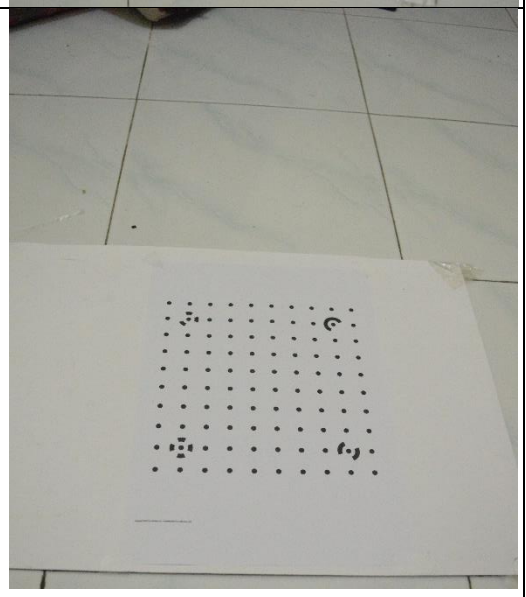
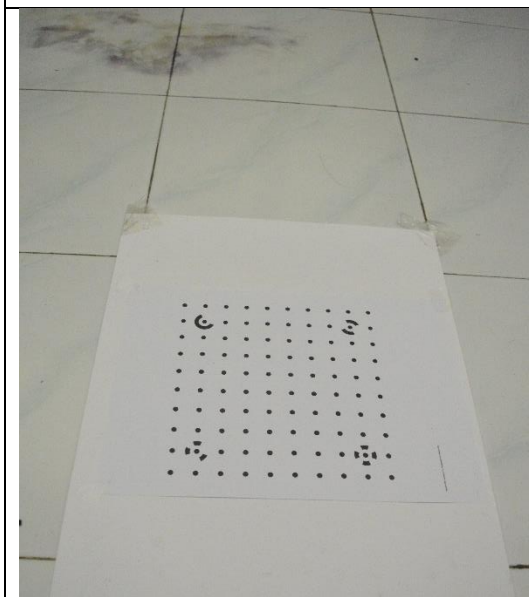
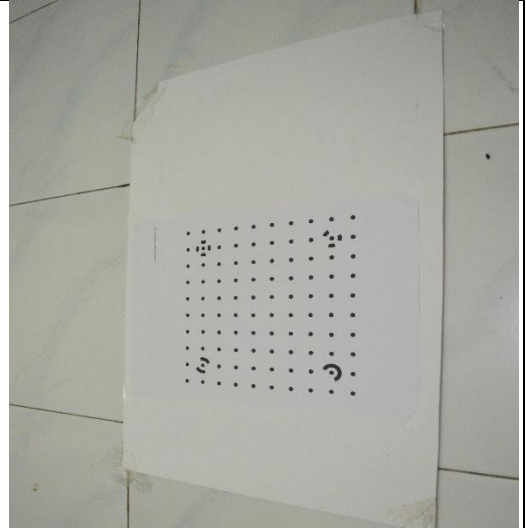
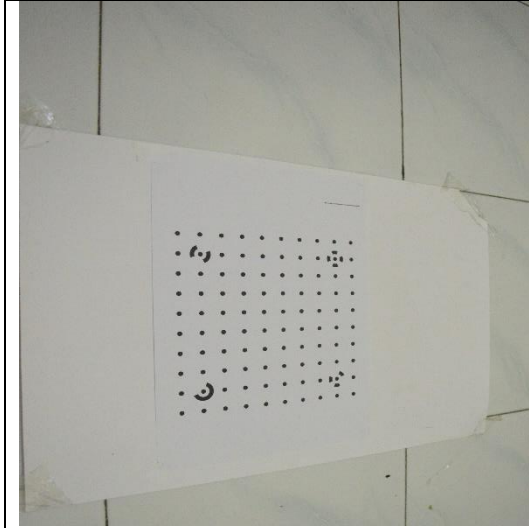
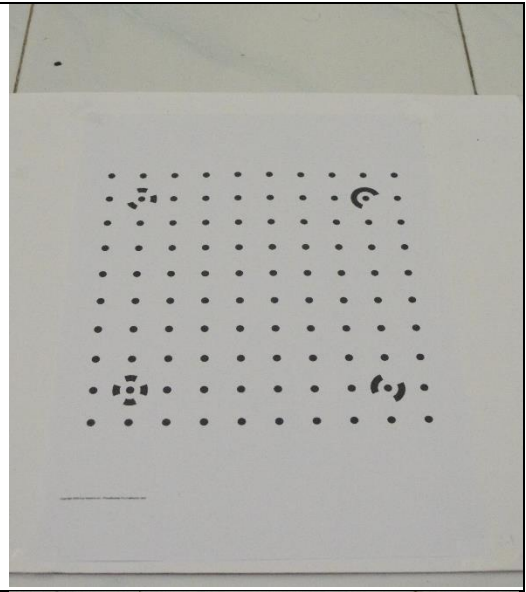
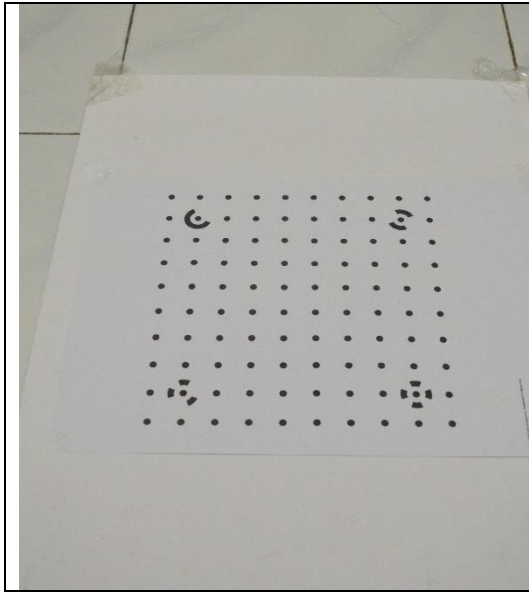
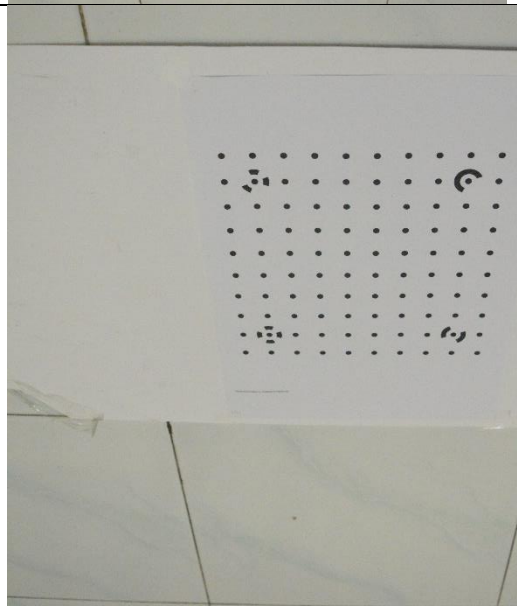
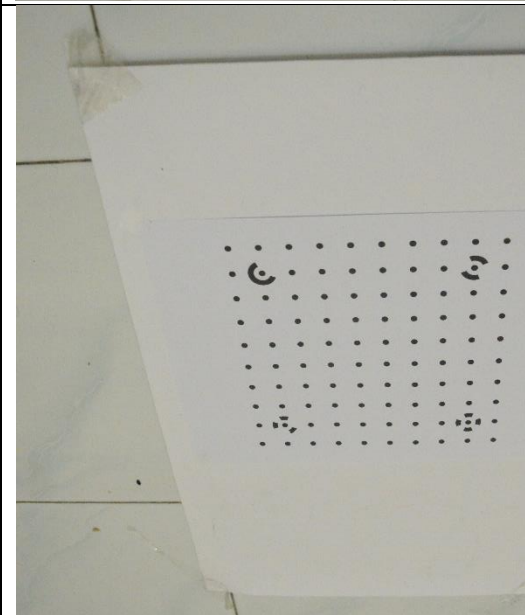
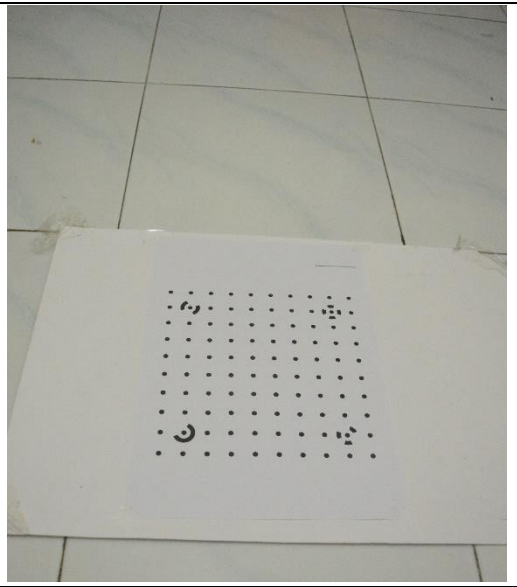
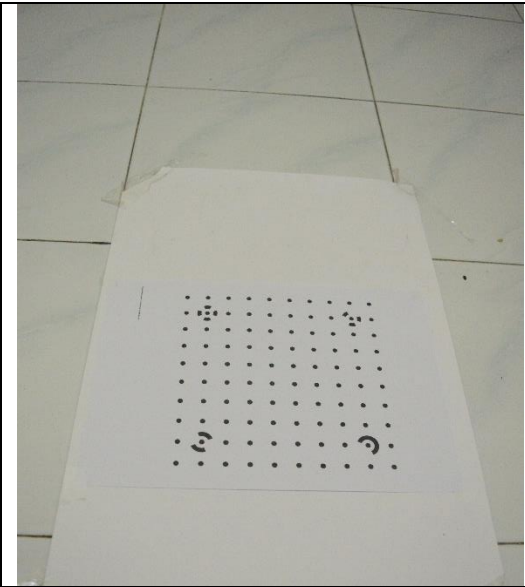


LAMPIRAN A

Hasil Foto Kalibrasi





LAMPIRAN B

Report Hasil Kalibrasi

Status Report Tree

Project Name: *** Project has not yet been saved ***

Problems and Suggestions (1)

Project Problems (1)

The total photo area covered by points is 13%, which is less than the recommended 80%.

Try to take photos of the calibration grid so that marked points fill as much of the photo frame as possible. Also move the grid around the frame so overall there is good coverage across all photos. This will result in a better calibration as more of the lens will be calibrated to account for variability throughout the lens.

Problems related to most recent processing (0)

Information from most recent processing

Last Processing Attempt: Sun Jun 23 20:54:22 2019

Version: PhotoModeler 2019.1.2.2469, evaluation (64-bit)

Status: successful

Processing Options

Orientation: off

Global Optimization: on

Calibration: on (full calibration)

Constraints: off

Total Error

Number of Processing Iterations: 2

Number of Processing Stages: 2

First Error: 0.582

Last Error: 0.582

Precisions / Standard Deviations

Camera Calibration Standard Deviations

Camera1: NIKON D3200 [18.00]

Focal Length

Value: 18.898289 mm

Deviation: Focal: 0.001 mm

Xp - principal point x

Value: 12.041350 mm

Deviation: Xp: 0.002 mm

Yp - principal point y

Value: 7.782455 mm

Deviation: Yp: 0.002 mm

Fw - format width

Value: 23.998914 mm

Deviation: Fw: 5.2e-04 mm

Fh - format height

Value: 15.957447 mm

K1 - radial distortion 1

Value: 2.793e-04

Deviation: K1: 4.8e-06

K2 - radial distortion 2

Value: -2.900e-07

Deviation: K2: 1.5e-07

K3 - radial distortion 3

Value: 0.000e+00

P1 - decentering distortion 1

Value: -1.043e-05

Deviation: P1: 1.5e-06

P2 - decentering distortion 2

Value: 1.213e-05

Deviation: P2: 1.8e-06

Photograph Standard Deviations

Photo 1: dsc_0659.jpg

Omega

Value: 32.526921 deg

Deviation: Omega: 0.006 deg

Phi

Value: -0.094575 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 0.343223 deg

Deviation: Kappa: 8.5e-04 deg

Xc

Value: 0.454751

Deviation: X: 1.7e-04

Yc

Value: -1.527772

Deviation: Y: 1.7e-04

Zc

Value: 3.260534

Deviation: Z: 2.7e-04

Photo 2: dsc_0660.jpg

Omega

Value: 1.623485 deg

Deviation: Omega: 0.007 deg

Correlations over 95.0%: Kappa:-97.5%

Phi

Value: 33.613758 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 88.787173 deg

Deviation: Kappa: 0.004 deg

Correlations over 95.0%: Omega:-97.5%

Xc

Value: 2.634334

Deviation: X: 1.7e-04

Yc

Value: 0.370881

Deviation: Y: 1.7e-04

Zc

Value: 3.283517

Deviation: Z: 2.7e-04

Photo 3: dsc_0661.jpg

Omega

Value: -32.318192 deg

Deviation: Omega: 0.006 deg

Phi

Value: 1.470155 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 179.094227 deg

Deviation: Kappa: 8.9e-04 deg

Xc

Value: 0.628244

Deviation: X: 1.7e-04

Yc

Value: 2.521142

Deviation: Y: 1.7e-04

Zc

Value: 3.288033

Deviation: Z: 2.8e-04

Photo 4: dsc_0662.jpg

Omega

Value: -0.764757 deg

Deviation: Omega: 0.007 deg

Correlations over 95.0%: Kappa:97.5%

Phi

Value: -33.647246 deg

Deviation: Phi: 0.006 deg

Kappa

Value: -90.289740 deg

Deviation: Kappa: 0.004 deg

Correlations over 95.0%: Omega:97.5%

Xc

Value: -1.654826

Deviation: X: 1.7e-04

Yc

Value: 0.594382

Deviation: Y: 1.7e-04

Zc

Value: 3.298072

Deviation: Z: 2.7e-04

Photo 5: dsc_0671.jpg

Omega

Value: 34.860909 deg

Deviation: Omega: 0.006 deg

Phi

Value: -3.964051 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 91.760387 deg

Deviation: Kappa: 9.1e-04 deg

Xc

Value: 0.159098

Deviation: X: 1.5e-04

Yc

Value: -1.715450

Deviation: Y: 1.9e-04

Zc

Value: 3.114607

Deviation: Z: 2.3e-04

Photo 6: dsc_0672.jpg

Omega

Value: 5.356851 deg

Deviation: Omega: 0.008 deg

Correlations over 95.0%: Kappa:-98.4%

Phi

Value: 34.766037 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 178.547051 deg

Deviation: Kappa: 0.004 deg

Correlations over 95.0%: Omega:-98.4%

Xc

Value: 2.749667

Deviation: X: 1.9e-04

Yc

Value: 0.164898

Deviation: Y: 1.5e-04

Zc

Value: 3.119792

Deviation: Z: 2.2e-04

Photo 7: dsc_0673.jpg

Omega

Value: -34.360447 deg

Deviation: Omega: 0.006 deg

Phi

Value: 4.453376 deg

Deviation: Phi: 0.006 deg

Kappa

Value: -88.315751 deg

Deviation: Kappa: 9.7e-04 deg

Xc

Value: 0.916583

Deviation: X: 1.6e-04

Yc

Value: 2.710422

Deviation: Y: 1.9e-04

Zc

Value: 3.132937

Deviation: Z: 2.3e-04

Photo 8: dsc_0674.jpg

Omega

Value: -4.787225 deg

Deviation: Omega: 0.008 deg

Correlations over 95.0%: Kappa:98.4%

Phi

Value: -34.549013 deg

Deviation: Phi: 0.006 deg

Kappa

Value: -1.444724 deg

Deviation: Kappa: 0.004 deg

Correlations over 95.0%: Omega:98.4%

Xc

Value: -1.766027

Deviation: X: 1.9e-04

Yc

Value: 0.850221

Deviation: Y: 1.5e-04

Zc

Value: 3.135184

Deviation: Z: 2.2e-04

Photo 9: dsc_0675.jpg

Omega

Value: 41.639333 deg

Deviation: Omega: 0.006 deg

Phi

Value: 1.397855 deg

Deviation: Phi: 0.006 deg

Kappa

Value: -93.180659 deg

Deviation: Kappa: 8.9e-04 deg

Xc

Value: 0.660026

Deviation: X: 1.5e-04

Yc

Value: -2.340234

Deviation: Y: 2.1e-04

Zc

Value: 3.222430

Deviation: Z: 2.3e-04

Photo 10: dsc_0676.jpg

Omega

Value: -1.413933 deg

Deviation: Omega: 0.008 deg

Correlations over 95.0%: Kappa:-98.7%

Phi

Value: 39.977574 deg

Deviation: Phi: 0.006 deg

Kappa

Value: -2.708337 deg

Deviation: Kappa: 0.005 deg

Correlations over 95.0%: Omega:-98.7%

Xc

Value: 3.223223

Deviation: X: 2.0e-04

Yc

Value: 0.637610

Deviation: Y: 1.6e-04

Zc

Value: 3.221831

Deviation: Z: 2.3e-04

Photo 11: dsc_0677.jpg

Omega

Value: -39.363855 deg

Deviation: Omega: 0.006 deg

Phi

Value: 3.295623 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 88.837139 deg

Deviation: Kappa: 9.0e-04 deg

Xc

Value: 0.680574

Deviation: X: 1.6e-04

Yc

Value: 3.179599

Deviation: Y: 2.1e-04

Zc

Value: 3.266599

Deviation: Z: 2.4e-04

Photo 12: dsc_0678.jpg

Omega

Value: -0.723849 deg

Deviation: Omega: 0.008 deg

Correlations over 95.0%: Kappa:98.6%

Phi

Value: -39.567969 deg

Deviation: Phi: 0.006 deg

Kappa

Value: 179.461368 deg

Deviation: Kappa: 0.005 deg

Correlations over 95.0%: Omega:98.6%

Xc

Value: -2.184375

Deviation: X: 2.0e-04

Yc

Value: 0.487484

Deviation: Y: 1.6e-04

Zc

Value: 3.251577

Deviation: Z: 2.3e-04

Quality

Photographs

Total Number: 12

Bad Photos: 0

Weak Photos: 0

OK Photos: 12

Number Oriented: 12

Number with inverse camera flags set: 0

Cameras

Camera1: NIKON D3200 [18.00]

Calibration: yes

Number of photos using camera: 12

Average Photo Point Coverage: 13%

Photo Coverage

Referenced points outside of the camera's calibrated coverage region:

Point Marking Residuals

Overall RMS: 0.075 pixels

Maximum: 0.352 pixels

Point 96 on Photo 1

Minimum: 0.066 pixels

Point 30 on Photo 8

Maximum RMS: 0.211 pixels

Point 96

Minimum RMS: 0.047 pixels

Point 36

Point Precisions

Overall RMS Vector Length: 3.39e-05

Maximum Vector Length: 4.76e-05

Point 96

Minimum Vector Length: 3.26e-05

Point 45

Maximum X: 2.32e-05

Maximum Y: 2.47e-05

Maximum Z: 3.35e-05

Minimum X: 1.56e-05

Minimum Y: 1.56e-05

Minimum Z: 2.37e-05

Point Angles

Maximum: 80.84 degrees

Point 54

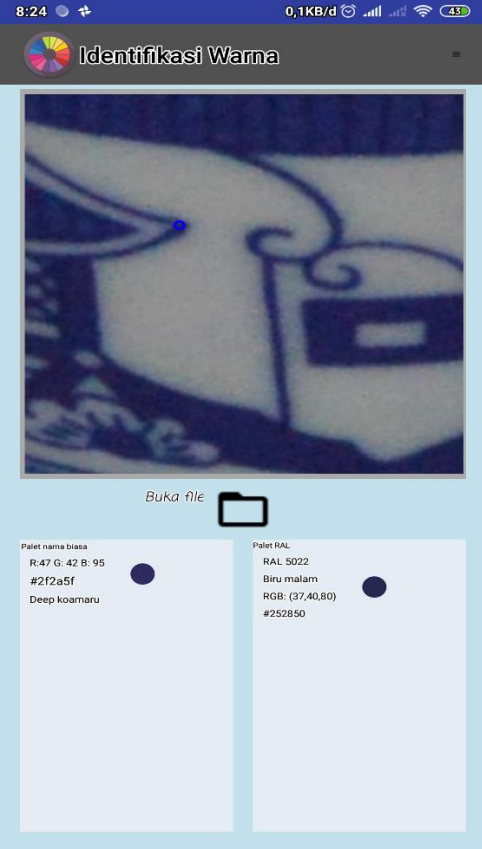

Minimum: 77.54 degrees



Point 2

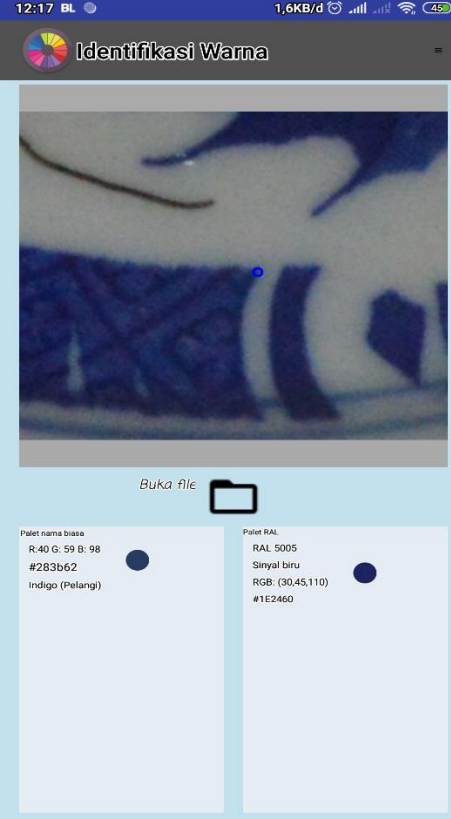

Average: 79.75 degrees


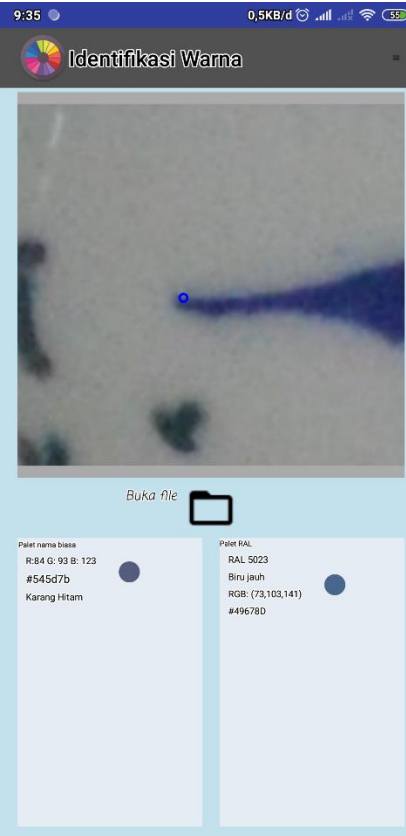
LAMPIRAN C



Hasil Identifikasi Warna

No.	Foto hasil identifikasi warna	Keterangan
1		<p>Titik ICP 1 Red : 47 Green : 42 Blue : 95</p>
2		<p>Titik ICP 2 Red : 112 Green : 113 Blue : 125</p>

<p>3</p>		<p>Titik ICP 3 Red : 53 Green : 53 Blue : 18</p>
<p>4</p>		<p>Titik ICP 4 Red : 106 Green : 108 Blue : 122</p>

<p>5</p>		<p>Titik ICP 5 Red : 40 Green : 59 Blue : 98</p>
<p>6</p>		<p>Titik ICP 6 Red : 60 Green : 71 Blue : 18</p>

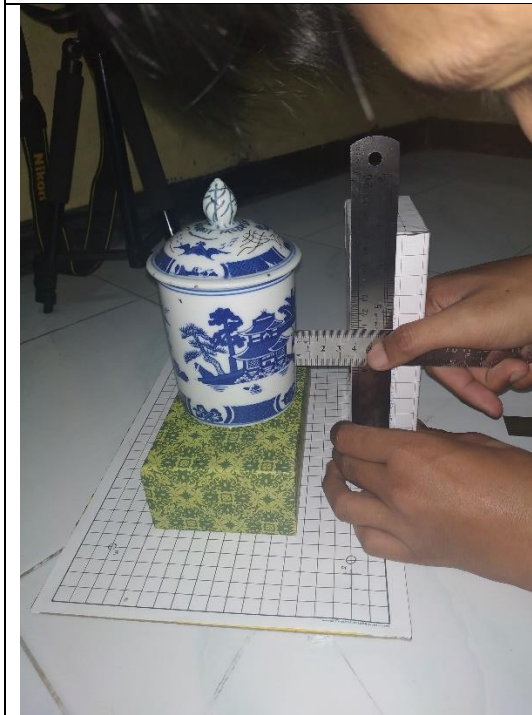
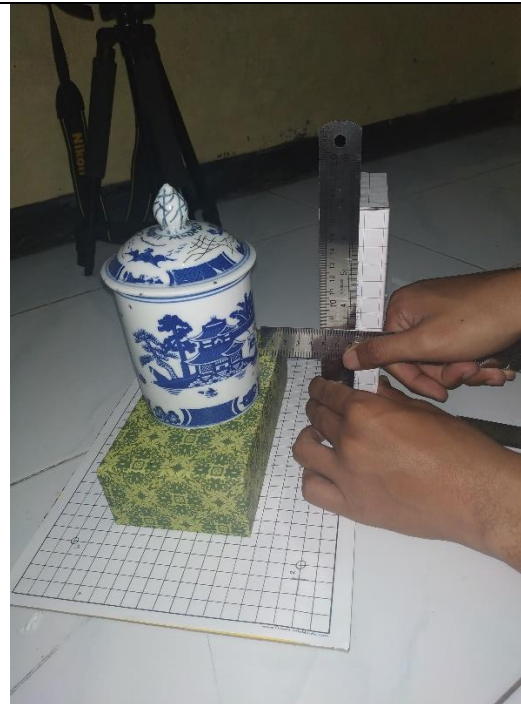
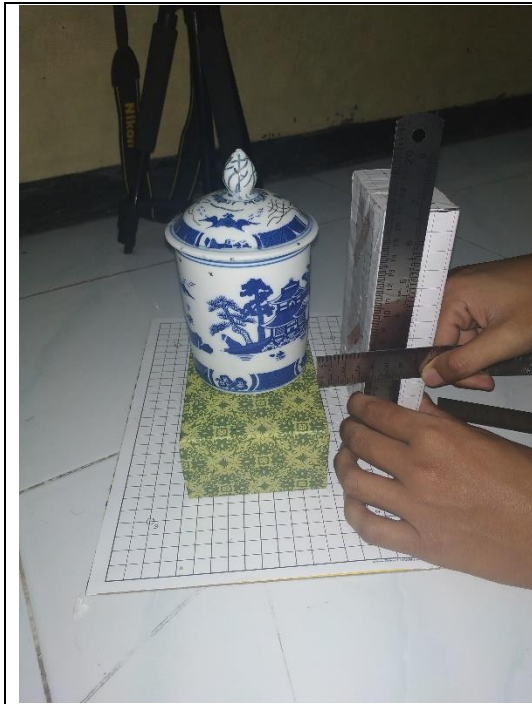
<p>7</p>		<p>Titik ICP 7 Red : 65 Green : 85 Blue : 114</p>
<p>8</p>		<p>Titik ICP 8 Red : 84 Green : 93 Blue : 123</p>

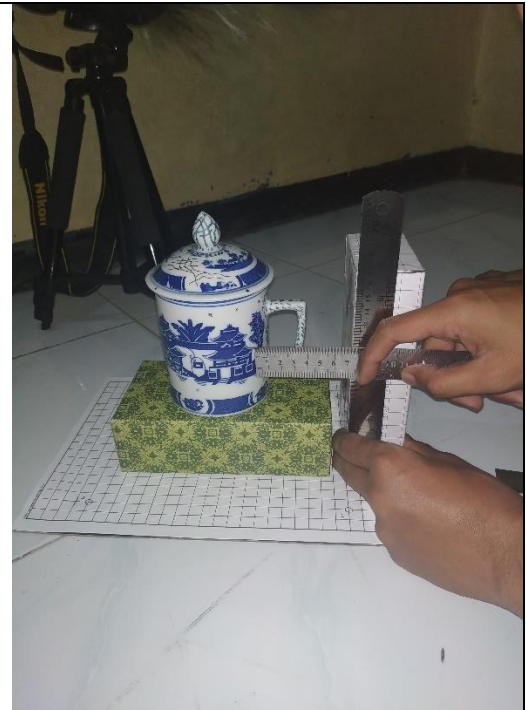
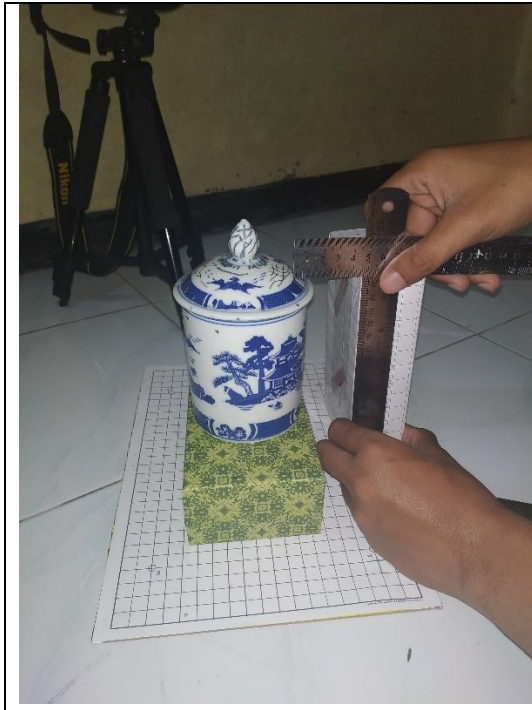
<p>9</p>		<p>Titik ICP 9 Red : 87 Green : 88 Blue : 30</p>
<p>10</p>		<p>Titik ICP 10 Red : 59 Green : 64 Blue : 28</p>

LAMPIRAN D

Pengukuran Koordinat ICP dan GCP







LAMPIRAN E

Analisis Nilai RMSE seluruh Model 3D tiap Intensitas Cahaya

Model 3D 1(0-400lux)

titik GCP	X error (mm)	Y error (mm)	Z error (mm)	total (mm)	Image (pix)
point 1	-0,0765027	-0,075627	-0,462053	0,47441	0,1
point 2	0,0780307	-0,0824693	0,462053	0,475797	0,093
point 3	0,0450174	0,0836153	-0,462053	0,47171	0,106
point 4	-0,0465453	0,074481	0,462053	0,470326	0,107
Total	0,0635108	0,0791511	0,462053	0,473066	0,102

Model 3D 2(400-800lux)

titik GCP	X error (mm)	Y error (mm)	Z error (mm)	total (mm)	Image (pix)
point 1	-0,0613513	-0,0994356	-0,457146	0,47184	0,101
point 2	0,089915	-0,075963	0,457146	0,472056	0,105
point 3	0,0460675	0,0973858	-0,457145	0,469668	0,095
point 4	-0,0746312	0,0780128	0,457145	0,469721	0,087
Total	0,069894	0,0883569	0,457145	0,470823	0,098

Model 3D 3(800-1200lux)

titik GCP	X error (mm)	Y error (mm)	Z error (mm)	total (mm)	Image (pix)
point 1	-0,0897838	-0,0465966	-0,43761	0,449149	0,205
point 2	0,0926541	-0,0737656	0,43761	0,453353	0,185
point 3	0,00160778	0,0759183	-0,43761	0,444149	0,182
point 4	-0,00447804	0,0444439	0,43761	0,439884	0,214
Total	0,0645534	0,0619505	0,43761	0,446663	0,197

Model 3D 4(1200-1600lux)

titik GCP	X error (mm)	Y error (mm)	Z error (mm)	total (mm)	Image (pix)
point 1	-0,0673821	-0,107352	-0,480671	0,497101	0,054
point 2	0,0816665	-0,066592	0,480671	0,492086	0,043
point 3	0,0536622	0,0773053	-0,480671	0,489797	0,044
point 4	-0,0679466	0,0966387	0,480671	0,494975	0,048
Total	0,0683852	0,0884224	0,480671	0,493498	0,048

Model 3D 5(1600-2000lux)

titik GCP	X error (mm)	Y error (mm)	Z error (mm)	total (mm)	Image (pix)
point 1	-0,0948761	-0,0939868	-0,440633	0,460426	0,199
point 2	0,12429	-0,104994	0,440631	0,46971	0,123
point 3	0,029178	0,127055	-0,44063	0,45951	0,132
point 4	-0,0585922	0,0719259	0,440632	0,450292	0,21
Total	0,0847555	0,101456	0,440632	0,460036	0,172

Rata-rata Nilai RMSE seluruh model 3D Intensitas Cahaya

Model	X error (mm)	Y error (mm)	Z error (mm)	RMSE (mm)
1	0,0635108	0,0791511	0,462053	0,473066
2	0,069894	0,0883569	0,457145	0,470823
3	0,0645534	0,0619505	0,43761	0,446663
4	0,0683852	0,0884224	0,480671	0,493498
5	0,0847555	0,101456	0,440632	0,460036

LAMPIRAN F

Hasil Perhitungan selisih Koordinat ICP

Hasil Pengukuran Koordinat ICP Pada Hasil Model 3D Intensitas Cahaya

Titik	Koordinat	Intensitas Cahaya				
		1	2	3	4	5
ICP 1	X(cm)	7,8342	7,8557	7,8895	7,8869	7,868
	Y(cm)	4,0291	4,0233	4,0341	4,0254	4,0027
	Z(cm)	10,9688	10,9969	11,0173	10,9893	11,0169
ICP 2	X(cm)	12,2477	12,2476	12,2216	12,2454	12,2844
	Y(cm)	4,884	4,8908	4,8995	4,9109	4,894
	Z(cm)	7,0956	7,14	7,1548	7,1261	7,1645
ICP 3	X(cm)	4,3553	4,3888	4,4367	4,3892	4,3772
	Y(cm)	5,2353	5,2266	5,2862	5,2931	5,2945
	Z(cm)	5,4157	5,4376	5,4673	5,4408	5,4449
ICP 4	X(cm)	5,2897	5,3308	5,3218	5,3423	5,2984
	Y(cm)	7,0656	6,9997	7,0289	6,9437	7,0244
	Z(cm)	10,9696	10,9883	10,9747	11,0012	10,9677
ICP 5	X(cm)	6,6454	6,738	6,6677	6,6992	6,6923
	Y(cm)	10,4633	10,4496	10,3773	10,3582	10,4069
	Z(cm)	16,4556	16,5652	16,499	16,5631	16,6298
ICP 6	X(cm)	14,595	14,5555	14,5005	14,516	14,5202
	Y(cm)	12,7414	12,7287	12,7249	12,7305	12,7384
	Z(cm)	3,4006	3,4403	3,4113	3,3349	3,455
ICP 7	X(cm)	11,2327	11,2641	11,2757	11,2234	11,2305
	Y(cm)	11,8552	11,8421	11,7889	11,834	11,8558
	Z(cm)	13,3077	13,3155	13,3435	13,3416	13,4231
ICP 8	X(cm)	13,5464	13,5385	13,5363	13,5096	13,5301
	Y(cm)	9,0804	9,0585	9,0301	9,0745	9,0831
	Z(cm)	8,7966	8,786	8,8136	8,882	8,8762
ICP 9	X(cm)	18,7929	18,7949	18,7796	18,787	18,7944
	Y(cm)	7,4192	7,427	7,4341	7,4784	7,4885
	Z(cm)	4,6593	4,6747	4,6358	4,6623	4,6016
ICP 10	X(cm)	14,5487	14,5009	14,5895	14,5956	14,5633
	Y(cm)	4,5614	4,488	4,599	4,5553	4,5937
	Z(cm)	5,4041	5,4334	5,4607	5,4356	5,4311

Selisih Pengukuran Koordinat ICP Pada Hasil Model 3D Intensitas Cahaya
Dengan koordinat Sesungguhnya

Titik	Koordinat	Intensitas Cahaya				
		1	2	3	4	5
ICP 1	$\Delta X(\text{cm})$	-0,0658	-0,0443	-0,0105	-0,0131	-0,032
	$\Delta Y(\text{cm})$	0,0291	0,0233	0,0341	0,0254	0,0027
	$\Delta Z(\text{cm})$	-0,0312	-0,0031	0,0173	-0,0107	0,0169
ICP 2	$\Delta X(\text{cm})$	0,0477	0,0476	0,0216	0,0454	0,0844
	$\Delta Y(\text{cm})$	-0,016	-0,0092	-0,0005	0,0109	-0,006
	$\Delta Z(\text{cm})$	-0,0044	0,04	0,0548	0,0261	0,0645
ICP 3	$\Delta X(\text{cm})$	-0,0447	-0,0112	0,0367	-0,0108	-0,0228
	$\Delta Y(\text{cm})$	-0,0647	-0,0734	-0,0138	-0,0069	-0,0055
	$\Delta Z(\text{cm})$	-0,0843	-0,0624	-0,0327	-0,0592	-0,0551
ICP 4	$\Delta X(\text{cm})$	-0,0103	0,0308	0,0218	0,0423	-0,0016
	$\Delta Y(\text{cm})$	0,0656	-0,0003	0,0289	-0,0563	0,0244
	$\Delta Z(\text{cm})$	-0,0304	-0,0117	-0,0253	0,0012	-0,0323
ICP 5	$\Delta X(\text{cm})$	-0,0546	0,038	-0,0323	-0,0008	-0,0077
	$\Delta Y(\text{cm})$	0,0633	0,0496	-0,0227	-0,0418	0,0069
	$\Delta Z(\text{cm})$	-0,0444	0,0652	-0,001	0,0631	0,1298
ICP 6	$\Delta X(\text{cm})$	0,095	0,0555	0,0005	0,016	0,0202
	$\Delta Y(\text{cm})$	0,0414	0,0287	0,0249	0,0305	0,0384
	$\Delta Z(\text{cm})$	0,0006	0,0403	0,0113	-0,0651	0,055
ICP 7	$\Delta X(\text{cm})$	0,0327	0,0641	0,0757	0,0234	0,0305
	$\Delta Y(\text{cm})$	0,0552	0,0421	-0,0111	0,034	0,0558
	$\Delta Z(\text{cm})$	0,0077	0,0155	0,0435	0,0416	0,1231
ICP 8	$\Delta X(\text{cm})$	0,0464	0,0385	0,0363	0,0096	0,0301
	$\Delta Y(\text{cm})$	0,0804	0,0585	0,0301	0,0745	0,0831
	$\Delta Z(\text{cm})$	-0,0034	-0,014	0,0136	0,082	0,0762
ICP 9	$\Delta X(\text{cm})$	-0,0071	-0,0051	-0,0204	-0,013	-0,0056
	$\Delta Y(\text{cm})$	-0,0808	-0,073	-0,0659	-0,0216	-0,0115
	$\Delta Z(\text{cm})$	0,0593	0,0747	0,0358	0,0623	0,0016
ICP 10	$\Delta X(\text{cm})$	0,0487	0,0009	0,0895	0,0956	0,0633
	$\Delta Y(\text{cm})$	0,0614	-0,012	0,099	0,0553	0,0937
	$\Delta Z(\text{cm})$	0,0041	0,0334	0,0607	0,0356	0,0311

LAMPIRAN H

Hasil Perhitungan selisih RGB warna ICP

Hasil Pengukuran RGB ICP Pada Hasil Model 3D Intensitas Cahaya

Titik	RGB	Intensitas Cahaya				
		1	2	3	4	5
ICP 1	Red	35	44	49	58	92
	Green	44	44	51	67	99
	Blue	82	90	99	135	168
ICP 2	Red	95	106	116	140	166
	Green	100	110	121	148	177
	Blue	114	118	128	169	179
ICP 3	Red	46	53	57	117	147
	Green	46	57	66	124	156
	Blue	15	26	30	56	77
ICP 4	Red	99	103	119	158	171
	Green	104	110	125	165	184
	Blue	118	129	137	182	197
ICP 5	Red	28	43	56	88	149
	Green	34	45	63	114	164
	Blue	66	95	109	165	210
ICP 6	Red	56	65	95	105	128
	Green	60	69	99	115	131
	Blue	14	18	37	55	68
ICP 7	Red	56	81	134	151	202
	Green	62	95	140	160	207
	Blue	84	119	141	180	207
ICP 8	Red	60	118	126	156	172
	Green	61	122	132	161	177
	Blue	97	130	142	165	181
ICP 9	Red	63	85	94	126	155
	Green	71	85	101	133	168
	Blue	22	29	36	62	106
ICP 10	Red	55	74	82	115	160
	Green	55	76	84	126	167
	Blue	17	31	30	57	75

Selisih Pengukuran RGB ICP Pada Hasil Model 3D Intensitas Cahaya Dengan
RGB acuan

Titik	RGB	Intensitas Cahaya				
		1	2	3	4	5
ICP 1	Red	-12	-3	2	11	45
	Green	2	2	9	25	57
	Blue	-13	-5	4	40	73
ICP 2	Red	-17	-6	4	28	54
	Green	-13	-3	8	35	64
	Blue	-11	-7	3	44	54
ICP 3	Red	-7	0	4	64	94
	Green	-7	4	13	71	103
	Blue	-3	8	12	38	59
ICP 4	Red	-7	-3	13	52	65
	Green	-4	2	17	57	76
	Blue	-4	7	15	60	75
ICP 5	Red	-12	3	16	48	109
	Green	-25	-14	4	55	105
	Blue	-32	-3	11	67	112
ICP 6	Red	-4	5	35	45	68
	Green	-11	-2	28	44	60
	Blue	-4	0	19	37	50
ICP 7	Red	-9	16	69	86	137
	Green	-23	10	55	75	122
	Blue	-30	5	27	66	93
ICP 8	Red	-24	34	42	72	88
	Green	-32	29	39	68	84
	Blue	-26	7	19	42	58
ICP 9	Red	-24	-2	7	39	68
	Green	-17	-3	13	45	80
	Blue	-8	-1	6	32	76
ICP 10	Red	-4	15	23	56	101
	Green	-9	12	20	62	103
	Blue	-11	3	2	29	47