

Smartphone-Based SARS-CoV-2 and Variants Detection System using Colorimetric DNzyme Reaction triggered by Loop-Mediated Isothermal Amplification (LAMP) with Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR)

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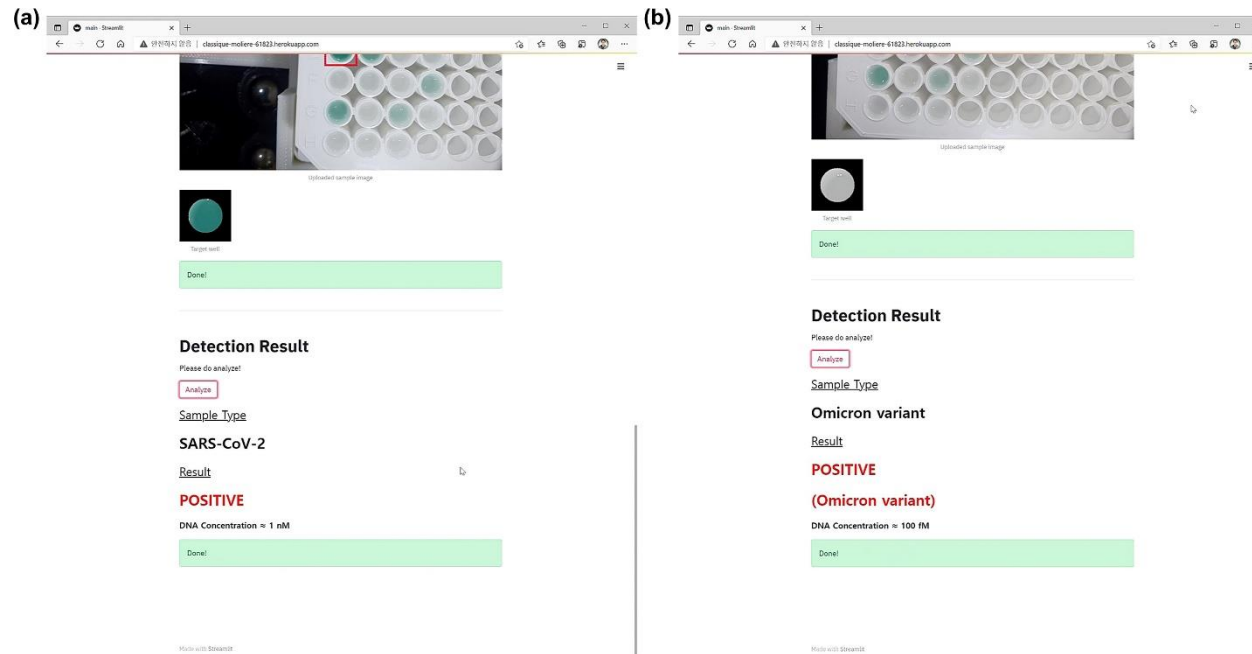
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Movie S1. (a) Movie of smartphone application for SARS-CoV-2 detection using DAMPR assay system. Diagnostic result considered is positive. (b) Movie of smartphone application for SARS-CoV-2 omicron variant detection using v-DAMPR assay system. Diagnostic result considered is positive.

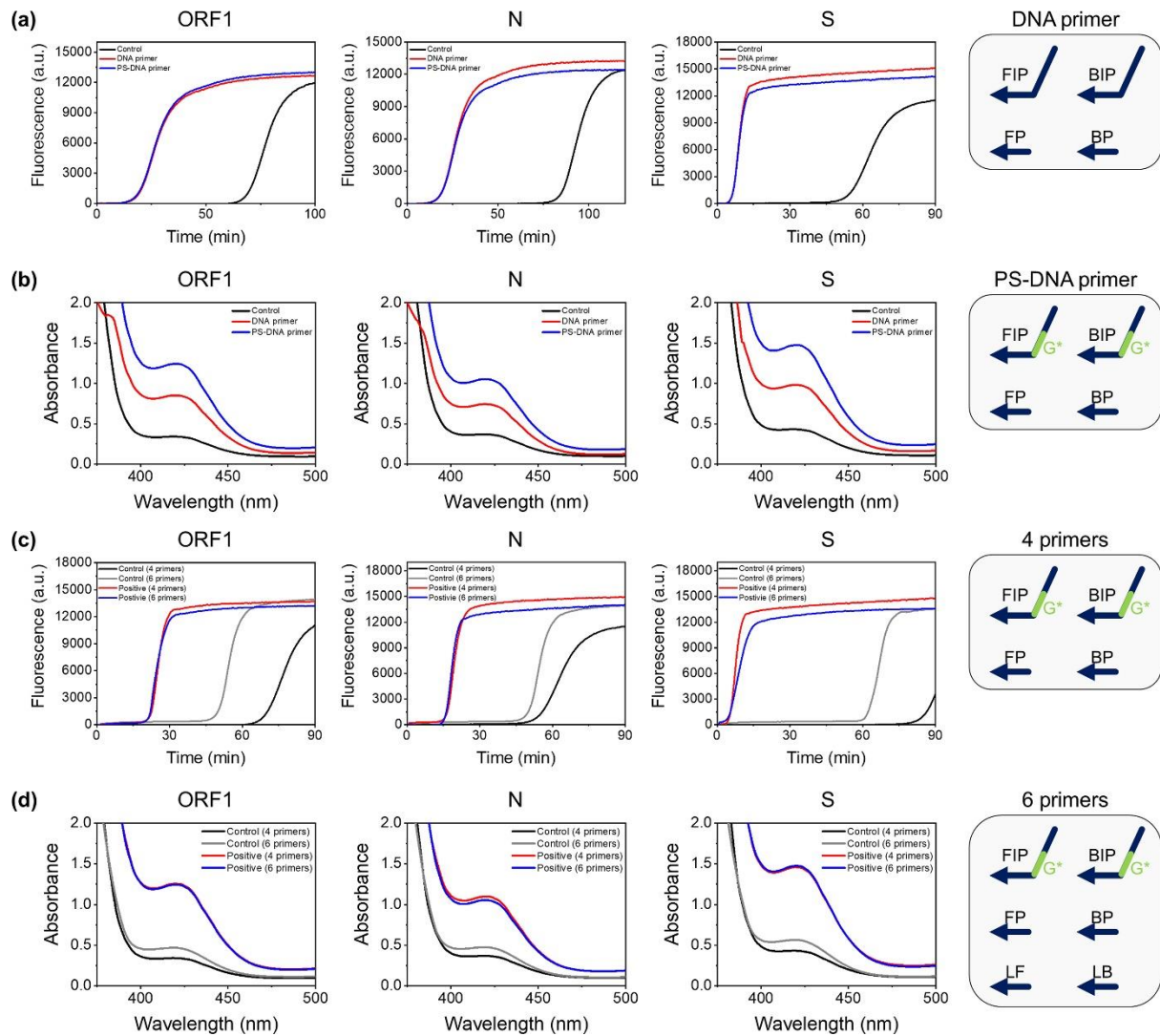


Figure S1. (a) Real-time fluorescence curves during detection of SARS-CoV-2 genes and control (no gene, black) using RT-LAMP reactions with DNA (red) and PS-DNA (blue) primers. (b) Absorbance spectra after detection of SARS-CoV-2 genes and control (no gene, black) by RT-LAMP and DNAzyme reactions with DNA (red) and PS-DNA (blue) primers. (c) Real-time fluorescence curves during detection of SARS-CoV-2 genes and control (no gene, black and gray) using RT-LAMP reactions with 4 (red) and 6 (blue) primers. (d) Absorbance spectra after detection of SARS-CoV-2 genes and control (no gene, black and gray) by RT-LAMP and DNAzyme reactions with 4 (red) and 6 (blue) primers.

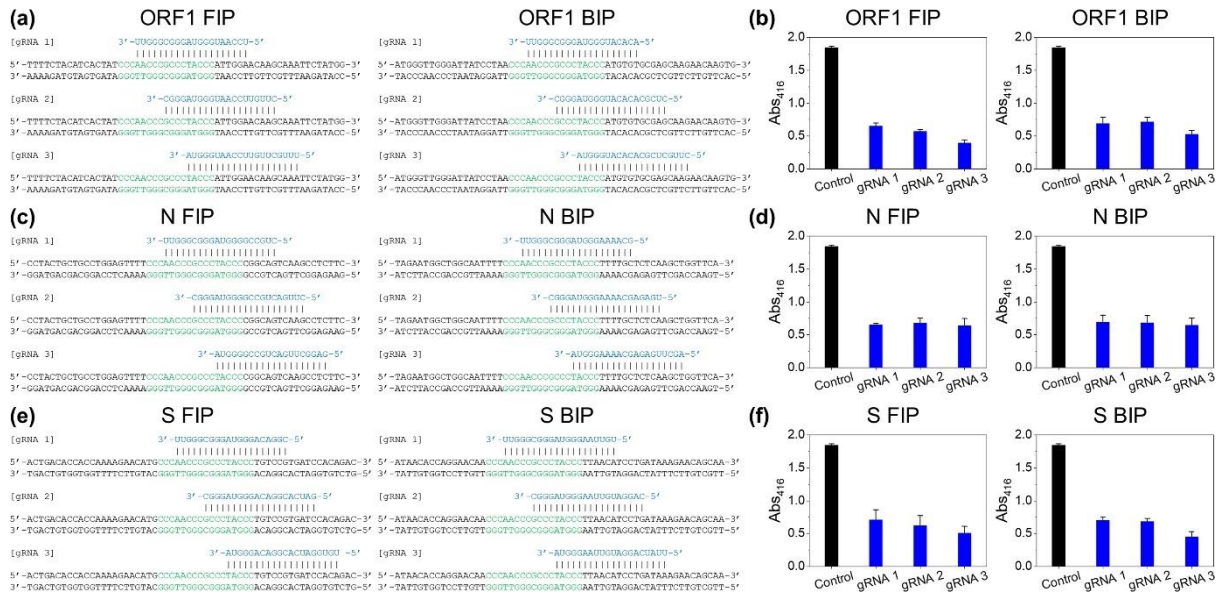


Figure S2. (a,c,e) Sequences of gRNAs (blue) for double-checking of (a) ORF1, (c) N, and (e) S gene LAMP products. Greens are DNaseI and complementary sequences in LAMP products. (b,d,f) Plots of Abs₄₁₆ as a function of gRNA (n = 3, error bar = standard deviation). Data were obtained after CRISPR reactions with gRNA 1, 2, and 3 (blue), and without gRNA (black) in the presence of LAMP products.

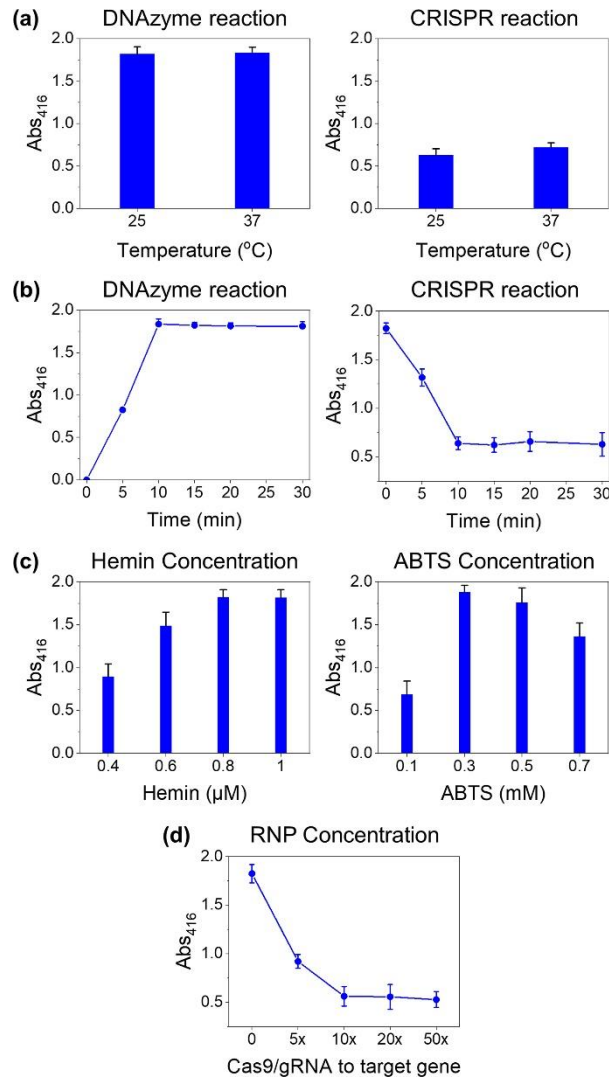


Figure S3. (a) Plots of Abs₄₁₆ as a function of temperature (n = 3, error bar = standard deviation). Left plot was obtained after detection of SARS-CoV-2 genes by RT-LAMP and DNAzyme reactions at 25 or 37 °C. Right plot was obtained after double-checking of SARS-CoV-2 genes by CRISPR reaction at 25 or 37 °C. (b) Plots of Abs₄₁₆ as a function of time (n = 3, error bar = standard deviation). Left plot was obtained after detection of SARS-CoV-2 genes by RT-LAMP and DNAzyme reactions for various times. Right plot was obtained after double-checking of SARS-CoV-2 genes by CRISPR reaction for various times. (c) Plots of Abs₄₁₆ as a function of hemin (left) and ABTS (right) concentrations (n = 3, error bar = standard deviation). Plots were obtained after detection of SARS-CoV-2 genes by RT-LAMP and DNAzyme reactions with various concentrations of hemin and ABTS. (d) Plot of Abs₄₁₆ as a function of RNP to target gene (n = 3, error bar = standard deviation). Plot was obtained after double-checking of SARS-CoV-2 genes by CRISPR reaction with various concentrations of RNP.

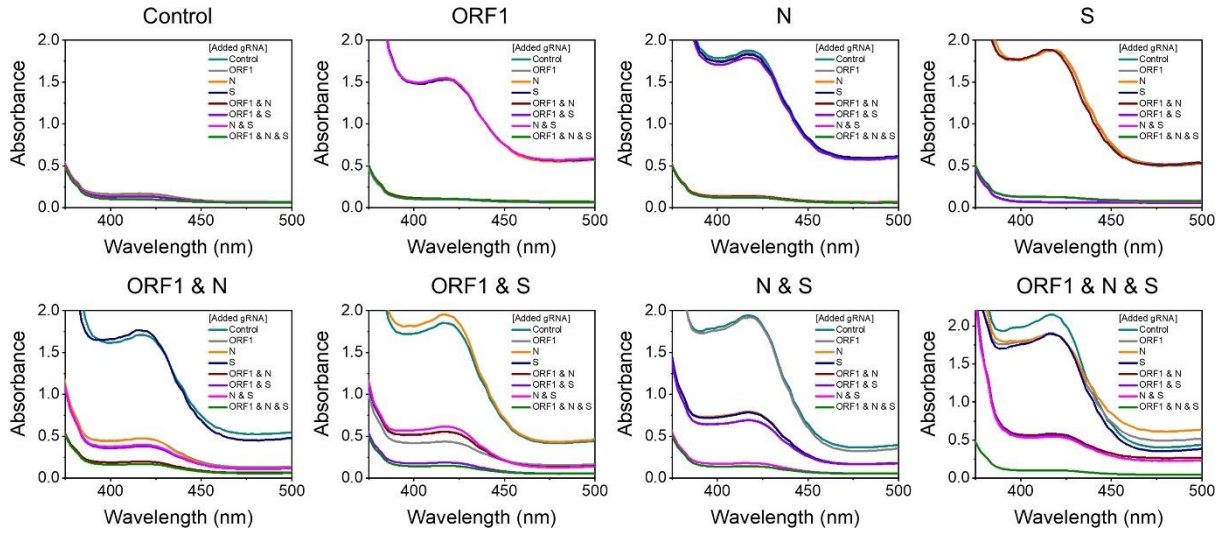


Figure S4. Absorbance spectra corresponding to Figure 2b.

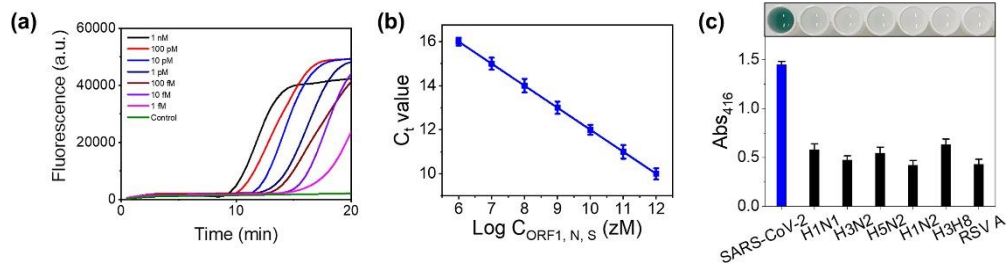


Figure S5. (a) Real-time fluorescence curves during detection of SARS-CoV-2 genes (ORF1, N, and S) using RT-LAMP reactions. The concentrations of genes were varied from 1 fM to 1 nM. (b) Plot of C_t value as a function of logarithmic concentration of SARS-CoV-2 genes (ORF1, N, and S) ($n = 3$, error bar = standard deviation). (c) Plot of Abs_{416} as a function of viral gene (SARS-CoV-2, H1N1, H3N2, H5N2, H1N2, H3H8, and RSV A) ($n = 3$, error bar = standard deviation). Plot was obtained after detection of viral genes (1 pM) using RT-LAMP and DNazyme reactions. Photograph is of well plate after RT-LAMP and DNazyme reactions.

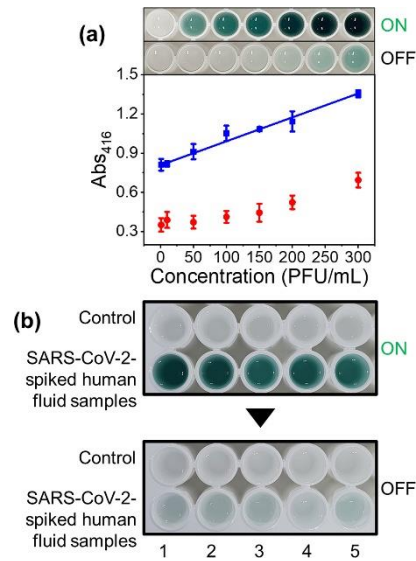


Figure S6. (a) Plot of Abs₄₁₆ as a function of SARS-CoV-2 lysate concentration (n = 3, error bar = standard deviation). Blue data were obtained after detection of SARS-CoV-2 lysates by RT-LAMP and DNazyme reactions. Red data were obtained after double-checking of SARS-CoV-2 lysates using Cas9/gRNA complexes. Photographs are well plates after RT-LAMP and DNazyme reactions (ON) and CRISPR reaction (OFF). Left wells are control samples. (b) Photograph of well plate after detection of SARS-CoV-2 lysate-spiked human nasopharyngeal aspirates (1, 2, and 3) and sputum (4 and 5) samples (10² PFU/mL) by using RT-LAMP and DNazyme reactions (ON). Photograph of the same well plate after double-checking of samples by using CRISPR reaction (OFF).

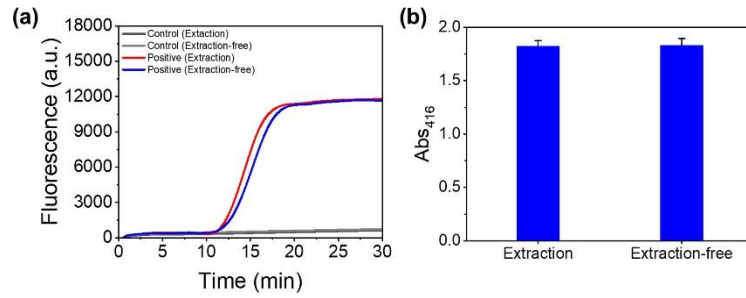


Figure S7. (a) Real-time fluorescence curves during detection of SARS-CoV-2 lysates (10^4 PFU/mL) and control (no lysates, black and gray) using RT-LAMP reactions before (blue) and after (red) RNA extraction. (b) Plot of Abs₄₁₆ as a function of RNA extraction ($n = 3$, error bar = standard deviation). Data were obtained after detection of SARS-CoV-2 lysates (10^4 PFU/mL) by RT-LAMP and DNazyme reactions before and after RNA extraction.

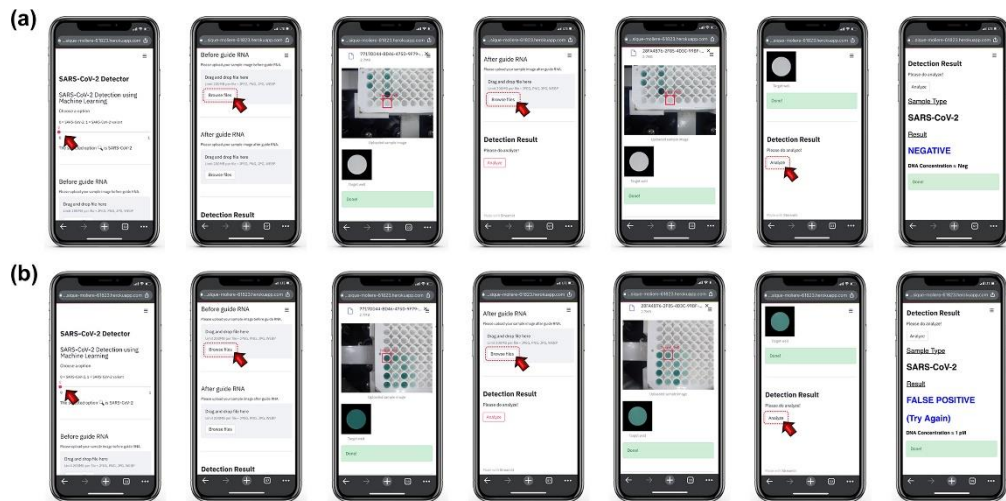


Figure S8. (a,b) User manuals of smartphone application for SARS-CoV-2 detection by DAMPR assay system. Exemplified diagnostic result is (a) negative and (b) false-positive.

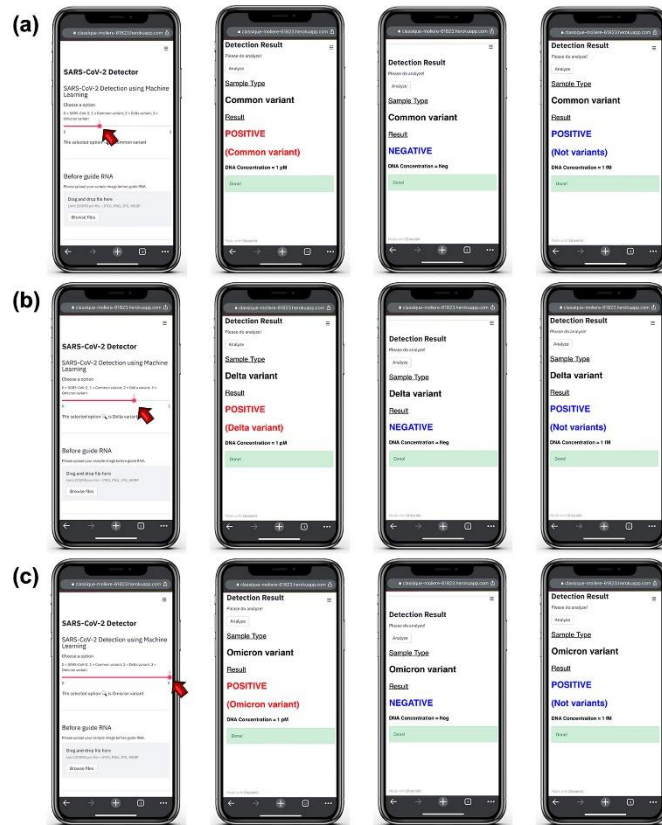
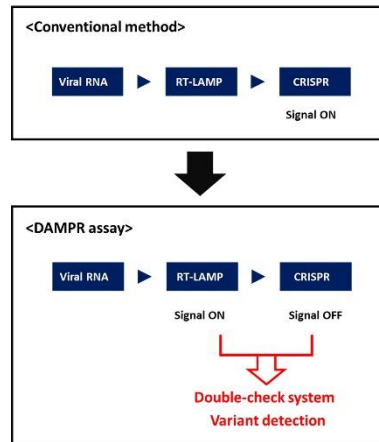


Figure S9. (a-c) User manuals of smartphone application for SARS-CoV-2 variants detection by v-DAMPR assay system. Exemplified diagnostic result is (a) variant (D614G), (b) delta-specific variant (T478K), and (c) omicron-specific variant (A67V).

Figure S10. Comparison of DAMPR assay with the previous colorimetric SARS-CoV-2 detection methods.

Method	Detection	Performance test				Practical applicability test			Reference	
		Sensitivity	Quantification	Multiplexing	Reaction time	Image sensing	Clinical test	Variant detection		POCT device
DAMPR assay	- DNAzyme reaction (Colorimetric detection for naked eye)	10, 9, 13 copies for ORF1, N, and S genes	O	O	50 min	Machine-learning based image processing	O 206 samples (147 positive and 59 negative)	O	O	This work
Antibody-conjugated Au NP assay	- Au NPs functionalized with antibodies targeting three surface proteins of SARS-CoV-2 - Salt control condition	-	X	X	Synthesis time (140 min) + Detection time (3 min)	X	O 94 samples (45 positive and 49 negative)	X	X	[S1]
CRISPR-Cas12a powered visual biosensor	- Two types of Au NPs with linker DNA - Centrifuge - Salt control condition	1 copy	O	X	Synthesis time + 90 min	RGB analysis	O 50 samples (20 positive and 30 negative)	X	O	[S2]
Conventional PCR assisted single-component assembly	- Two types of Au NPs with linker DNA - Complex HP design	1 copy	X	X	Synthesis time + 120 min	Naked eye	9 samples (3 positive, 3 low positive, and 3 negative samples)	X	X	[S3]
Antisense Oligonucleotide Capped Plasmonic Nanoparticles	- Au NP synthesis with ASO	8.3 copies	X	X	Synthesis time	Naked eye	X	X	X	[S4]
RT-RPA-Coupled CRISPR-Cas12a Colorimetric Assay	- Au NP synthesis with DNA	1 copy	X	X	Over 13 h	Naked eye	X	X	X	[S5]

Figure S11. Comparison of DAMPR assay with the previously integrated assays of LAMP and CRISPR-Cas systems.



Method	Detection	Multiplexing	CRISPR System	Double-checking the amplified LAMP products	Clinical test	Variant detection	Reference
DAMPR assay	DNAzyme reaction (Colorimetric detection for naked eye)	O (ORF1, N, S genes)	Cas9 (cis-cleavage)	O	206 clinical samples	D614G T478K A67V	This work
RT-LAMP +CRISPR	Reporter probe (Fluorescence detection)	X (N, E genes)	Cas12a (trans-cleavage)	X	100 clinical samples	X	[S6]
RT-LAMP +CRISPR	Reporter probe (Fluorescence detection)	X (ORF1, N, E genes)	Cas12a (trans-cleavage)	X	10 clinical samples	X	[S7]
RT-LAMP +CRISPR	Reporter probe (Fluorescence detection+ Blue light detection for naked eye)	X (S gene)	Cas12a (trans-cleavage)	X	26 clinical samples	X	[S8]
DETECTR, RT-LAMP +CRISPR	Reporter probe (Fluorescence detection)	X (N, E genes)	Cas12a (trans-cleavage)	X	6 clinical samples	X	[S9]
iSCAN	LFA	X (N, E genes)	Cas12a (trans-cleavage)	X	24 clinical samples	X	[S10]

Table S1. Primer sequences used in this study.

Target	Name	Sequence (5' → 3') ^a
ORF1 gene	ORF1 FP	GCA CCG TAG CTG GTG TCT CTA
	ORF1 BP	CAA ATG TTA AAA ACA CTA TTA GCA TA
	ORF1 LF ^b	ACA GTT TTT AAC ATG TTG
	ORF1 LB	AGC CAT GCC TAA CAT GCT
	ORF1 FIP	AGG TGA GGG TTT TCT ACA TCA CTA TCC CAA CCC GCC CTA CCC ATT GGA ACA AGC AAA TTC TAT GG
	ORF1 BIP	ATG GGT TGG GAT TAT CCT AAC CCA ACC CGC CCT ACC CAT GTG TGC GAG CAA GAA CAA GTG
N gene	N FP	GCC AAA AGG CTT CTA CGC A
	N BP	TTT GGC CTT GTT GTT GTT GG
	N LF	GAA TTT CTT GAA CTG TTG
	N LB	GGC GGT GAT GCT GCT CTT
	N FIP	TCC CCT ACT GCT GCC TGG AGT TTT CCC AAC CCG CCC TAC CCC GGC AGT CAA GCC TCT TC
	N BIP	TCC TGC TAG AAT GGC TGG CAA TTT TCC CAA CCC GCC CTA CCC TTT TGC TCT CAA GCT GGT TCA
S gene	S FP	CAT TCA ACT CAG GAC TTG TTC T
	S BP	GCA ACA GGG ACT TCT GTG CA
	S LF	TAA TGT CAA GAA TCT CAA
	S LB	ATA CTT CTA ACC AGG TTG
	S FIP	ACT GAC ACC ACC AAA AGA ACA TGC CCA ACC CGC CCT ACC CTG TCC GTG ATC CAC AGA C
	S BIP	ATA ACA CCA GGA ACA ACC CAA CCC GCC CTA CCC TTA ACA TCC TGA TAA AGA ACA GCA A

^aGreen color represents G-quadruplex complementary sequences with PS modification.

^bLF and LB primers were used for optimization tests.

Table S2. gRNA sequences used in this study.

Target	Name	Sequence (5' → 3')
ORF1 gene	gRNA FIP 1	UCC AAU GGG UAG GGC GGG UU
	gRNA FIP 2	CUU GUU CCA AUG GGU AGG GC
	gRNA FIP 3	UUU GCU UGU UCC AAU GGG UA
	gRNA BIP 1	ACA CAU GGG UAG GGC GGG UU
	gRNA BIP 2	CUC GCA CAC AUG GGU AGG GC
	gRNA BIP 3	CUU GCU CGC ACA CAU GGG UA
N gene	gRNA FIP 1	CUG CCG GGG UAG GGC GGG UU
	gRNA FIP 2	CUU GAC UGC CGG GGU AGG GC
	gRNA FIP 3	GAG GCU UGA CUG CCG GGG UA
	gRNA BIP 1	GCA AAA GGG UAG GGC GGG UU
	gRNA BIP 2	UGA GAG CAA AAG GGU AGG GC
	gRNA BIP 3	AGC UUG AGA GCA AAA GGG UA
S gene	gRNA FIP 1	CGG ACA GGG UAG GGC GGG UU
	gRNA FIP 2	GAU CAC GGA CAG GGU AGG GC
	gRNA FIP 3	UGU GGA UCA CGG ACA GGG UA
	gRNA BIP 1	GUU AAG GGA UGU UAA GGG UA
	gRNA BIP 2	CAG GAU GUU AAG GGU AGG GC
	gRNA BIP 3	UUA UCA GGA UGU UAA GGG UA
S gene D614G	D614G gRNA	UUA UCA GGG UGU UAA GGG UA
S gene T478K	T478K gRNA S' gRNA	CGG UAG CAA ACC UUG GGG UA
		CGG UAG CAC ACC UUG GGG UA
S gene A67V	A67V gRNA S'' gRNA	GUU CCA UGU UAU ACA GGG UA
		GUU CCA UGC UAU ACA GGG UA

Table S3. Comparison of this work with previous reported SARS-CoV-2 assays.

Method	Target gene	LOD (copies/μL)	Time (min)	Ref.	
qRT-PCR	RdRP, E, N	1.25	60 - 70	[S11]	
RT-RCA	RdRP	2.2	90	[S12]	
RT-LAMP	RT-LAMP	RdRP, S	10	60	[S13]
	opvCRISPR	S	5	45	[S8]
	IFAST RT-LAMP	ORF1, N	470	30	[S14]
	One-tube colorimetric RT-LAMP	RdRP, NSP2	200	60	[S15]
	RT-Proofman-LAMP	ORF1ab, N	100	50	[S16]
	Cas13a/RT-LAMP	N1, N2, N3	2.5	60	[S17]
	SPOT	N, E	0.44, 1.09	30	[S18]
NEAR	RdRP	20	< 20	[S19]	
RT-RPA	N	7.74	< 30	[S20]	
SHERLOCK	ORF1ab, S, N	2.1	90	[S21]	
DETECTR	E, N	10	40	[S9]	
DAMPR	ORF1, N, S	10, 9, 13	50	This work	

Table S4. Evaluation of LDA, RF, and GBC classifiers for DAMPR assay system in terms of precision, recall, and f1 score.

Sample	Precision (LDA/RF/GBC)	Recall (LDA/RF/GBC)	F1 score (LDA/RF/GBC)	Support (LDA/RF/GBC)
Control	0.89/1.00/0.95	0.82/0.97/0.92	0.85/0.98/0.93	30/30/30
1 aM	0.76/0.97/0.90	0.8./0.97/0.90	0.79/0.97/0.90	30/30/30
10 aM	0.91/0.97/0.97	0.97/1.00/1.00	0.94/0.98/0.98	30/30/30
100 aM	0.97/1.00/1.00	0.93/1.00/1.00	0.95/1.00/1.00	30/30/30
1 fM	1.00/1.00/1.00	0.97/1.00/1.00	0.98/1.00/1.00	30/30/30
10 fM	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00	30/30/30
100 fM	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00	30/30/30
1 pM	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00	30/30/30
10 pM	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00	30/30/30
100 pM	1.00/1.00/1.00	1.00/1.00/1.00	1.00/1.00/1.00	30/30/30
1 nM	0.97/1.00/1.00	1.00/1.00/1.00	0.98/1.00/1.00	30/30/30
10 nM	1.00/1.00/1.00	1.00/1.00/1.00	0.98/1.00/1.00	30/30/30
Average	0.96/0.99/0.98	0.96/0.99/0.99	0.96/0.99/0.98	360/360/360

Table S5. Accuracy of LDA, RF, and GBC classifiers for DAMPR assay system.

LDA (%)	RF (%)	GBC (%)
95.84	99.38	98.75

Table S6. Diagnostic results of 136 clinical samples by qRT-PCR.

Number	Sample type	C _t value		
		ORF1	N	S
1	NPS ^a	11.73	13.2	12.7
2	NPS	27.4	28.3	30.22
3	NPS	33.33	26.4	30.48
4	NPS	14.2	14.3	15.2
5	NPS	35.08	33.81	33.6
6	NPS	N/A	N/A	N/A
7	NPS	N/A	N/A	N/A
8	NPS	29.4	30.2	29.95
9	NPS	8.3	8.9	8.7
10	NPS	11.9	13.1	12.8
11	NPS	12.6	10.81	10.94
12	NPS	N/A	N/A	N/A
13	NPS	22.5	20.6	21.31
14	NPS	28.7	31.1	26.3
15	NPS	7.56	8.3	8.5
16	NPS	22.1	20.09	22.3
17	NPS	24.7	25.2	23.2
18	NPS	N/A	N/A	N/A
19	NPS	N/A	N/A	N/A
20	NPS	N/A	N/A	N/A
21	NPS	21.8	22.4	20.9
22	NPS	26.4	25.7	24.3
23	NPS	38.85	37.7	37.83

Number	Sample type	C _t value		
		ORF1	N	S
24	NPS	N/A	N/A	N/A
25	NPS	N/A	N/A	N/A
26	NPS	N/A	N/A	N/A
27	NPS	N/A	N/A	N/A
28	NPS	20.4	23.4	21.2
29	NPS	N/A	N/A	N/A
30	NPS	N/A	N/A	N/A
31	NPS	N/A	N/A	N/A
32	NPS	17.3	17.8	15.97
33	NPS	N/A	N/A	N/A
34	NPS	N/A	N/A	N/A
35	NPS	N/A	N/A	N/A
36	NPS	30.17	35.8	34.1
37	NPS	22.5	23.1	24.3
38	NPS	31.3	32.1	30.2
39	NPS	24.58	28.3	25.26
40	NPS	N/A	N/A	N/A
41	NPS	25.2	23.8	24.8
42	NPS	23.1	22.8	21.9
43	NPS	N/A	N/A	N/A
44	NPS	26.19	33.01	27.26
45	NPS	N/A	N/A	N/A
46	NPS	26.47	30.1	26.5
47	NPS	N/A	N/A	N/A

Number	Sample type	C _t value		
		ORF1	N	S
48	NPS	32.2	31.2	27.07
49	NPS	30.2	29.4	28.3
50	NPS	27.3	22.5	29.2
51	NPS	25.3	28.31	27.3
52	NPS	27.9	28.3	21.88
53	NPS	N/A	N/A	N/A
54	NPS	18.4	18.4	15.33
55	NPS	N/A	N/A	N/A
56	NPS	N/A	N/A	N/A
57	NPS	25.11	26.3	26.1
58	NPS	29.95	29.16	28.73
59	NPS	N/A	N/A	N/A
60	NPS	N/A	N/A	N/A
61	NPS	N/A	N/A	N/A
62	NPS	26.3	25.4	25.2
63	NPS	N/A	N/A	N/A
64	NPS	N/A	N/A	N/A
65	NPS	12.52	13.84	11.63
66	NPS	N/A	N/A	N/A
67	NPS	25.3	28.31	24.3
68	NPS	N/A	N/A	N/A
69	NPS	25.26	25.34	26.53
70	NPS	24.85	26.16	24.35
71	NPS	25.1	23.6	26.3

Number	Sample type	C _t value		
		ORF1	N	S
72	NPS	17.3	17.5	16.1
73	NPS	25.1	28.9	25.3
74	NPS	N/A	N/A	N/A
75	NPS	10.57	11.3	11.73
76	NPS	25.2	29.1	24.3
77	NPS	N/A	N/A	N/A
78	NPS	N/A	N/A	N/A
79	NPS	N/A	N/A	N/A
80	NPS	N/A	N/A	N/A
81	NPS	11.13	14.2	12.88
82	NPS	N/A	N/A	N/A
83	NPS	N/A	N/A	N/A
84	NPS	28.73	33.1	29.27
85	NPS	33.2	34.2	31.1
86	NPS	N/A	N/A	N/A
87	NPS	N/A	N/A	N/A
88	NPS	N/A	N/A	N/A
89	NPS	24.88	28.1	23.07
90	NPS	N/A	N/A	N/A
91	NPS	N/A	N/A	N/A
92	NPS	22.7	21.3	21.8
93	NPS	N/A	N/A	N/A
94	NPS	33.2	30.22	28.84
95	NPS	N/A	N/A	N/A

Number	Sample type	C _t value		
		ORF1	N	S
96	NPS	N/A	N/A	N/A
97	NPS	11.56	13.8	11.9
98	NPS	32.7	30.1	33.1
99	NPS	22.1	21.2	25.3
100	NPS	31.43	32.1	32.7
101	NPS	N/A	N/A	N/A
102	NPS	N/A	N/A	N/A
103	NPS	N/A	N/A	N/A
104	NPS	26.8	26.9	27.56
105	NPS	11.69	12.5	12.27
106	NPS	N/A	N/A	N/A
107	NPS	N/A	N/A	N/A
108	NPS	33.7	34.5	33.8
109	NPS	N/A	N/A	N/A
110	NPS	10.14	11.3	11.57
111	NPS	N/A	N/A	N/A
112	NPS	13.35	19.05	13.69
113	NPS	26.8	25.4	26.2
114	NPS	25.2	28.3	25.1
115	NPS	29.19	28.12	29.06
116	NPS	N/A	N/A	N/A
117	NPS	N/A	N/A	N/A
118	NPS	N/A	N/A	N/A
119	NPS	32.7	33.4	31.3

Number	Sample type	C _t value		
		ORF1	N	S
120	NPS	N/A	N/A	N/A
121	NPS	10.59	13.1	12.4
122	NPS	N/A	N/A	N/A
123	NPS	N/A	N/A	N/A
124	NPS	N/A	N/A	N/A
125	NPS	9.37	11.3	10.1
126	NPS	27.15	28.31	29.95
127	Sputum	13.8	14.5	8.7
128	Sputum	33.51	32.92	12.8
129	Sputum	20.3	21.7	20.1
130	Sputum	33.25	34.1	33.2
131	Sputum	14.3	13.8	13.5
132	Sputum	19.8	18.1	20.6
133	Sputum	31.9	32.8	24.8
134	Sputum	32.7	32.58	32.4
135	Sputum	33.11	33.45	15.65
136	Sputum	17.3	19.2	20.1

^aNasopharyngeal swab

^bNot available

Table S7. Diagnostic results of 80 clinical samples by qRT-PCR.

Number	Variant	Sample type	C _t value	
			RdRP	E
1	Delta	NPS	9.81	10.64
2	Delta	NPS	13.81	13.98
3	Delta	NPS	13.38	13.41
4	Delta	NPS	13.65	13.92
5	Delta	NPS	12.89	12.88
6	Delta	NPS	12.32	12.53
7	Delta	NPS	13.83	13.65
8	Delta	NPS	10.28	10.53
9	Delta	NPS	10.35	10.54
10	Delta	NPS	10.42	10.13
11	WT	NPS	9.37	11.37
12	WT	NPS	10.14	11.57
13	WT	NPS	10.57	11.73
14	WT	NPS	10.59	12.03
15	WT	NPS	11.13	12.88
16	WT	NPS	11.56	11.90
17	WT	NPS	11.69	12.27
18	WT	NPS	12.40	12.19
19	WT	NPS	12.52	11.63
20	WT	NPS	13.35	13.69
21	Delta	NPS ^a	24.28	22.19
22	Delta	NPS	18.11	15.34
23	Delta	NPS	17.48	18.23

Number	Variant	Sample type	C _t value	
			RdRP	E
24	Delta	NPS	16.17	15.50
25	Delta	NPS	18.26	19.25
26	Delta	NPS	16.85	17.54
27	Delta	NPS	18.21	16.67
28	Delta	NPS	21.06	21.23
29	Delta	NPS	13.72	15.13
30	Delta	NPS	15.43	15.41
31	Delta	NPS	13.86	14.42
32	Delta	NPS	15.62	16.37
33	Delta	NPS	27.48	24.73
34	Delta	NPS	15.06	15.17
35	Delta	NPS	19.65	16.41
36	Delta	NPS	25.24	25.27
37	Delta	NPS	19.21	19.56
38	Delta	NPS	23.79	20.82
39	Delta	NPS	22.02	20.11
40	Delta	NPS	18.37	16.37
41	Delta	NPS	16.83	18.02
42	Delta	NPS	28.82	30.81
43	Delta	NPS	20.04	21.40
44	Delta	NPS	21.29	20.14
45	Delta	NPS	19.15	19.00
46	Delta	NPS	14.25	15.10
47	Delta	NPS	13.73	14.02

Number	Variant	Sample type	C _t value	
			RdRP	E
48	Delta	NPS	16.80	16.39
49	Delta	NPS	11.59	11.89
50	Delta	NPS	25.20	26.27
51	Delta	NPS	14.09	13.58
52	Delta	NPS	18.56	18.80
53	Delta	NPS	17.74	17.48
54	Delta	NPS	22.14	21.08
55	Delta	NPS	30.75	29.74
56	Delta	NPS	31.73	32.31
57	Delta	NPS	17.02	16.25
58	Delta	NPS	16.27	16.30
59	Delta	NPS	22.67	23.32
60	Delta	NPS	30.15	26.68
61	Delta	NPS	28.11	29.87
62	Delta	NPS	17.45	18.31
63	Delta	NPS	13.32	16.47
64	Delta	NPS	18.55	20.15
65	Delta	NPS	20.10	16.98
66	Delta	NPS	30.72	32.54
67	Delta	NPS	25.73	23.69
68	Delta	NPS	15.13	13.89
69	Delta	NPS	29.36	28.64
70	Delta	NPS	18.36	16.58
71	Omicron	NPS	22.08	20.77

Number	Variant	Sample type	C _t value	
			RdRP	E
72	Omicron	NPS	16.77	16.95
73	Omicron	NPS	14.81	14.68
74	Omicron	NPS	16.89	15.21
75	Omicron	NPS	29.34	29.24
76	Omicron	NPS	14.85	15.37
77	Omicron	NPS	15.24	15.96
78	Omicron	NPS	23.45	21.7
79	Omicron	NPS	17.3	18.16
80	Omicron	NPS	23.98	24.67

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