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Prediksi Mikroorganisme pada Tambak Udang berbasis Neural Network

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Outline

01 Background of The Study

02 Purpose of The Study

03 Problem Formulation

04 Scope and Limitation

05 Review of Literature

06 System Design and Progress

Background of The Study

In aquaculture, especially shrimp ponds, we need to pay attention to the environment where the cultivation is in order to obtain maximum result. Water quality is one of the most important things to pay attention to. In fact, the most important factor in water quality is the oxygen content, which affects the pH value. Often this level is influenced by aquatic bio-organisms, especially algae. Algae monitoring can be done by looking at the color of the water. This is where the idea for the study of water quality came from. It is hoped that this tool will be able to monitor algae as in a lab test

Purpose

- Creating a tool to record data on samples
- Create a prediction system based on recorded data

Problem formulation

- How to create device for data sensing and collecting
- How to make good model for predict the sample

Scope and Limitation

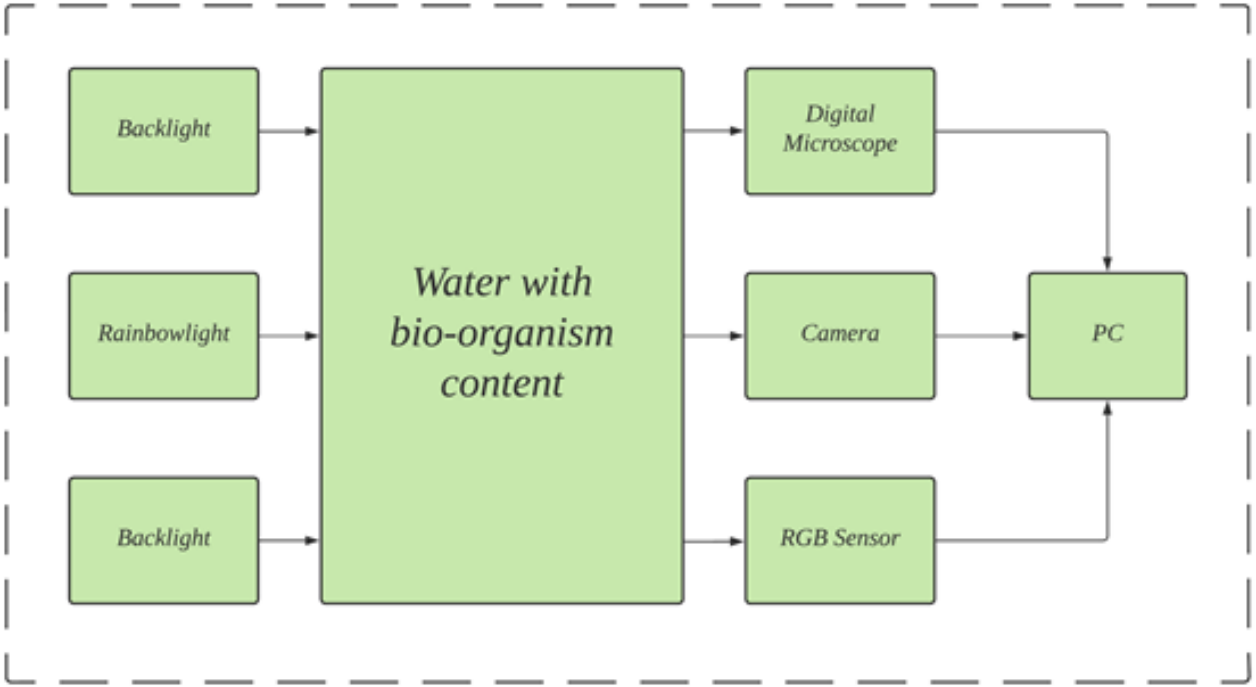
- Sample is conditioned data whose concentration level is known.
- Model is created from the data recorded from the device

Literature review

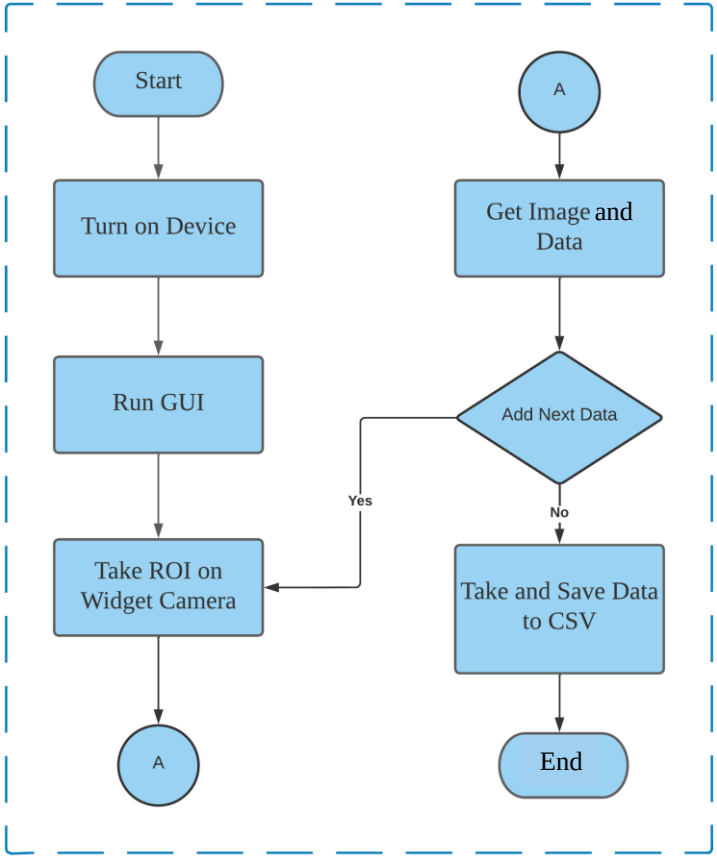
A. I. Gunawan, B. S. B. Dewantara, A. E. Pratama, I. Puspitasari, T. A. Setya. (2019). A Study for Estimation of Bio Organism Content on Aquaculture Pond Based on Image Color and Light Intensity. International Electronics Symposium on Engineering Technology and Applications (IES-ETA). Surabaya, Indonesia, : doi:10.1109/ELECSYM.2019.8901544.

O. Meiyanto, A. I. Gunawan, dan B. S. B. Dewantara. (2021, November). Studi Analisis Konsentrasi Warna Pada Cairan Pewarna Makanan Dengan Metode Pengukuran *Optical Density*. Briliant, Hal. 710-725.

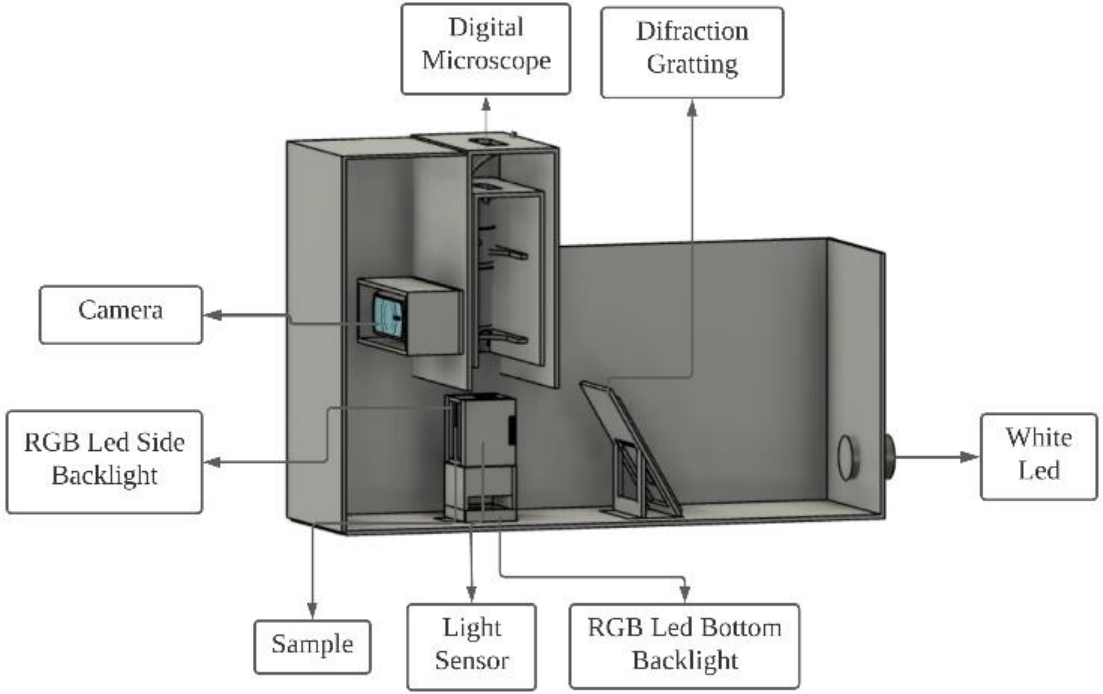
System Design



Flowchart


Start
Turn on Device
Run GUI
Take ROI on Widget Camera
A
A
Get Image and Data
Add Next Data
Yes
No
Take and Save Data to CSV
End

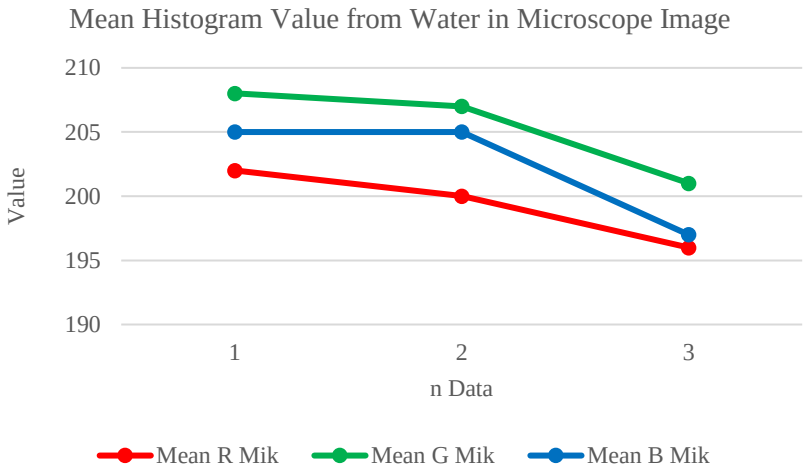
Prototype Design

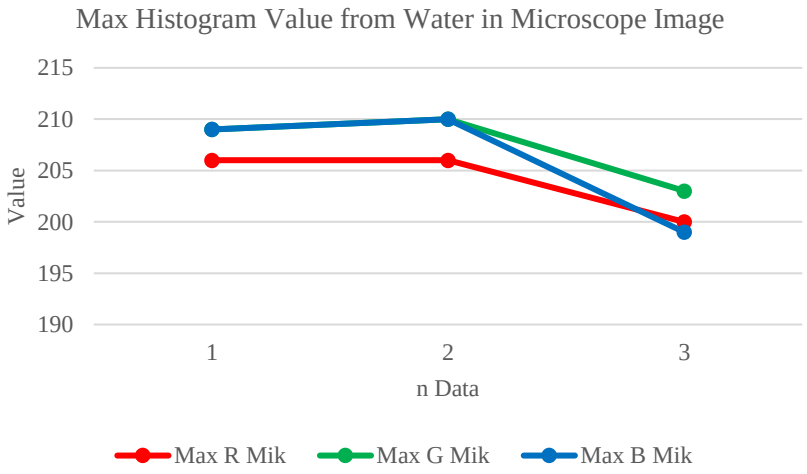


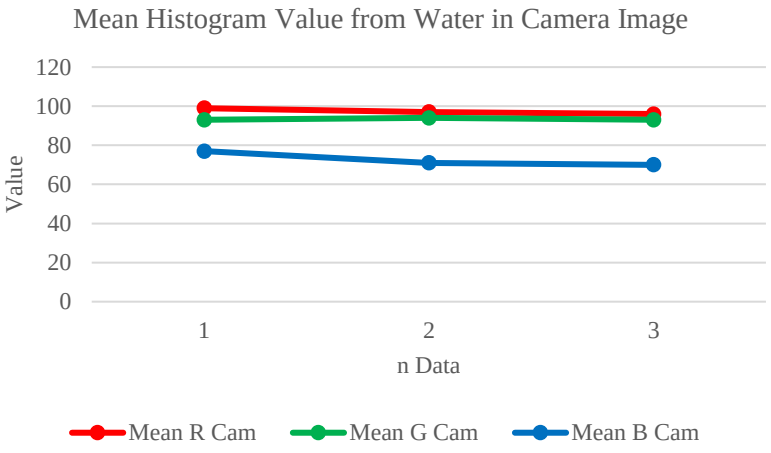
Prototype

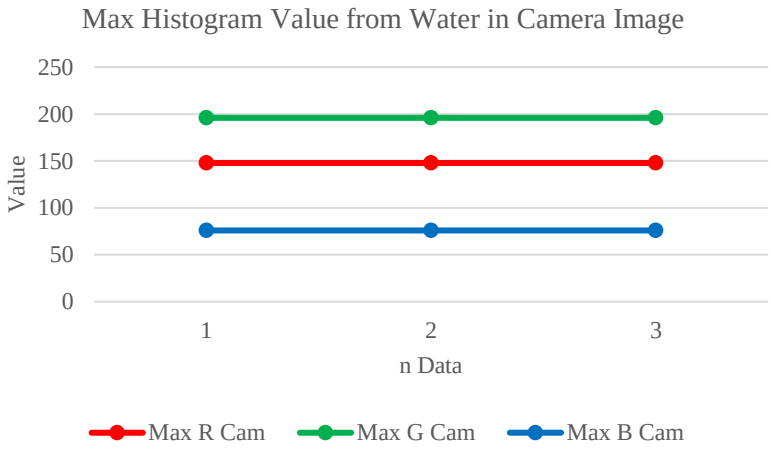
Data

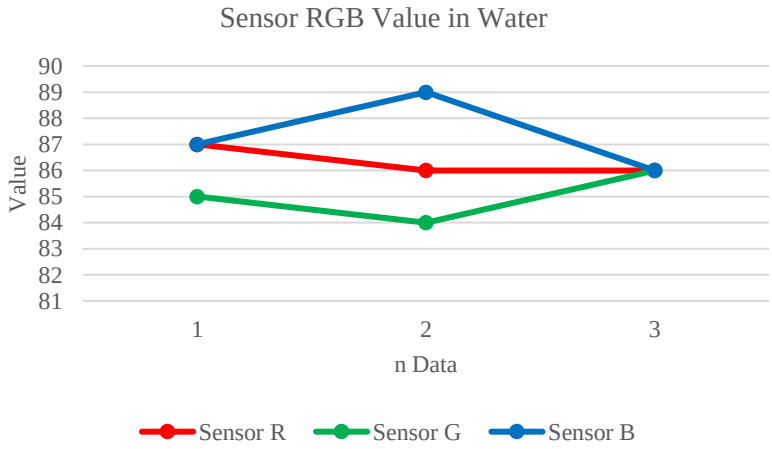
Water


Mean Histogram Value from Water in Microscope Image
210
205
200
195
190
Value
1
2
3
n Data
Mean R Mik
Mean G Mik
Mean B Mik


Max Histogram Value from Water in Microscope Image
215
210
205
200
195
190
Value
1
2
3
n Data
Max R Mik
Max G Mik
Max B Mik


Mean Histogram Value from Water in Camera Image
120
100
80
60
40
20
0
Value
1
2
3
n Data
Mean R Cam
Mean G Cam
Mean B Cam


Max Histogram Value from Water in Camera Image
250
200
150
100
50
0
Value
1
2
3
n Data
Max R Cam
Max G Cam
Max B Cam

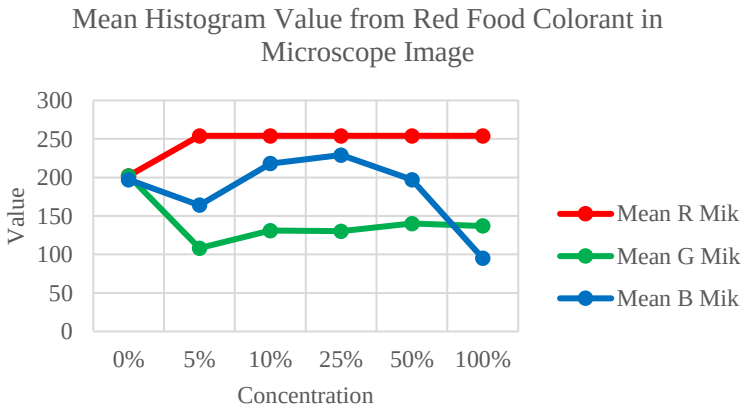

Sensor RGB Value in Water
90
89
88
87
86
85
84
83
82
81
Value
1
2
3
n Data
Sensor R
Sensor G
Sensor B

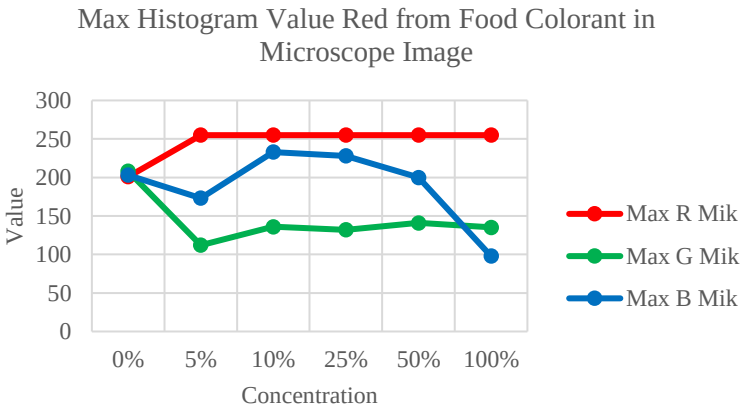
Single Food Coloring

Sample Composition

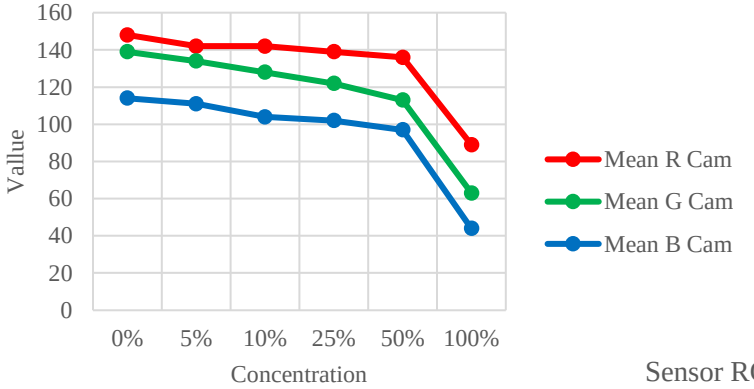
Concentration	Composition
0 % Food Colorant	4 ml air
5 % Food Colorant	0.2 ml Food Colorant + 3.8 ml water
10 % Food Colorant	0.4 ml Food Colorant + 3.6 ml water
25 % Food Colorant	1 ml Food Colorant + 3 ml water
50 % Food Colorant	2 ml Food Colorant + 2 ml water
100 % Food Colorant	4 ml Food Colorant

Single Red Colorant

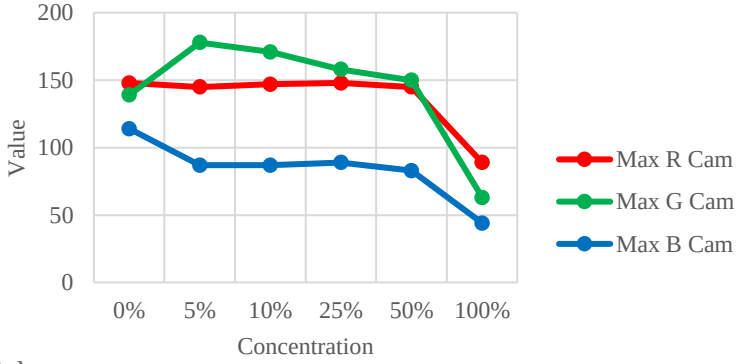

Mean Histogram Value from Red Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Mean R Mik
Mean G Mik
Mean B Mik


Max Histogram Value Red from Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Max R Mik
Max G Mik
Max B Mik

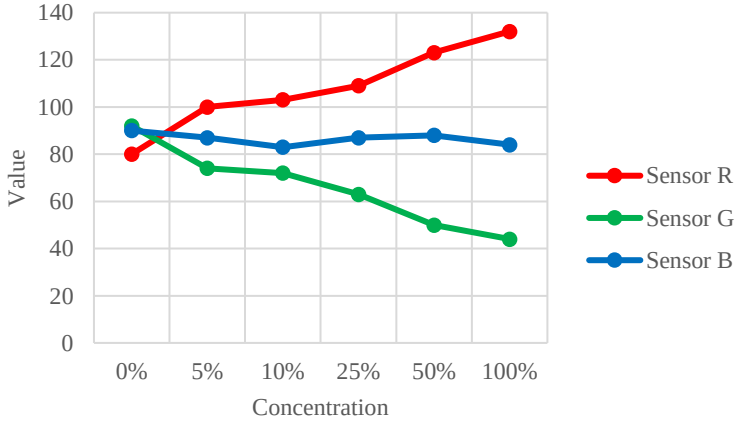
Mean Histogram Value from Red Food Colorant in Camera Image



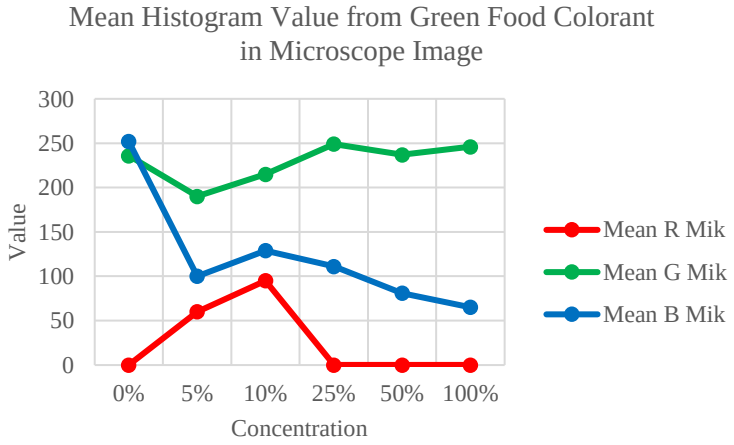
Max Histogram Value from Red Food Colorant in Camera Image

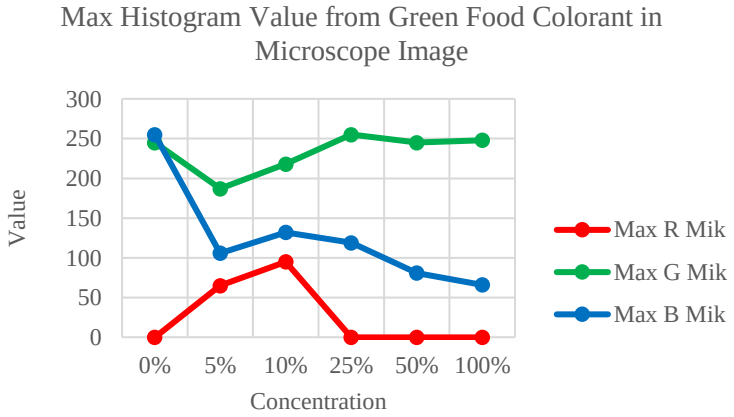


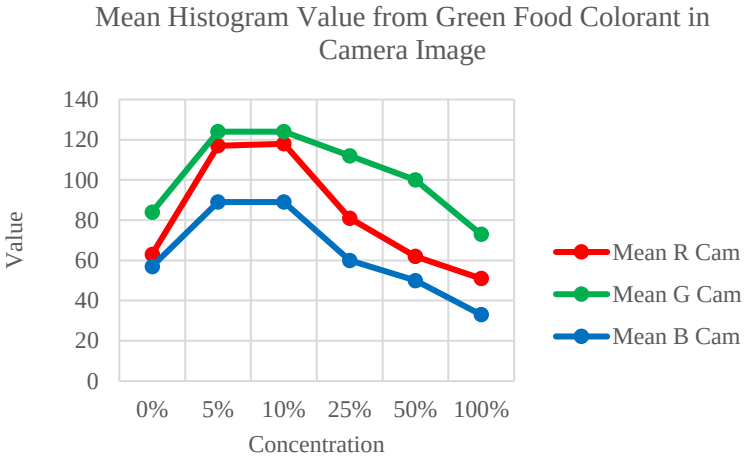
Sensor RGB Value from Red Food Colorant

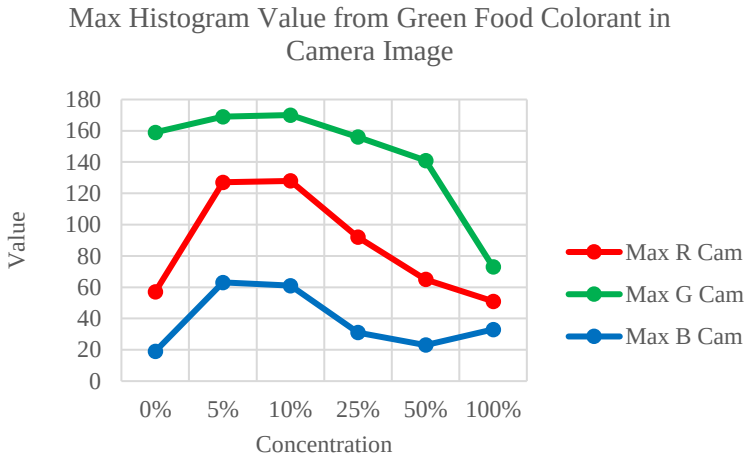


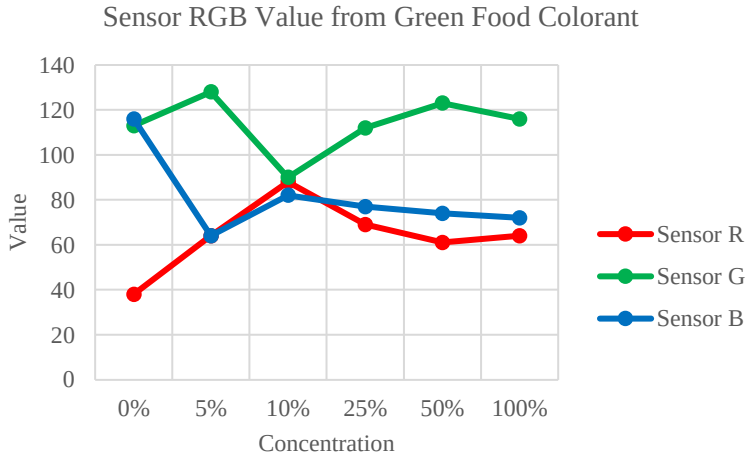
Single Green Colorant


Mean Histogram Value from Green Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Mean R Mik
Mean G Mik
Mean B Mik

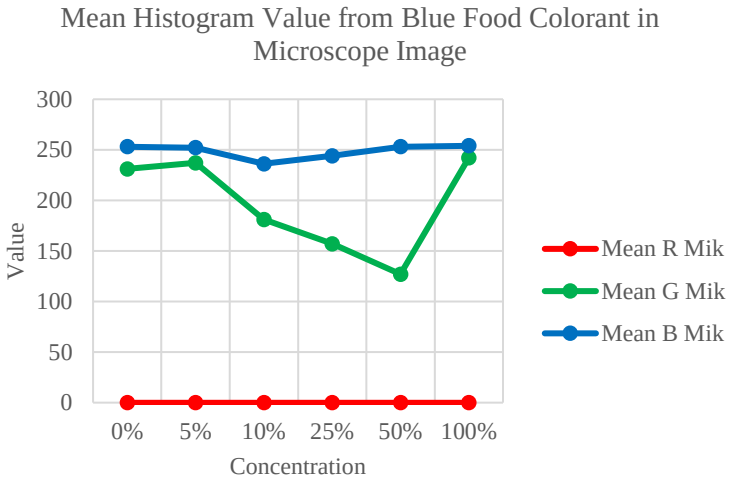

Max Histogram Value from Green Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Max R Mik
Max G Mik
Max B Mik

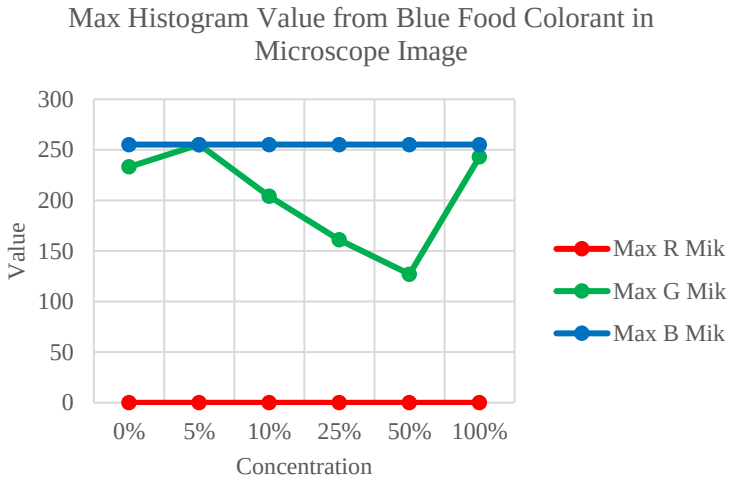

Mean Histogram Value from Green Food Colorant in Camera Image
140
120
100
80
60
40
20
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Mean R Cam
Mean G Cam
Mean B Cam


Max Histogram Value from Green Food Colorant in Camera Image
180
160
140
120
100
80
60
40
20
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Max R Cam
Max G Cam
Max B Cam

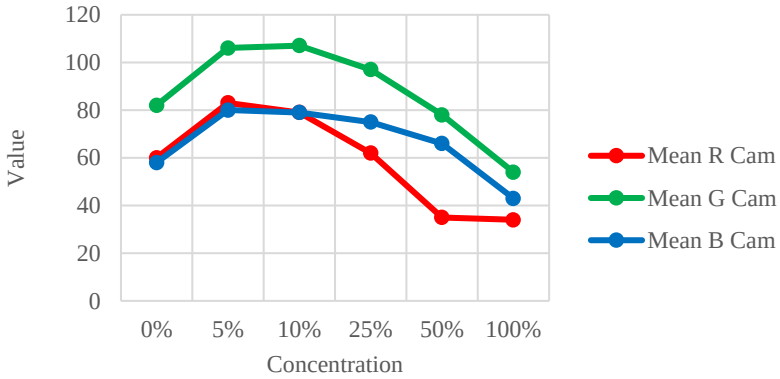

Sensor RGB Value from Green Food Colorant
140
120
100
80
60
40
20
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Sensor R
Sensor G
Sensor B

Single Blue Colorant

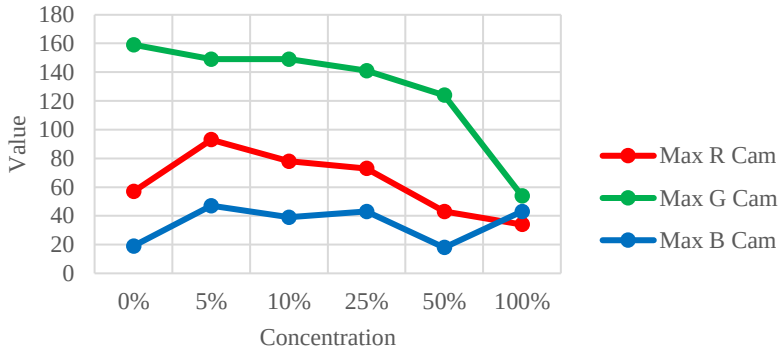

Mean Histogram Value from Blue Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Mean R Mik
Mean G Mik
Mean B Mik


Max Histogram Value from Blue Food Colorant in Microscope Image
300
250
200
150
100
50
0
Value
0%
5%
10%
25%
50%
100%
Concentration
Max R Mik
Max G Mik
Max B Mik

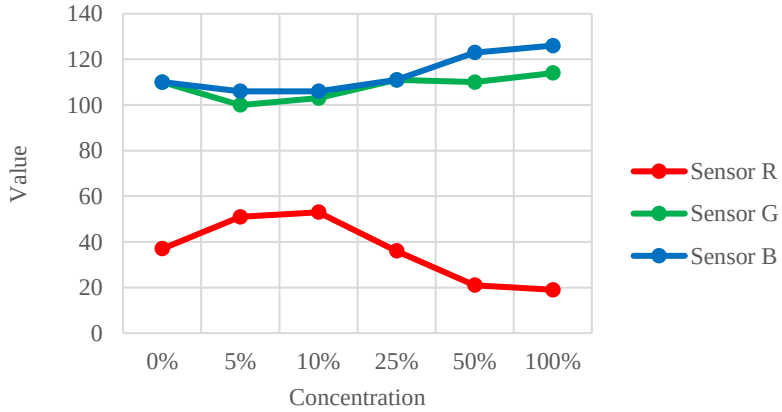
Mean Histogram Value from Blue Food Colorant in Camera Image



Max Histogram Value from Blue Food Colorant in Camera Image



Sensor RGB Value from Blue Food Colorant

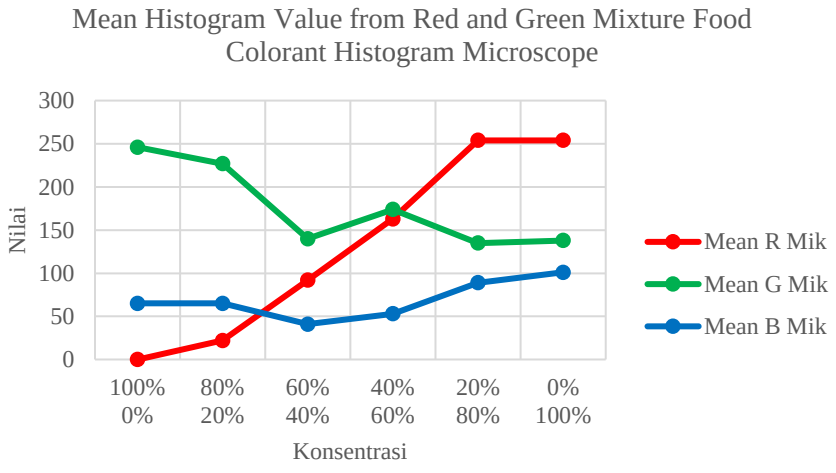


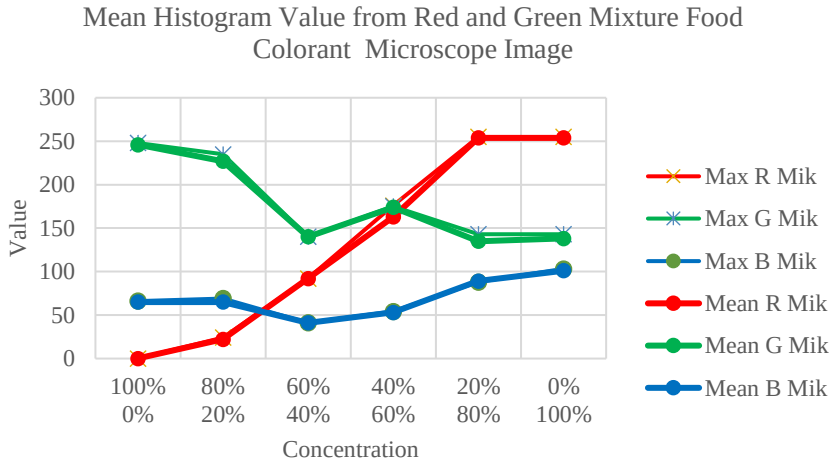
Double Food Coloring Mixture

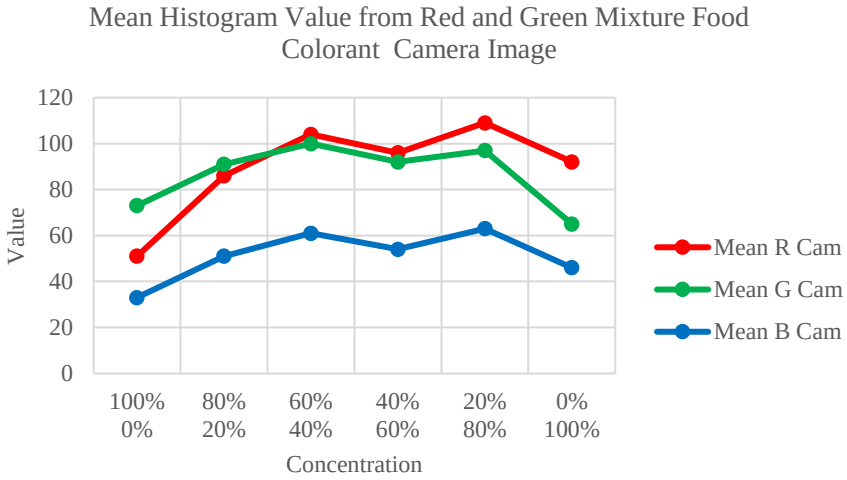
Sample Composition

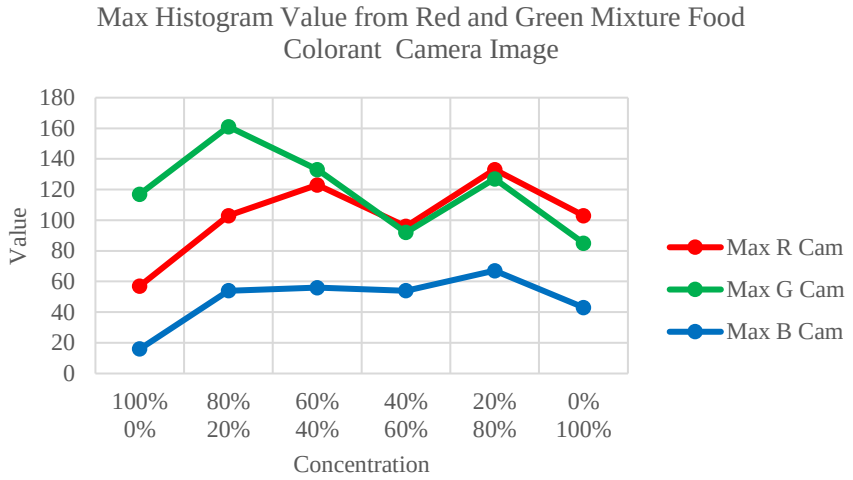
Concentration	Composition
100 % First Colorant **0 % Second Colorant**	4 ml Second Colorant
80 % First Colorant **20 % Second Colorant**	0.8 ml First Colorant + 3.2 ml Second Colorant
60 % First Colorant **40 % Second Colorant**	1.6 ml First Colorant + 2.4 ml Second Colorant
40 % First Colorant **60 % Second Colorant**	2.4 ml First Colorant + 1.6 ml Second Colorant
20 % First Colorant **80 % Second Colorant**	3.2 ml First Colorant + 0.8 ml Second Colorant
0 % First Colorant **100 % Second Colorant**	4 ml First Colorant

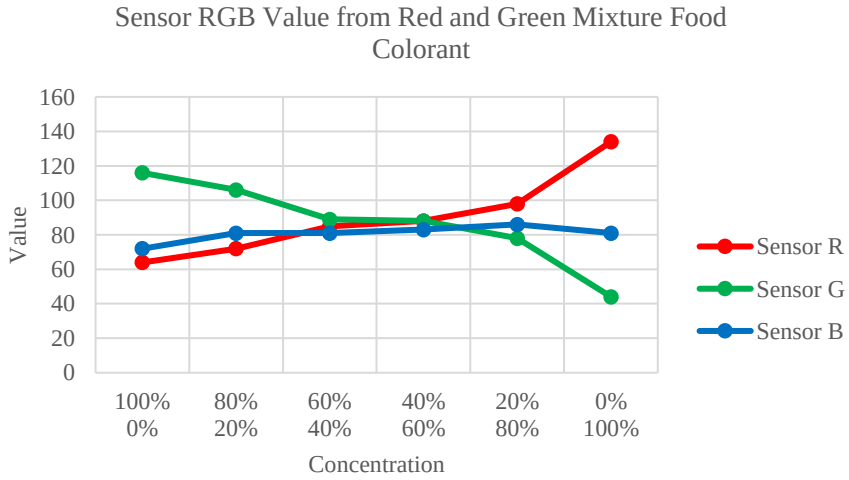
Red and Green


Mean Histogram Value from Red and Green Mixture Food Colorant Histogram Microscope
Nilai
300
250
200
150
100
50
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Konsentrasi
Mean R Mik
Mean G Mik
Mean B Mik

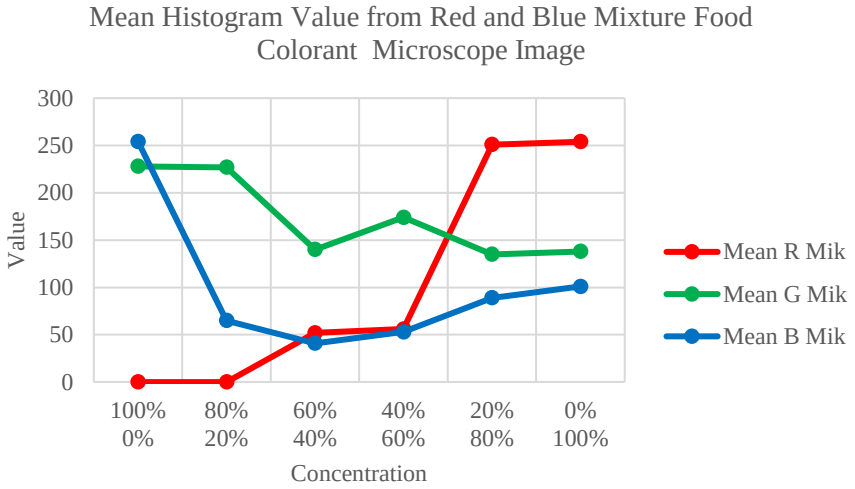

Mean Histogram Value from Red and Green Mixture Food Colorant Microscope Image
Value
300
250
200
150
100
50
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Max R Mik
Max G Mik
Max B Mik
Mean R Mik
Mean G Mik
Mean B Mik

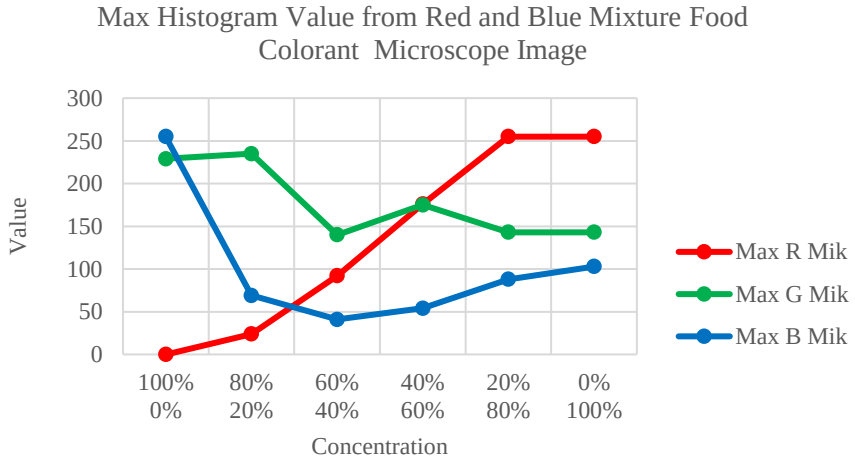

Mean Histogram Value from Red and Green Mixture Food Colorant Camera Image
Value
120
100
80
60
40
20
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Mean R Cam
Mean G Cam
Mean B Cam

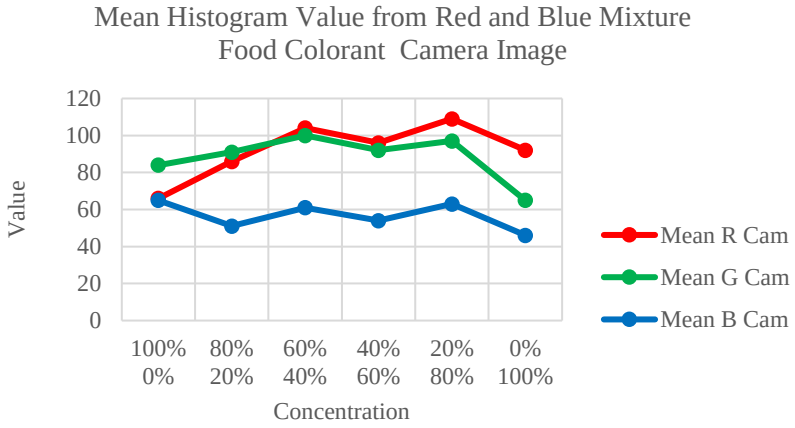

Max Histogram Value from Red and Green Mixture Food Colorant Camera Image
Value
180
160
140
120
100
80
60
40
20
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Max R Cam
Max G Cam
Max B Cam

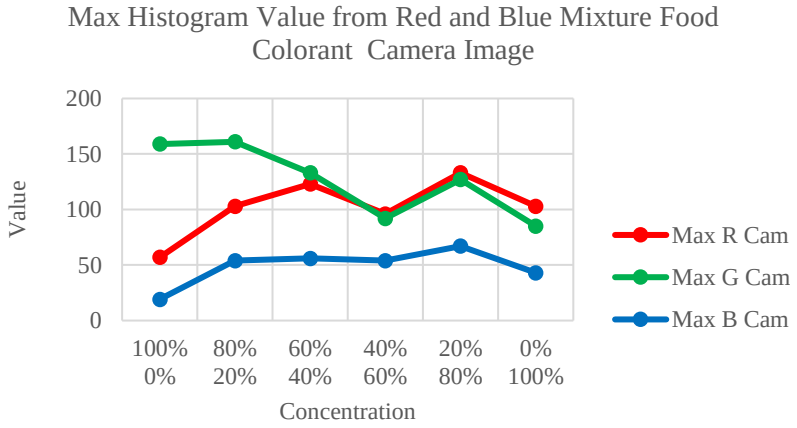

Sensor RGB Value from Red and Green Mixture Food Colorant
Value
160
140
120
100
80
60
40
20
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Sensor R
Sensor G
Sensor B

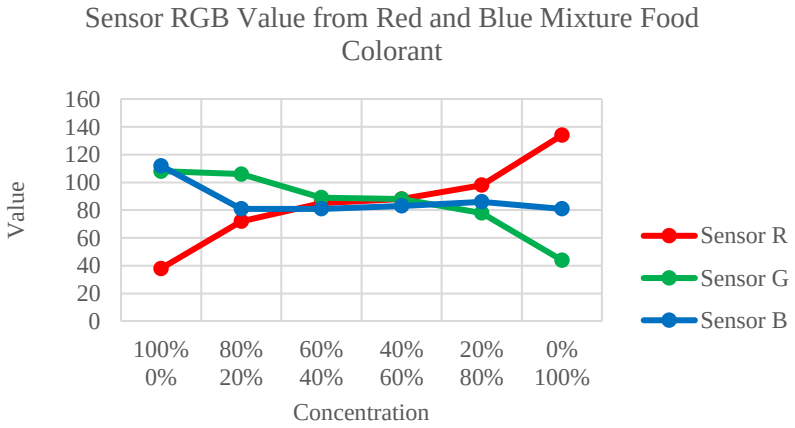
Red and Blue


Mean Histogram Value from Red and Blue Mixture Food Colorant Microscope Image
300
250
200
150
100
50
0
Value
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Mean R Mik
Mean G Mik
Mean B Mik

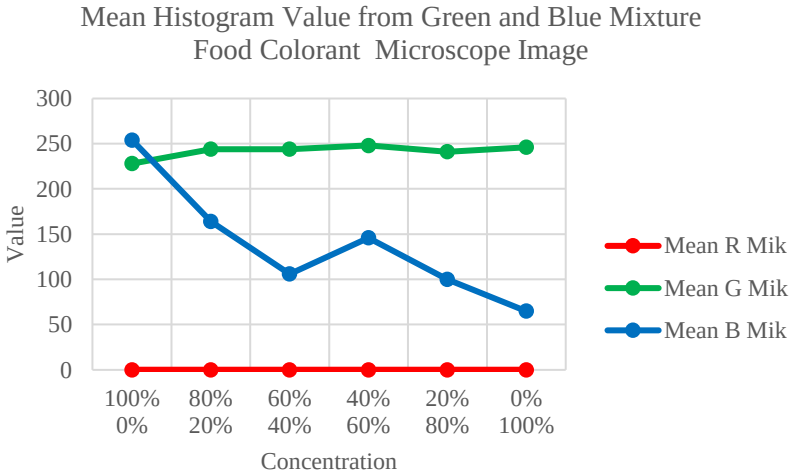

Max Histogram Value from Red and Blue Mixture Food Colorant Microscope Image
300
250
200
150
100
50
0
Value
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Max R Mik
Max G Mik
Max B Mik

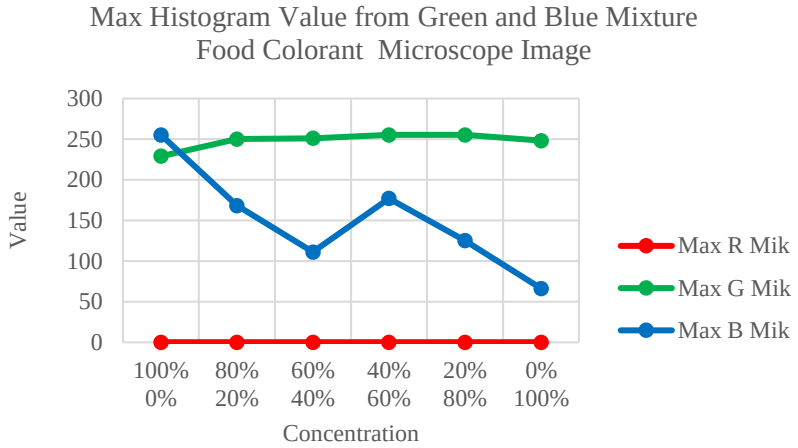

Mean Histogram Value from Red and Blue Mixture Food Colorant Camera Image
Value
120
100
80
60
40
20
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Mean R Cam
Mean G Cam
Mean B Cam


Max Histogram Value from Red and Blue Mixture Food Colorant Camera Image
Value
200
150
100
50
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Max R Cam
Max G Cam
Max B Cam

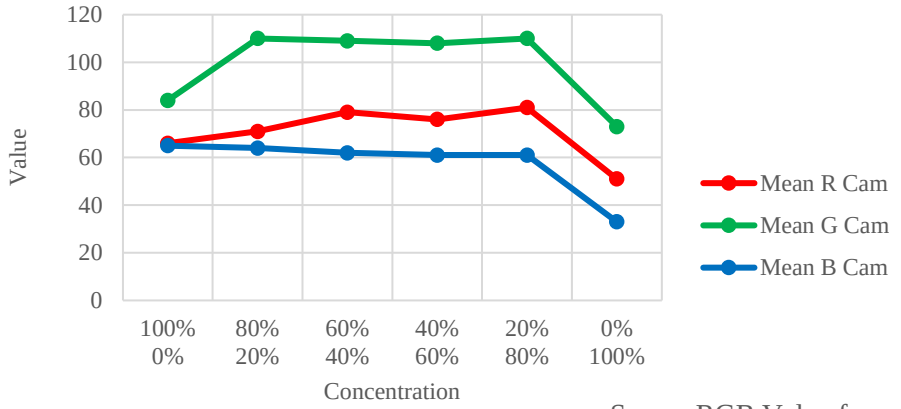

Sensor RGB Value from Red and Blue Mixture Food Colorant
Value
160
140
120
100
80
60
40
20
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Sensor R
Sensor G
Sensor B

Green and Blue

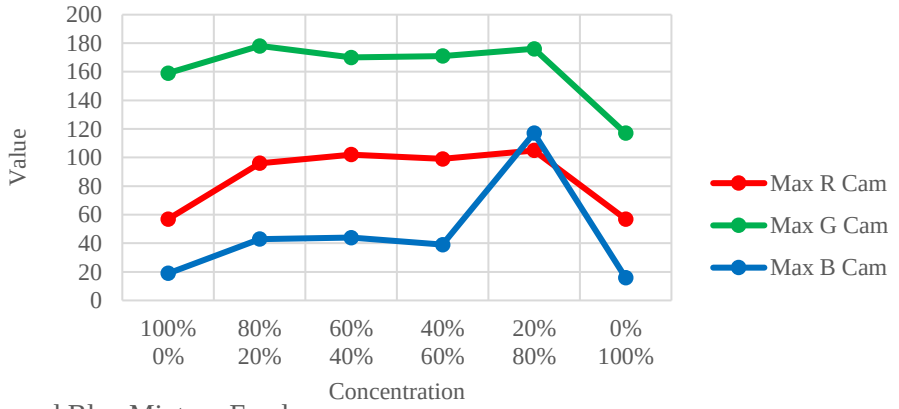

Mean Histogram Value from Green and Blue Mixture Food Colorant Microscope Image
Value
300
250
200
150
100
50
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Mean R Mik
Mean G Mik
Mean B Mik


Max Histogram Value from Green and Blue Mixture Food Colorant Microscope Image
Value
300
250
200
150
100
50
0
100% 0%
80% 20%
60% 40%
40% 60%
20% 80%
0% 100%
Concentration
Max R Mik
Max G Mik
Max B Mik

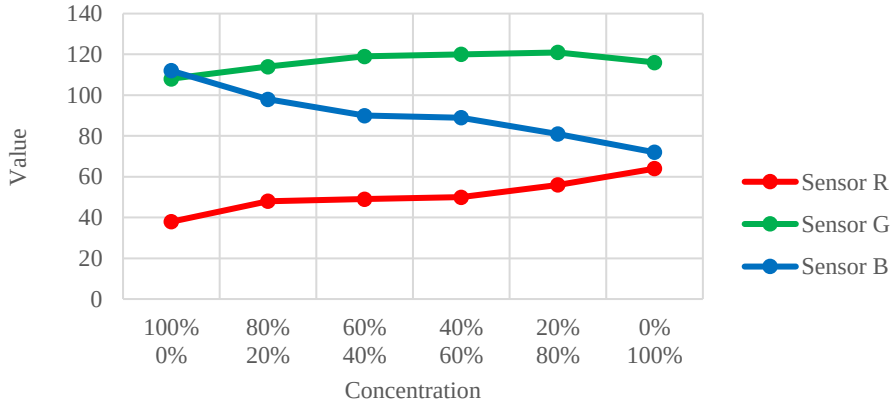
Mean Histogram Value from Green and Blue Mixture Food Colorant Camera Image



Max Histogram Value from Green and Blue Mixture Food Colorant Camera Image



Sensor RGB Value from Green and Blue Mixture Food Colorant



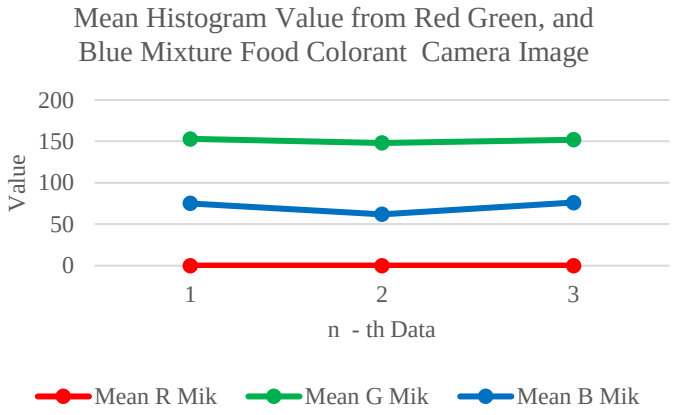
Triple Food Coloring Mixture

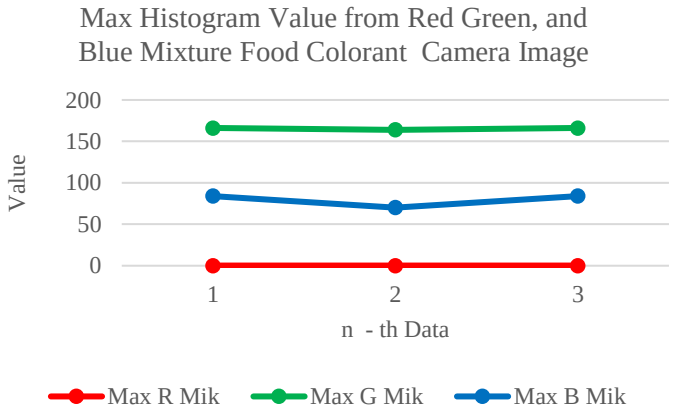
Sample Composition

Concentration	Composition
20 % Red Colorant **60 % Green Colorant** **20 % Blue Colorant**	0.8 ml Red Colorant + 2.4 ml Green Colorant + 0.8 ml Blue Colorant
20 % Red Colorant **40 % Green Colorant** **40 % Blue Colorant**	0.8 ml Red Colorant + 1.6 ml Green Colorant + 1.6 ml Blue Colorant
20 % Red Colorant **20 % Green Colorant** **60 % Blue Colorant**	0.8 ml Red Colorant + 0.8 ml Green Colorant + 2.4 ml Blue Colorant
40 % Red Colorant **40 % Green Colorant** **20 % Blue Colorant**	1.6 ml Red Colorant + 1.6 ml Green Colorant + 0.8 ml Blue Colorant
40 % Red Colorant **20 % Green Colorant** **40 % Blue Colorant**	1.6 ml Red Colorant + 0.8 ml Green Colorant + 1.6 ml Blue Colorant
60 % Red Colorant **20 % Green Colorant** **20 % Blue Colorant**	2.4 ml Red Colorant + 0.8 ml Green Colorant + 0.8 ml Blue Colorant
33 % Red Colorant **33 % Green Colorant** **33 % Blue Colorant**	1.3 ml Red Colorant + 1.3 ml Green Colorant + 1.3 ml Blue Colorant

Red (20 %) Green (20 %) and Blue(60 %)

Image Result





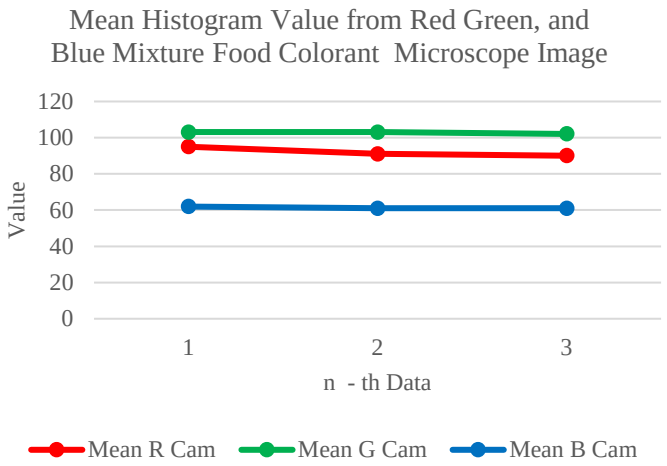
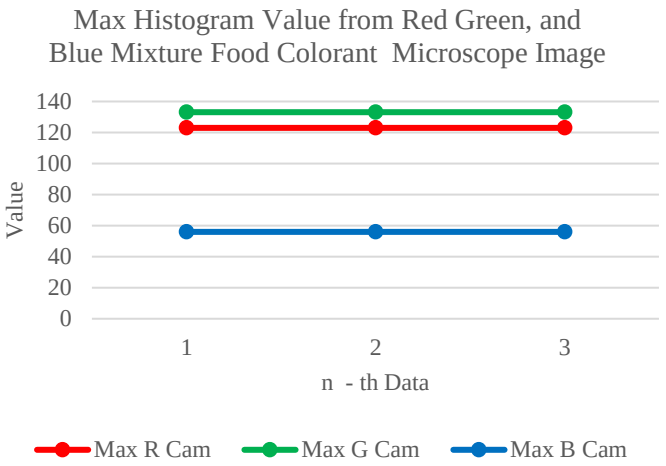
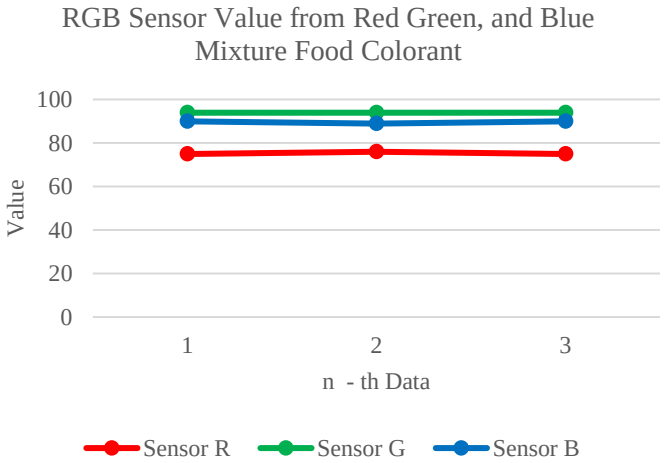


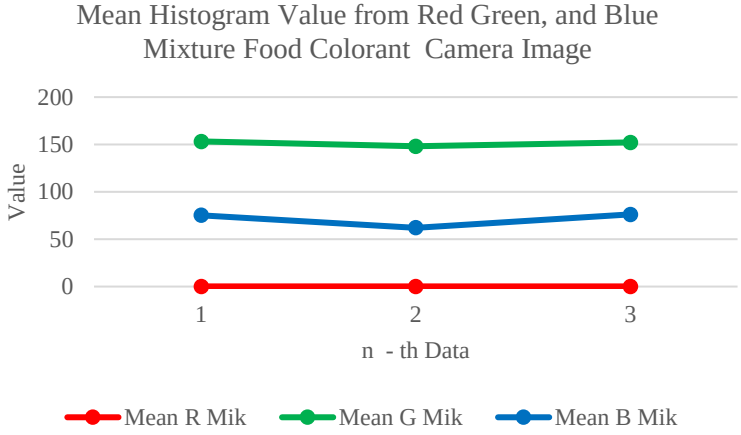
Image Result

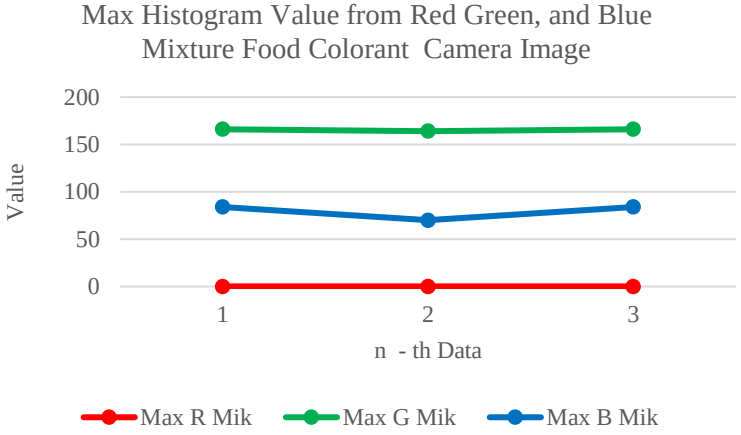




Red (40 %) Green (40 %) and Blue(20 %)

Image Result





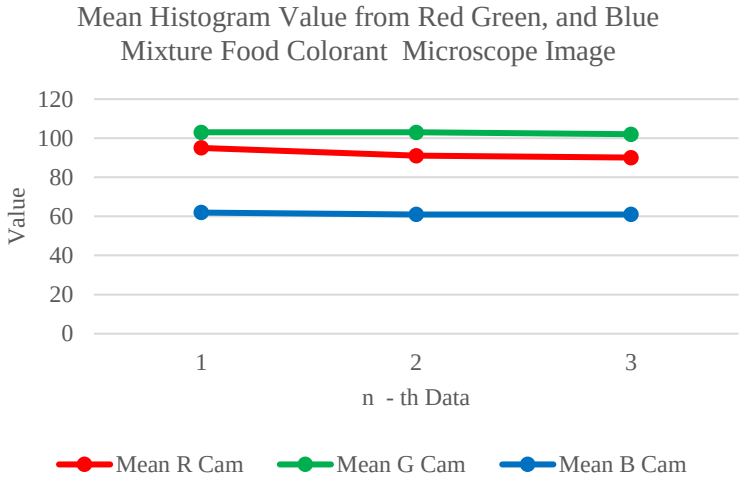
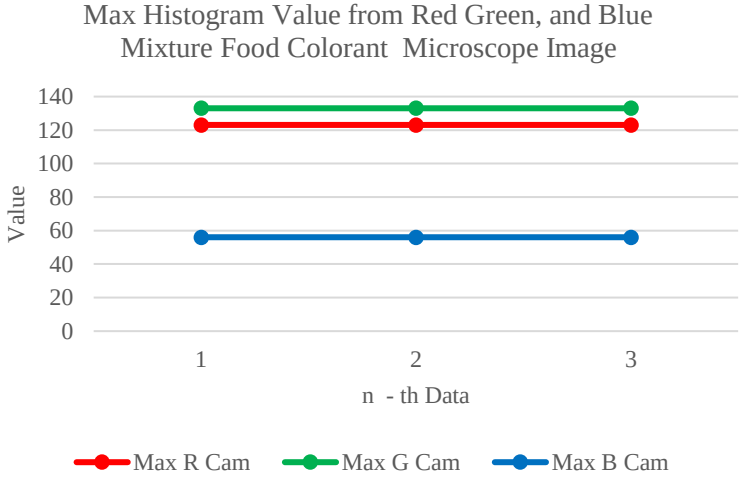
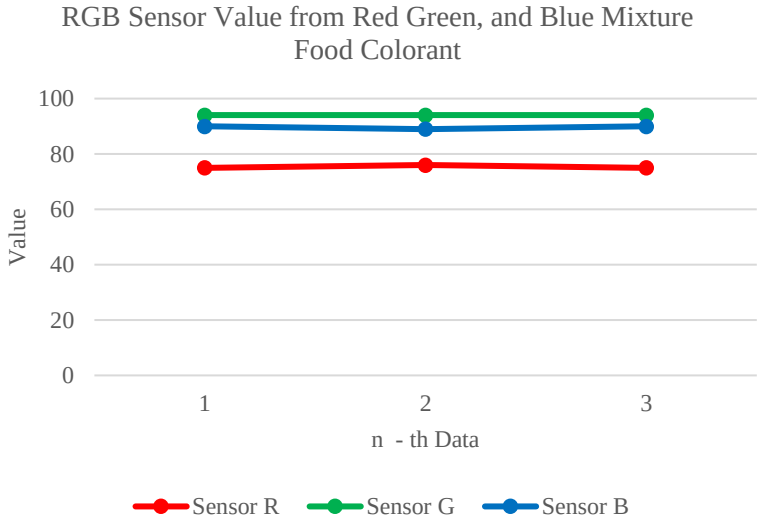


Image Result





ANN

ANN Model and Result

Model

No	Parameter	Value
1.	Number of neurons in the input layer	15
2.	Number of hidden layers	3
3.	Number of neurons in the output layer	3
4.	Epoch	250
5.	Learning rate	0,0004
6.	Normalization	yes

Result

No	Sample Concentration Content (%)								
	Actual			Prediction			Absolute error		
	R	G	B	R	G	B	R	G	B
1.	0	0	0	-2.16	0.25	1.03	2.16	0.25	1.03
2.	0	0	100	-0.31	1.16	101.04	0.31	1.16	1.04
3.	20	80	0	12.97	81.67	-1.90	7.03	1.67	1.90
4.	0	60	40	-3.02	36.32	65.39	3.02	23.68	25.39
5.	80	0	20	65.55	-6.96	14.65	14.45	6.96	5.35
6.	40	40	20	39.18	38.59	21.16	0.82	1.41	1.16
7.	33.3	33.3	33.3	33.05	30.17	31.76	0.25	3.13	1.54
8.	20	0	0	18.76	0.19	-0.22	1.24	0.19	0.22
9.	0	20	0	0.05	17.21	-0.09	0.05	2.79	0.09
10.	0	0	10	1.13	-1.04	12.93	1.13	1.04	2.93

No	Absolute error			Sample Error
	R	G	B	
1	2.16	0.25	1.03	1.15
2	0.31	1.16	1.04	0.83
3	7.03	1.67	1.90	3.54
4	3.02	23.68	25.39	17.37
5	14.45	6.96	5.35	8.92
6	0.82	1.41	1.16	1.13
7	0.25	3.13	1.54	1.64
8	1.24	0.19	0.22	0.55
9	0.05	2.79	0.09	0.98
10	1.13	1.04	2.93	1.70
Mean Error				3.78

Model

No	Parameter	Nilai
1.	Number of neurons in the input layer	15
2.	Number of hidden layers	15
3.	Number of neurons in the output layer	3
4.	Epoch	300
5.	Learning rate	0,001
6.	Normalization	No

Result

No	Sample Concentration Content (%)								
	Actual			Prediction			Absolute error		
	R	G	B	R	G	B	R	G	B
1.	0	0	0	-4.17	3.46	-0.30	4.17	3.46	0.30
2.	0	0	100	-4.44	-0.22	96.55	4.44	0.22	3.45
3.	20	80	0	18.98	83.83	1.31	1.02	3.83	1.31
4.	0	60	40	-10.98	21.52	68.48	10.98	38.48	28.48
5.	80	0	20	76.70	-0.70	17.75	3.30	0.70	2.25
6.	40	40	20	40.71	40.92	21.41	0.71	0.92	1.41
7.	33.3	33.3	33.3	26.52	19.19	40.35	6.78	14.11	7.05
8.	20	0	0	14.65	0.47	0.53	5.35	0.47	0.53
9.	0	20	0	-0.03	16.22	-1.54	0.03	3.78	1.54
10.	0	0	10	-3.08	0.65	11.48	3.08	0.65	1.48

No	Absolute error			Sample Error
	R	G	B	
1	4.17	3.46	0.30	2.64
2	4.44	0.22	3.45	2.70
3	1.02	3.83	1.31	2.05
4	10.98	38.48	28.48	25.98
5	3.30	0.70	2.25	2.08
6	0.71	0.92	1.41	1.01
7	6.78	14.11	7.05	9.32
8	5.35	0.47	0.53	2.12
9	0.03	3.78	1.54	1.78
10	3.08	0.65	1.48	1.74
Mean Error				5.14

Conclusion

- Prototype is already be used for monitoring and retrieving data
- The data obtained from food colorant have appropriate values between the concentration and the graphic form of the single red and green colorant. Meanwhile, for the blue colorant and the mixed colorant, the data obtained is still not in accordance with the graphic form, which has a difference with the number of concentration settings.
- The first model with a simple layer architecture and using normalization has better predictive results than the model with a complex layer architecture with an error value of 3.78 compared to 5.14.

Thankyou