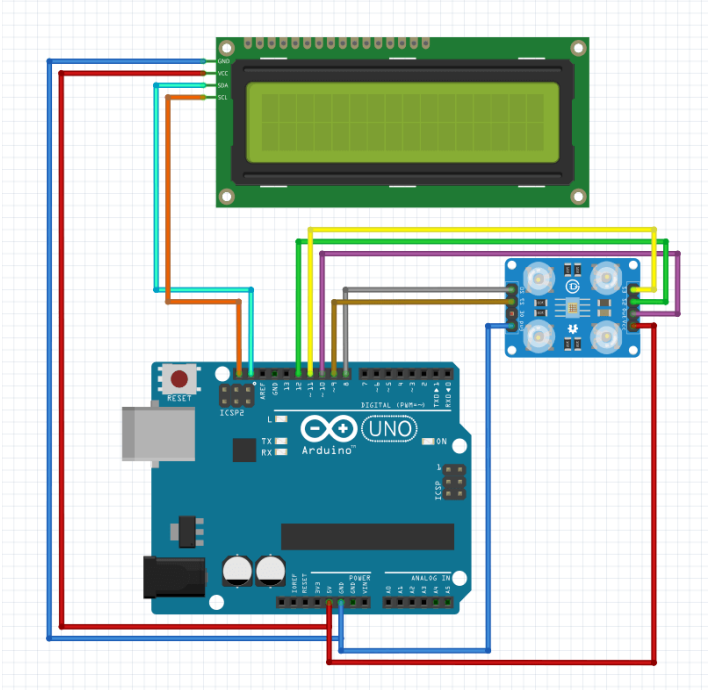
When a particular photodiode is selected, the PULSEIN feature on the Arduino is activated. This is connected to the output of the colour sensor which helps to calculate the variation in output signal.

This is the same for the other photodiodes, Red, Green, and Blue. In each case, the frequency is measured using the PULSEIN feature and is displayed on the Serial Terminal.

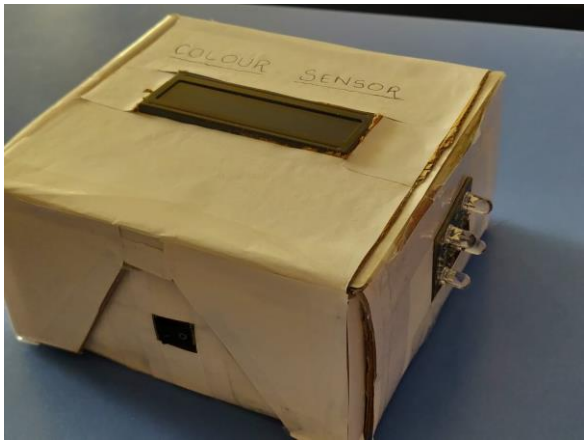
The colour is therefore detected and displayed onto the LCD which lights up.

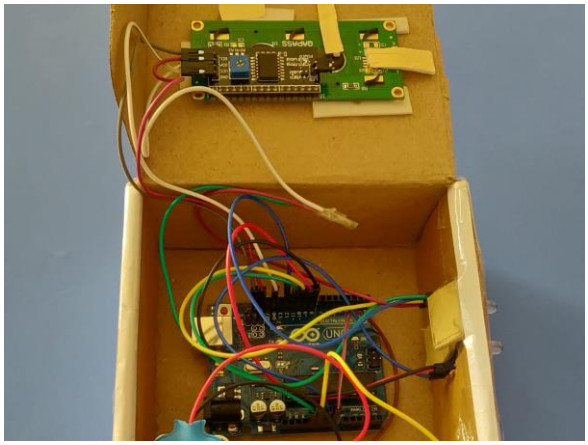


Circuit Diagram:



Project Images:





Conclusion:

The code has been uploaded here:
https://github.com/synchronise/TCS3200

The video of illustration is uploaded here:
https://youtu.be/x_JMx8fD3CE

References:

1) https://scholar.google.com
2) https://circuito.io
3) https://arduino.cc
4) https://hackster.io