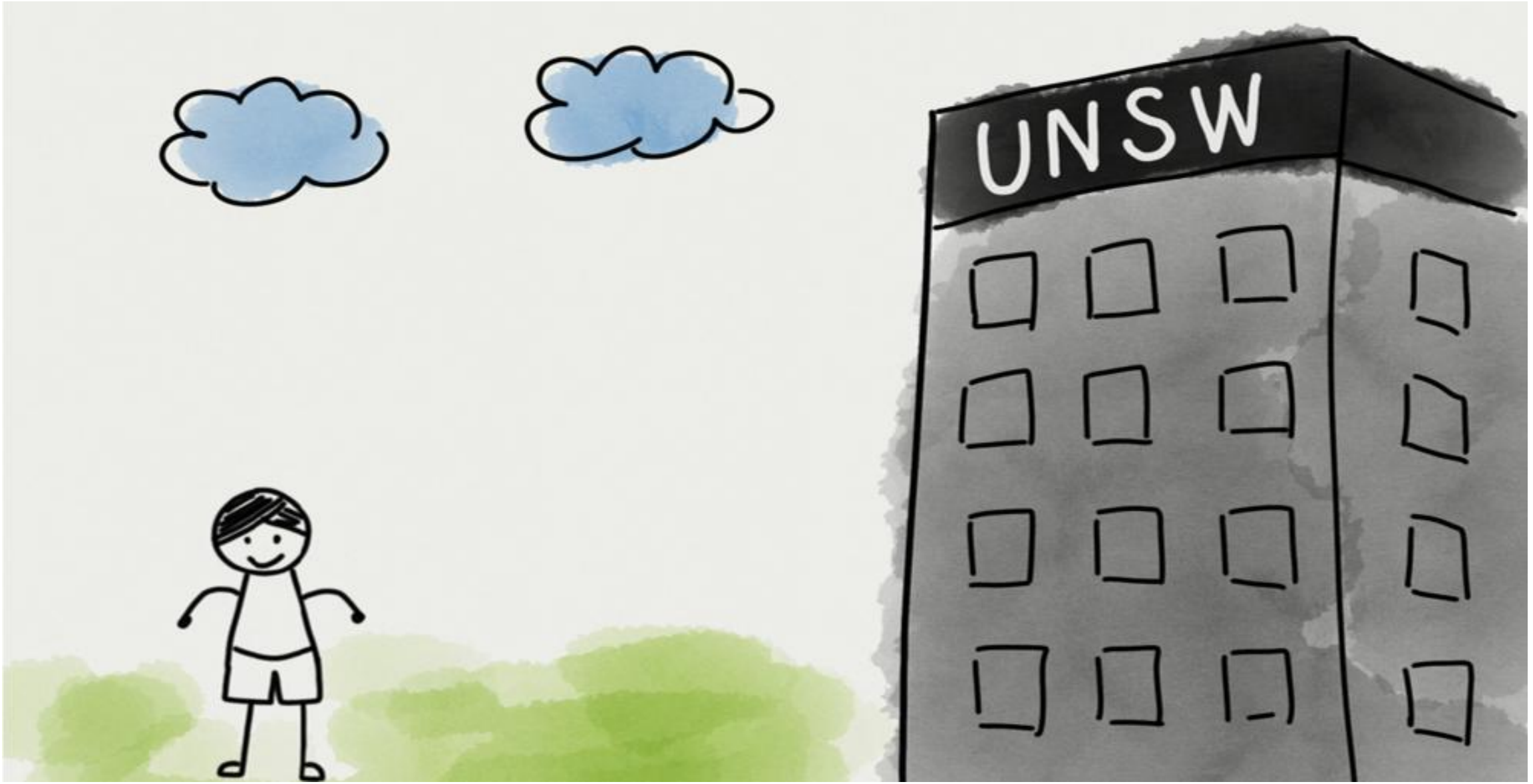

UNSW


Lecture
01:58
Exit
Biologist
CG
ZZ
WC
LQ

Desn2000 Group Project

EE&T – ambient light sensor for seabird conservation project

Group members:

ChengLong Gao

Liang Qiao

Wenyao Chen

Zhengda Zhong

Problem definition

From:https://www.fws.gov/panamacity/redknot.html

Ambient light sensor for migratory birds

From:http://www.avianbiology.org/blog/comparing-geolocator-and-high-precision-gps-data

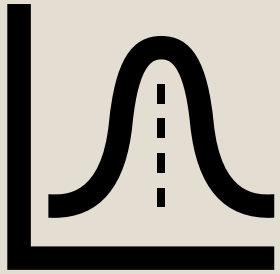
Biologist 's point of view

Long lasting

A
good sensor
should be ...

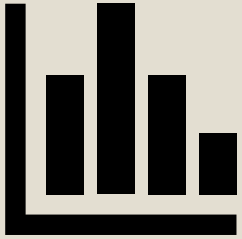
<5%

less than 5% of
the bodyweight



Wide data range

competitive cost



Easy to analysis

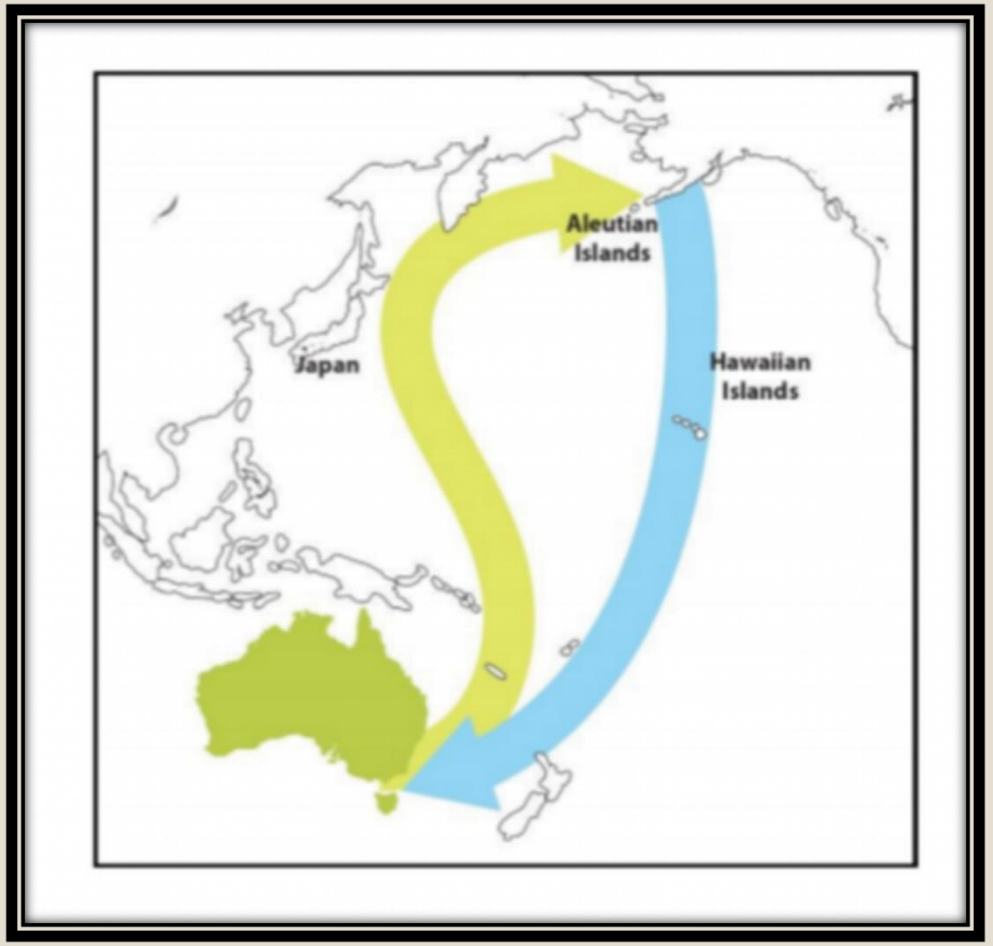
Research subject must conform

Long scale movement

Return to the same site

Solution

Research Subject



From: https://www.penguins.org.au/assets/Conservation/Education/PDF/2017-NN-Short-tailed-Shearwaters.pdf

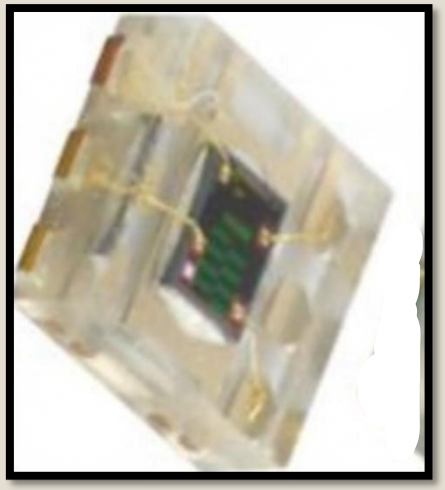
Research Subject

Body weight: ~500 grams

Light level geolocators weight: ~0.3 grams

(<< 5% weight)

Sensor selection



analogue ambient light sensor

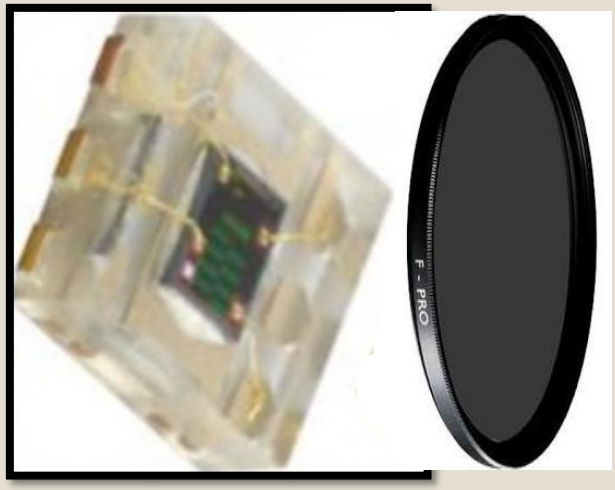
luminosity range: 0.3 ~ 10k lux

Sensor selection

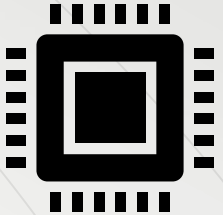
Original sensing range

New luminosity range:
0.3 ~ 100k lux

Overall ambient luminosity decreased by a constant factor

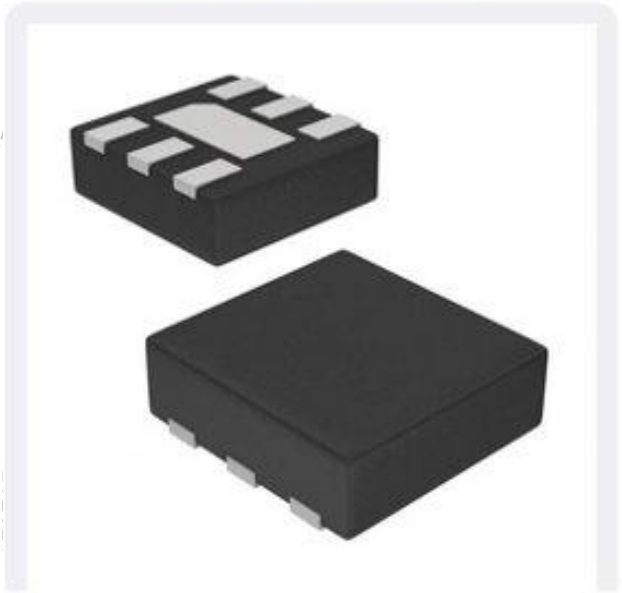


Technical validation



model	price (AUD)	peak wavelength (80% responsivity)	luminosity range (lux)	current draw (max)	input voltage (V)	output voltage (V)
ISL29102	2.48	480 - 600	0.3 - 10k	15uA	1.8 - 3.3	0 - Vin
ALS-PT19	2.50	570 - 640	0 - 10k	520uA	2.5 - 5.5	0 - Vin
APDS-9006-020	2.16	490 - 560	0 - 1k	52uA	2.4 - 5.5	0 - (Vin - 0.7)

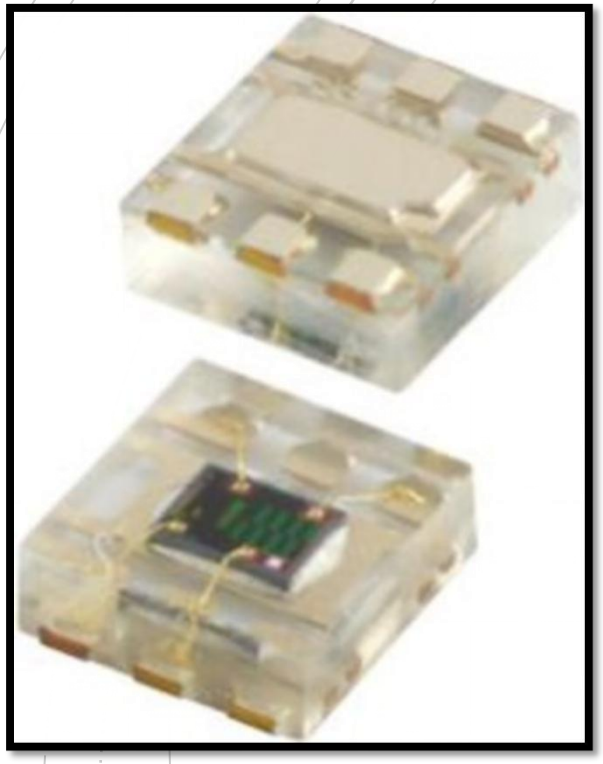
ISL29102IROZ-T7



ALS-PT19

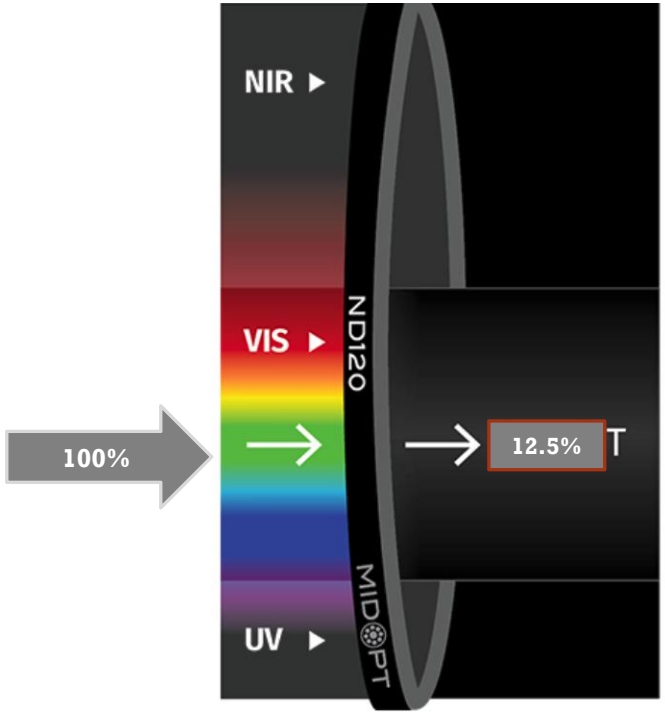
APDS-9006-020

Renesas ISL29102 – Low Power Ambient Light Sensor

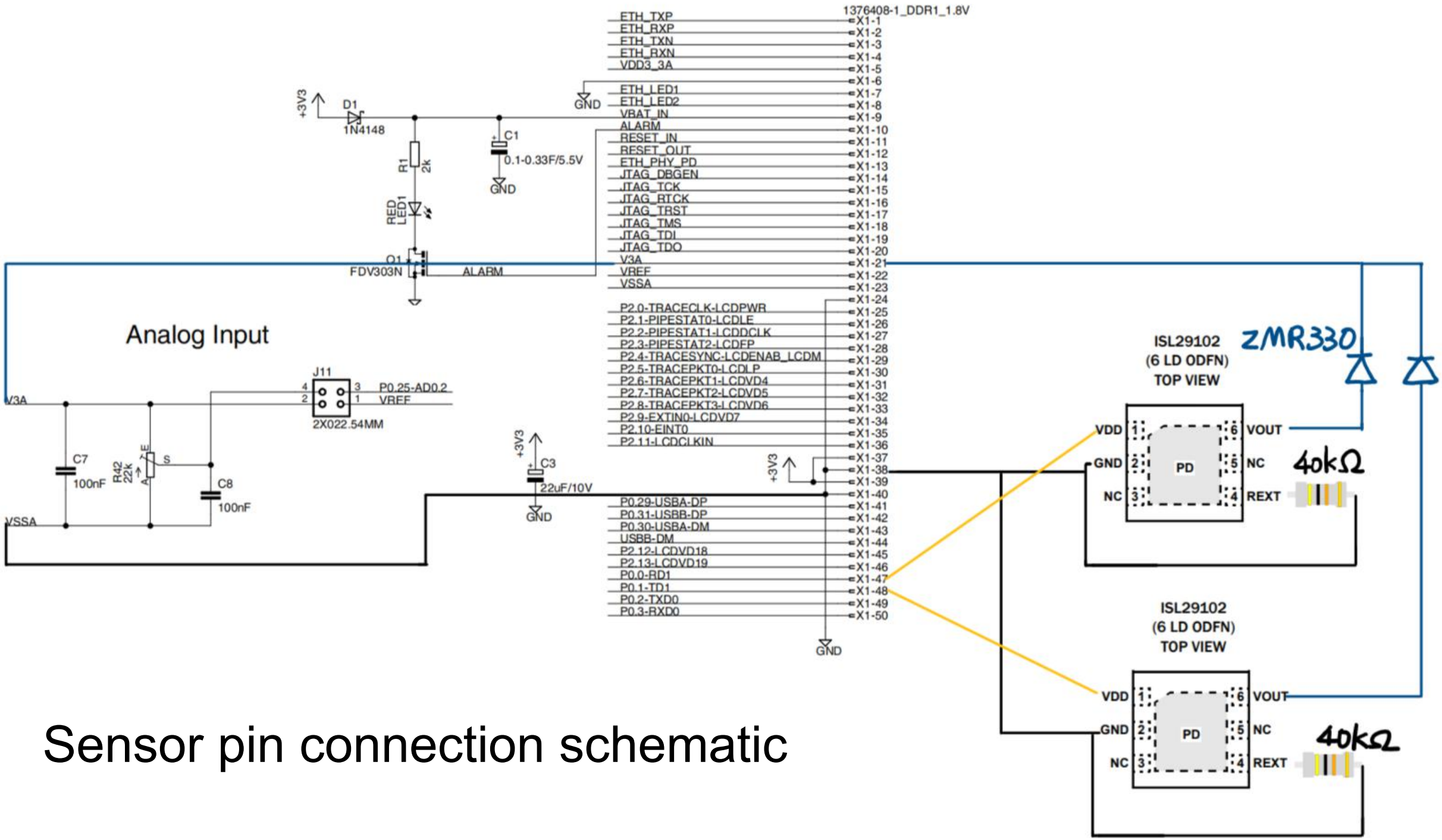


From:https://static6.arrow.com/aropdfconversion/arrowimages/641125d437f29ffe544f425309809046334eed6f/cq5dam.thumbnail.319.319.jpg

Wavelength: 400-800nm
Voltage: 1.8-3.3v
Current: <10mA
Senitivity: 0.3-10,000 lux

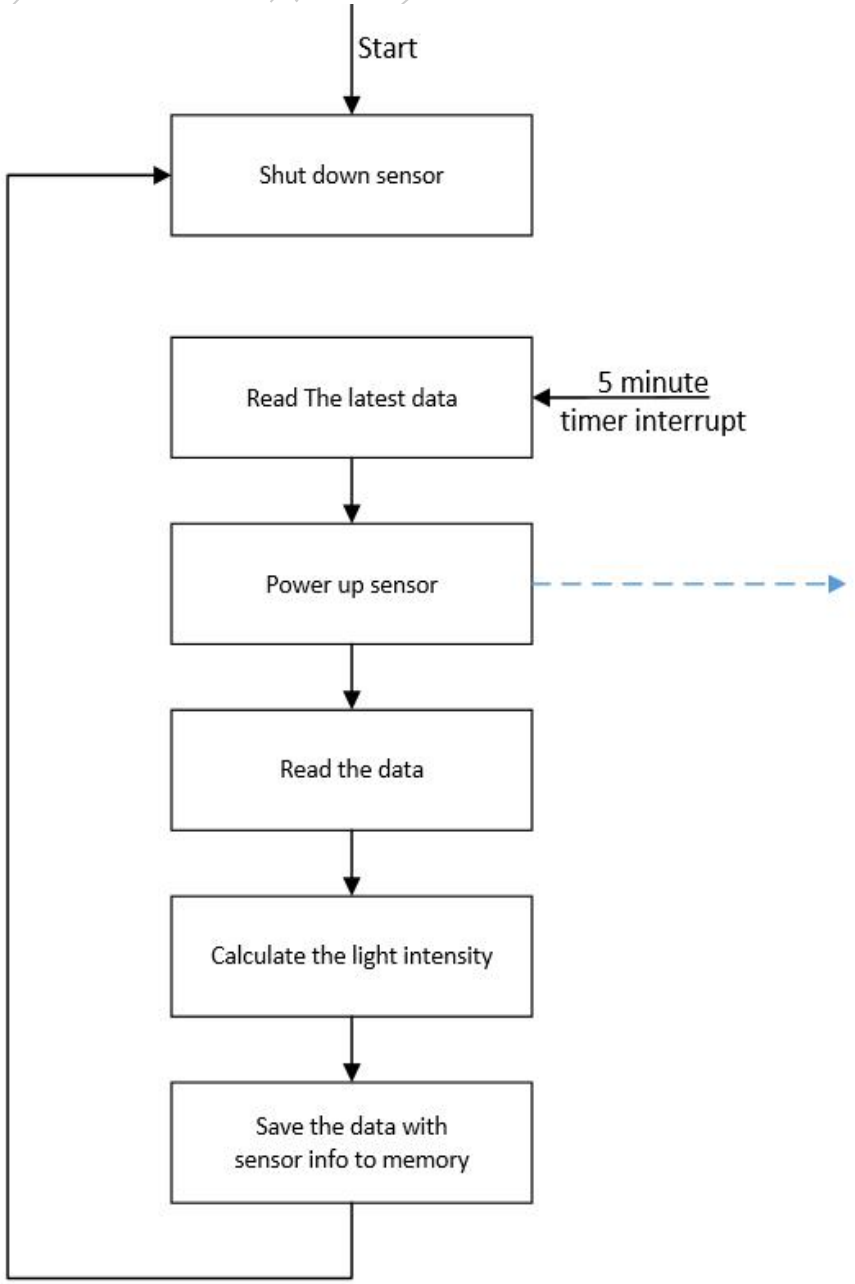


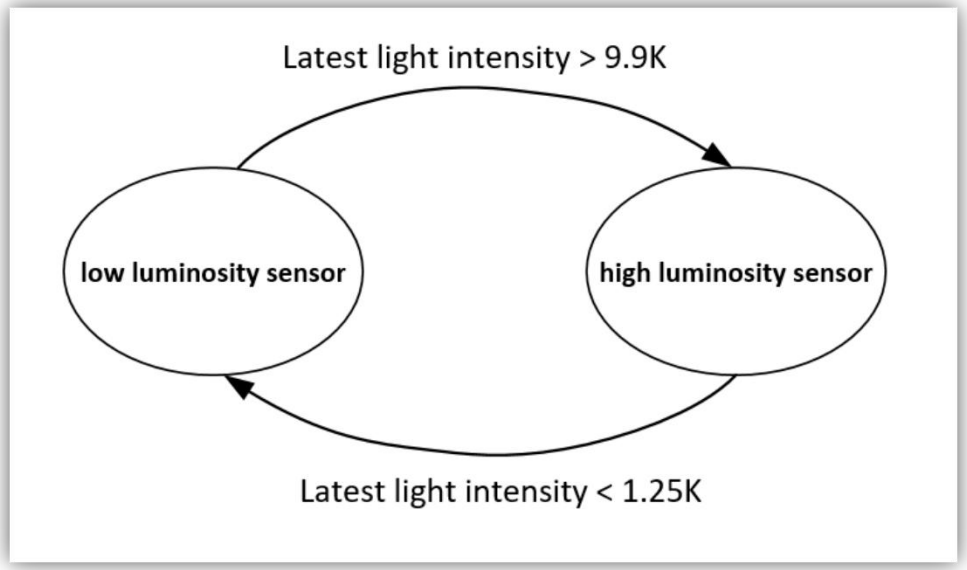
Neutral Density Filter



Sensor pin connection schematic

Flow chart of the logic





NXP ARM7 -LPC2478

Power consumption comparison

	LPC2478	M4-Cortex
annual power consumption	~991mAh	~14mAh

button cell battery capacity	220mAh

Atmel ARM M4-Cortex SAM4L

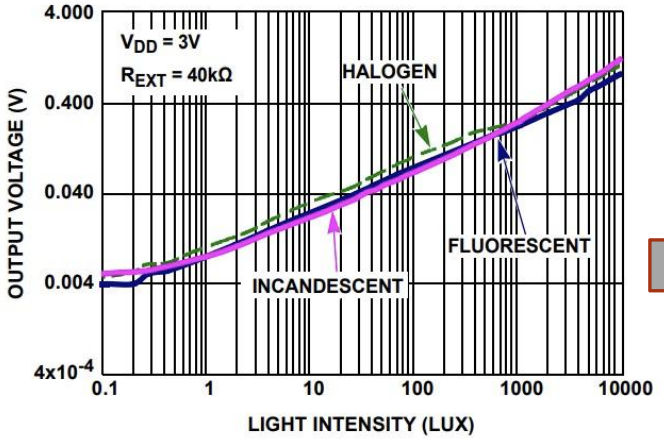
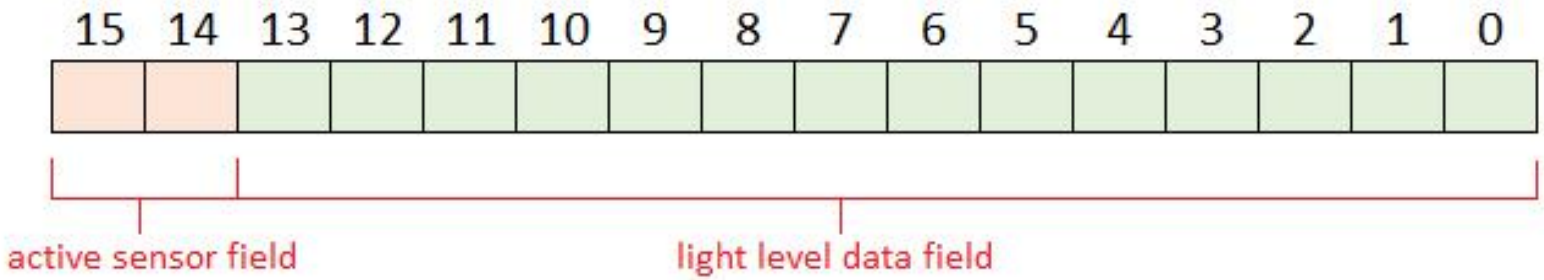


FIGURE 7. OUTPUT VOLTAGE vs LIGHT INTENSITY

From: ISL29012 datasheet

```
9 #define get_intensity(x) (exp((log(x) + 0.539) / 0.6393))
```



number of readings per hour		number of hours per day		number of days per year		bytes needed per reading	total bytes needed per year
12	x	24	x	365	x	2	210240

optical sensor prototype test setup

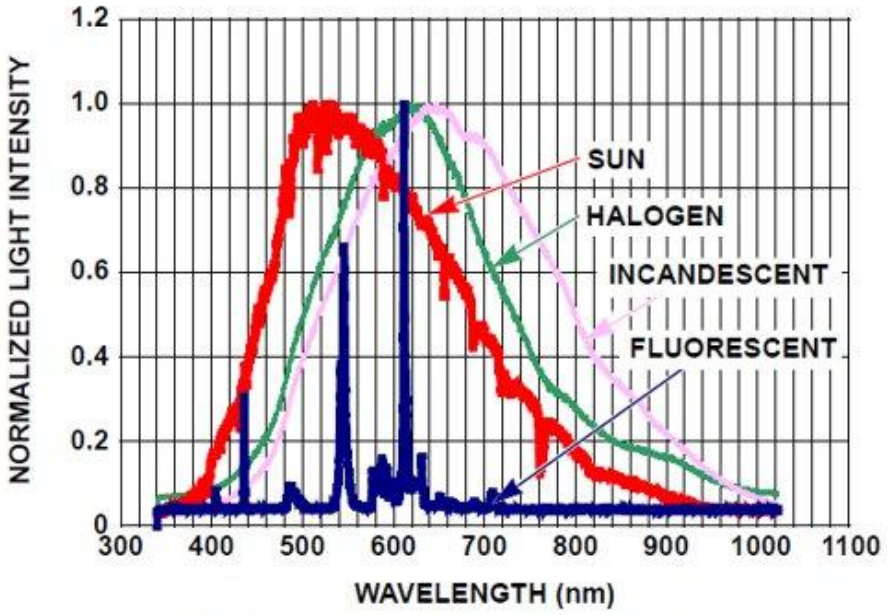
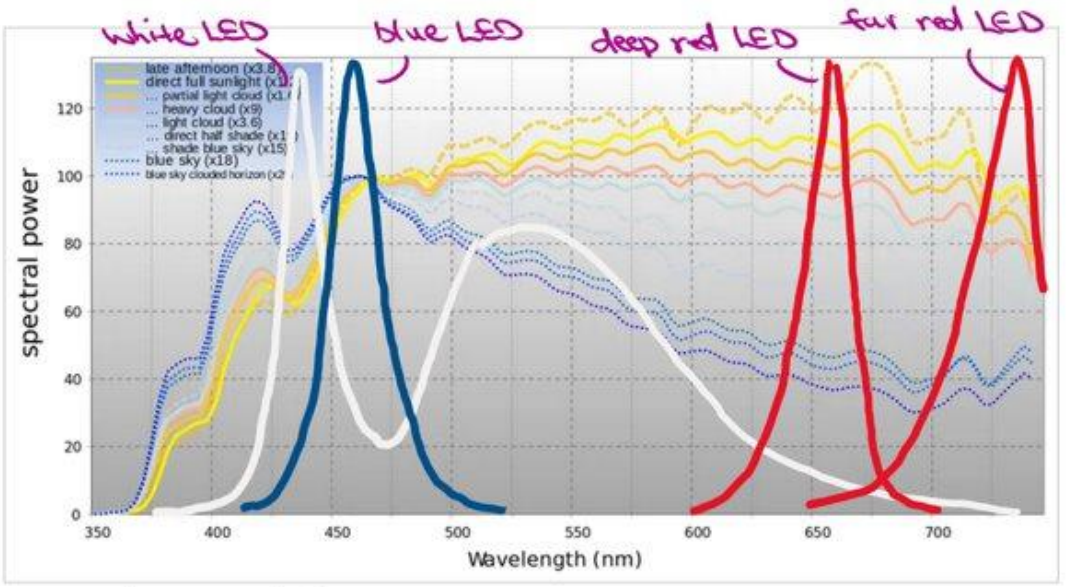
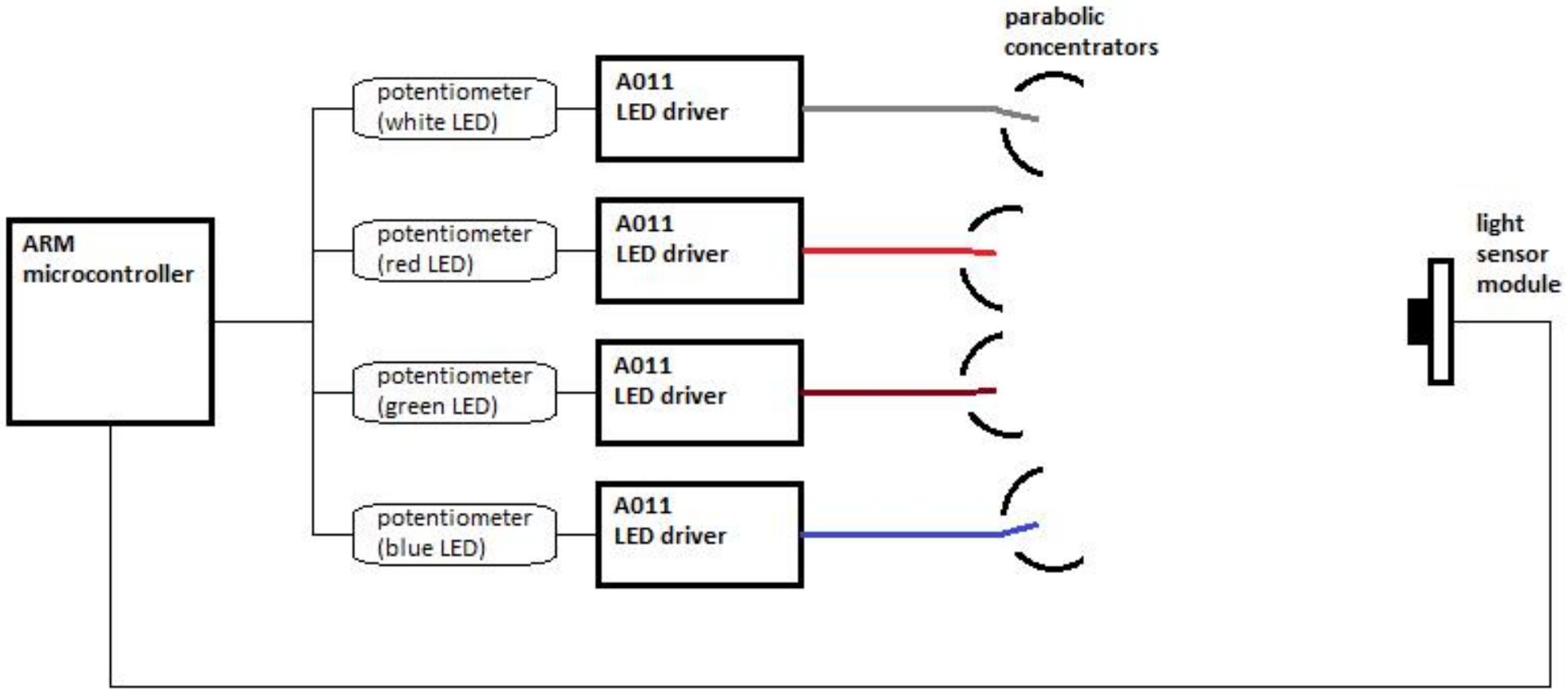


FIGURE 5. SPECTRUM OF LIGHT SOURCES

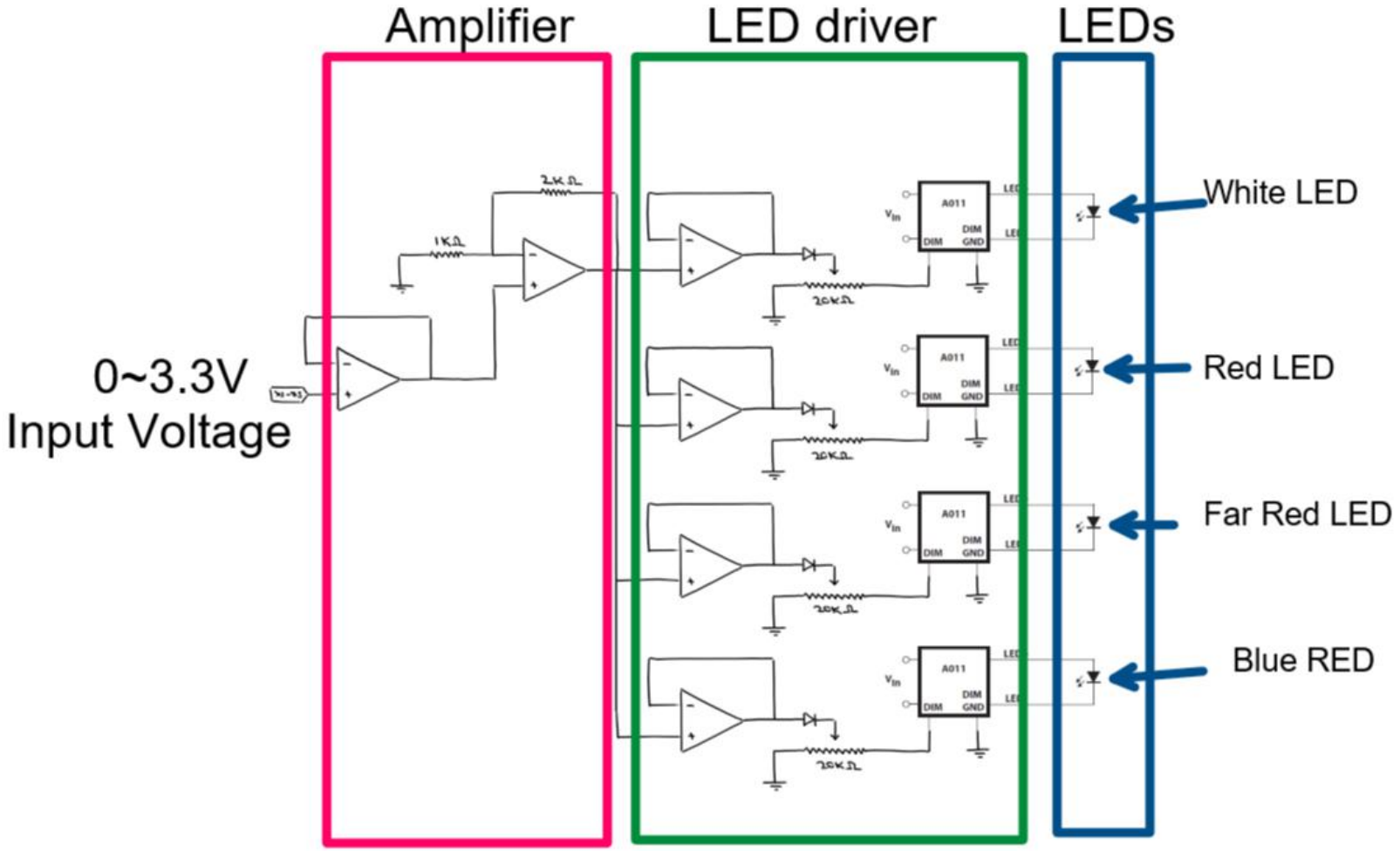


Source: https://en.wikipedia.org/wiki/Sunlight

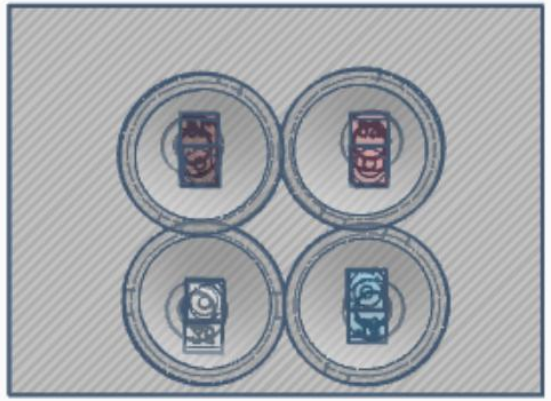
Spectral distribution

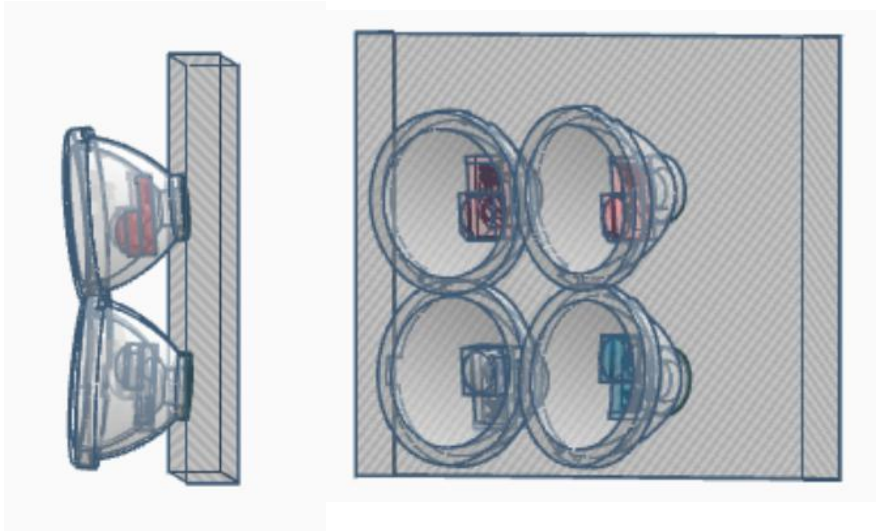


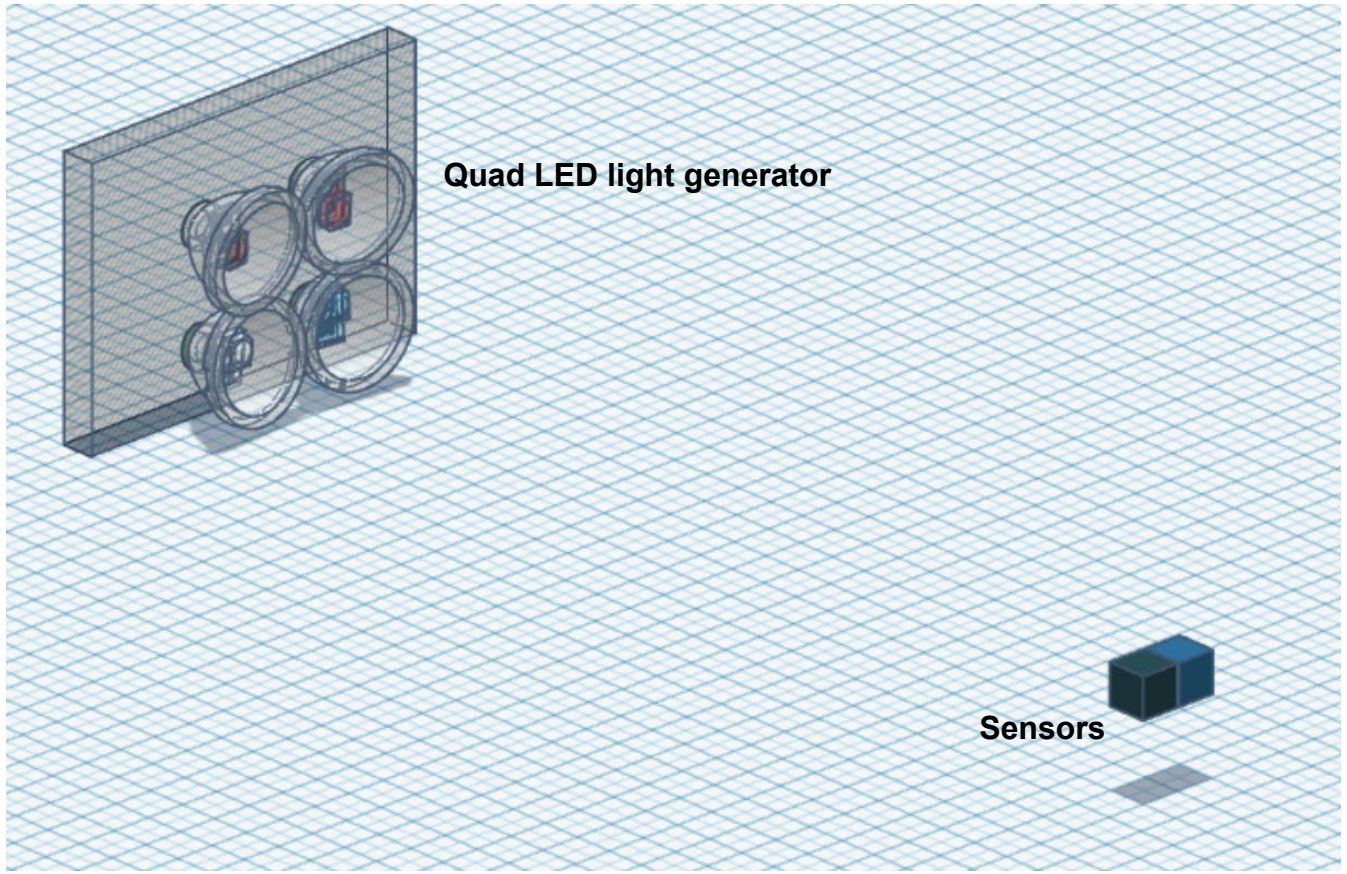
Block Diagram of the apparatus



Schematic of the light generator







CAD illustration of the apparatus

Table: bill-of-material (BOM) table for the light generator

components	part name	part number	quantity	cost (USD)
white LED	Cool White (6500K) Rebel LED on a SinkPAD-II 25mm Square Base with 9° Optic	SP-12-W4	1	13.98
deep red LED	Deep Red (655nm) Rebel LED on a SinkPAD-II 25mm Square Base with 9° Optic	SP-12-D2	1	14.85
far red LED	Far Red (720nm) Rebel LED on a SinkPAD-II 25mm Square Base with 9° Optic	SP-12-D4	1	13.85
blue LED	Blue (470nm) Rebel LED on a SinkPAD-II 25mm Square Base with 9° Optic	SP-12-B6	1	18.75
LED driver	700mA Dimmable FlexBlock LED driver - With Leads	A011-D-V-700	4	17.49
20k potentiometer	rotary potentiometer 20k ohms	PTV09A-4030U-B203	4	1.07
neutral density filters	Neewer 58mm neutral density ND2 ND4 ND8 ND16 filter and accessory kit	B06XRVYCPV	1	11.79
diode	smart bypass diode, 30V reverse breakdown	SM74611KTTR	4	5.22
total (USD)				168.34
total (AUD)				228.94

$ Bill-of-material table

Thank you!