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Group 4B

Week 10 studio 1

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Activity 1

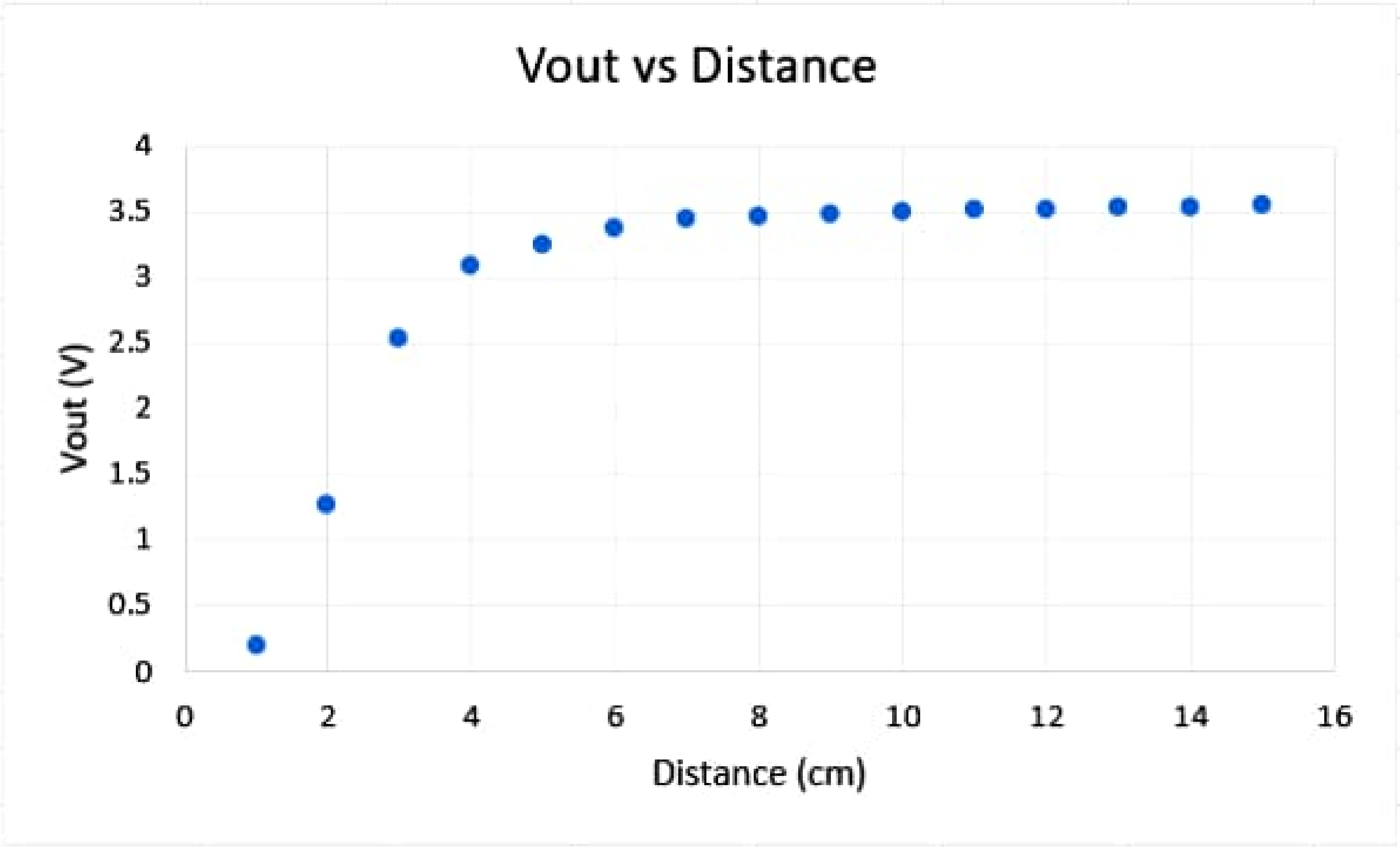
1. From the IR Emitter datasheet, the radiation diagram shows the relative radiant intensity is closer to 1 the closer the viewing angle is to 0°. From the IR Detector datasheet, the sensitivity diagram shows the relative sensitivity of the detector is closer to 1 the closer the angle is to 0°. Hence, for optimal result when the detector is most sensitive to IR light of matching wavelength produced by the IR emitter at greatest radiant intensity, the incidence angle should be as close to 0 as possible, thus the IR pair should be placed close to each other

* Measure Vout to 2 dp

6.

Distance between object & sensor (cm)	Vout (v)
1	0.20
2	1.26
3	2.54
4	3.08
5	3.24
6	3.38
7	3.44
8	3.47
9	3.48
10	3.50
11	3.51
12	3.52
13	3.53
14	3.54
15	3.55

7. ~ insert scatter plot of Vout vs distance ~


Vout vs Distance
Vout (V)
Distance (cm)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
2
4
6
8
10
12
14
16

8. At small distances of about 0 to 1 cm, Vout increases at a very slow rate
From 1cm to 4cm, Vout increases at a linear and much faster rate of
about 0.91 V/cm. Beyond 4cm, Vout increases at a much slower rate
and slowly plateaus off

Sensitivity is the amount of change in a sensor's output in response to a
change at its input. Hence, the IR sensor is the most sensitive when its
slope from the Vout vs Distance curve is largest. The IR sensor is most
sensitive around 1cm to 4cm working distance. Before or beyond that, it
is much less sensitive

9. The optimal working distance for this IR sensor should be about 1cm to 4cm
where it's most sensitive and a small change in distance produces a large voltage
change

Activity 2

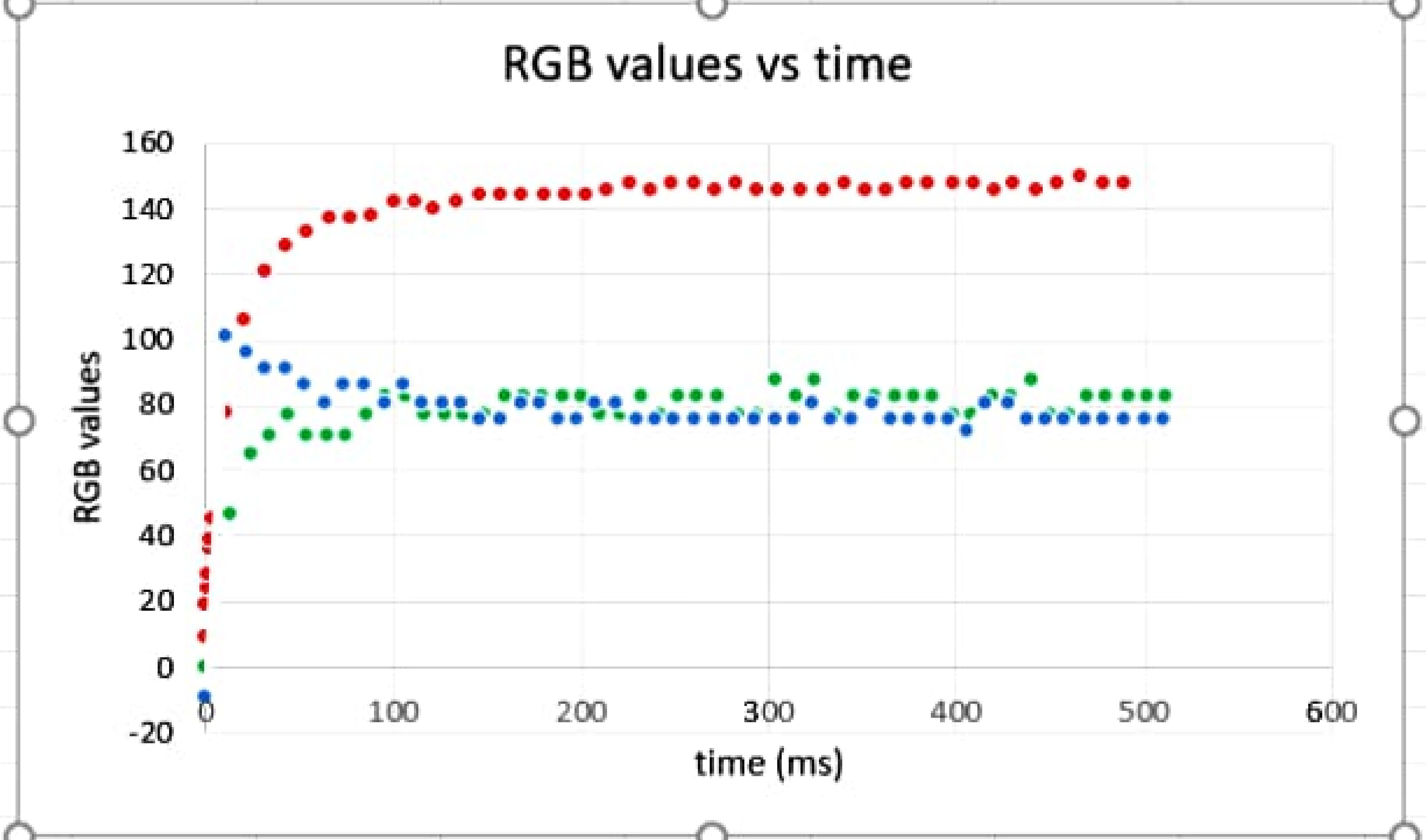
A. LDR Response Time

2. pinMode (pin, mode) configures the specified digital pin to behave either as an
input or output. However, the LDR sensor pin at A0 reads in voltage at A0
which is an analog input. Hence we only need to call analogRead (LDR) to
convert input voltage to a 10 bit value between 0 to 1023

millis () returns the number of milliseconds passed since the Arduino
board began running the current program. Since print (millis ()); is called
when printColour(reading) is called, it prints out the time elapsed since the
start for each RGB reading.

12. ~ insert RGB plot ~ I used a red piece of paper

13. From the graph, it takes about 90ms for all 3 colours to
stabalise and return constant RGB values.


RGB values vs time
160
140
120
100
80
60
40
20
0
-20
RGB values
0
100
200
300
400
500
600
time (ms)

B. Importance of Proper Calibration

1. The function responsible for sensor callibration is setBalance () Everytime the Arduino board is reset, the white Array [] , blackArray [] and grey Diff [] would be reset to {0, 0, 0}. Hence we would need to generate the value for these arrays again to get accurate readings of colours later.

2. The calibration function should not be omitted as different environments or different times when the experiment is conducted may cause the same sample colour to have different RGB values due to changes in lighting. To maintain accuracy and repeatability of results for the same sample, the sensor should be recalibrated to match the current conditions.

3. If a not so white or not so black object is presented as the white or black sample, the difference between the white Array and black Array which gives the grey Diff array is smaller. Hence, the range of colours the sensor can detect decreases. The RGB values would be compressed within this new max - min range