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LAMPIRAN

Data Latih Sensor

1	MQ135,Volt135,MQ137,Volt137,MQ4,Volt4,Label	41	250,1.22,98,0.47,185,0.91,1
2	245,1.20,90,0.44,150,0.73,1	42	255,1.24,65,0.32,150,0.73,1
3	252,1.23,87,0.43,160,0.78,1	43	260,1.27,70,0.34,160,0.78,1
4	260,1.27,92,0.45,170,0.83,1	44	270,1.32,72,0.35,170,0.83,1
5	275,1.34,110,0.54,185,0.91,1	45	275,1.34,80,0.39,165,0.81,1
6	288,1.41,95,0.46,180,0.88,1	46	285,1.39,95,0.46,180,0.88,1
7	240,1.17,80,0.39,140,0.68,1	47	295,1.44,105,0.51,185,0.91,1
8	230,1.12,70,0.34,135,0.66,1	48	298,1.46,110,0.54,175,0.86,1
9	220,1.07,85,0.41,150,0.73,1	49	205,1.00,60,0.29,135,0.66,1
10	215,1.05,78,0.38,165,0.81,1	50	215,1.05,65,0.32,140,0.68,1
11	205,1.00,60,0.29,145,0.71,1	51	225,1.10,72,0.35,150,0.73,1
12	198,0.97,75,0.37,155,0.76,1	52	235,1.15,85,0.41,155,0.76,1
13	190,0.93,65,0.32,160,0.78,1	53	245,1.20,90,0.44,160,0.78,1
14	185,0.90,72,0.35,175,0.86,1	54	255,1.24,100,0.49,165,0.81,1
15	175,0.85,68,0.33,165,0.81,1	55	265,1.29,108,0.53,170,0.83,1
16	160,0.78,55,0.27,150,0.73,1	56	270,1.32,112,0.55,180,0.88,1
17	155,0.76,52,0.25,148,0.72,1	57	275,1.34,105,0.51,185,0.91,1
18	165,0.81,58,0.28,155,0.76,1	58	280,1.37,95,0.46,150,0.73,1
19	172,0.84,62,0.30,160,0.78,1	59	190,0.93,72,0.35,165,0.81,1
20	180,0.88,70,0.34,170,0.83,1	60	175,0.85,68,0.33,150,0.73,1
21	190,0.93,75,0.37,180,0.88,1	61	160,0.78,65,0.32,155,0.76,1
22	195,0.95,80,0.39,185,0.91,1	62	165,0.81,70,0.34,165,0.81,1
23	205,1.00,90,0.44,175,0.86,1	63	180,0.88,75,0.37,175,0.86,1
24	210,1.03,94,0.46,165,0.81,1	64	195,0.95,80,0.39,185,0.91,1
25	220,1.07,100,0.49,160,0.78,1	65	198,0.97,82,0.40,178,0.87,1
26	225,1.10,105,0.51,155,0.76,1	66	210,1.03,88,0.43,165,0.81,1
27	235,1.15,108,0.53,170,0.83,1	67	220,1.07,92,0.45,160,0.78,1
28	240,1.17,112,0.55,180,0.88,1	68	230,1.12,98,0.47,170,0.83,1
29	250,1.22,114,0.56,185,0.91,1	69	240,1.17,102,0.50,180,0.88,1
30	255,1.24,110,0.54,175,0.86,1	70	250,1.22,108,0.53,185,0.91,1
31	265,1.29,92,0.45,170,0.83,1	71	260,1.27,110,0.54,175,0.86,1
32	270,1.32,88,0.43,165,0.81,1	72	270,1.32,112,0.55,160,0.78,1
33	280,1.37,95,0.46,150,0.73,1	73	280,1.37,90,0.44,150,0.73,1
34	290,1.42,100,0.49,155,0.76,1	74	290,1.42,100,0.49,165,0.81,1
35	295,1.44,104,0.51,160,0.78,1	75	295,1.44,110,0.54,170,0.83,1
36	298,1.46,112,0.55,170,0.83,1	76	298,1.46,114,0.56,180,0.88,1
37	210,1.03,75,0.37,145,0.71,1	77	205,1.00,55,0.27,145,0.71,1
38	220,1.07,80,0.39,155,0.76,1	78	210,1.03,58,0.28,150,0.73,1
39	230,1.12,90,0.44,165,0.81,1	79	220,1.07,65,0.32,160,0.78,1
40	240,1.17,88,0.43,175,0.86,1	80	230,1.12,70,0.34,175,0.86,1

81	240,1.17,80,0.39,185,0.91,1	121	370,1.81,150,0.73,255,1.25,2
82	250,1.22,90,0.44,150,0.73,1	122	375,1.83,152,0.74,260,1.27,2
83	260,1.27,95,0.46,160,0.78,1	123	380,1.86,155,0.76,265,1.30,2
84	270,1.32,100,0.49,170,0.83,1	124	385,1.88,158,0.77,270,1.32,2
85	280,1.37,110,0.54,180,0.88,1	125	390,1.90,160,0.78,275,1.34,2
86	290,1.42,112,0.55,185,0.91,1	126	395,1.93,162,0.79,280,1.37,2
87	295,1.44,108,0.53,175,0.86,1	127	400,1.95,165,0.80,285,1.39,2
88	298,1.46,102,0.50,165,0.81,1	128	405,1.98,168,0.82,290,1.42,2
89	180,0.88,85,0.41,155,0.76,1	129	410,2.00,170,0.83,295,1.44,2
90	175,0.85,80,0.39,148,0.72,1	130	415,2.02,172,0.84,300,1.47,2
91	165,0.81,78,0.38,150,0.73,1	131	420,2.05,175,0.85,305,1.49,2
92	160,0.78,75,0.37,160,0.78,1	132	425,2.07,178,0.87,310,1.52,2
93	155,0.76,70,0.34,165,0.81,1	133	430,2.10,180,0.88,315,1.54,2
94	150,0.73,68,0.33,170,0.83,1	134	435,2.12,183,0.89,320,1.56,2
95	158,0.77,72,0.35,175,0.86,1	135	440,2.15,186,0.91,325,1.59,2
96	165,0.81,75,0.37,180,0.88,1	136	445,2.17,188,0.92,330,1.61,2
97	172,0.84,82,0.40,185,0.91,1	137	450,2.20,190,0.93,335,1.64,2
98	185,0.90,85,0.41,175,0.86,1	138	455,2.22,193,0.94,340,1.66,2
99	195,0.95,92,0.45,165,0.81,1	139	460,2.25,196,0.96,345,1.69,2
100	208,1.02,98,0.47,155,0.76,1	140	465,2.27,198,0.97,350,1.71,2
101	218,1.07,100,0.49,148,0.72,1	141	470,2.30,200,0.98,355,1.74,2
102	228,1.12,102,0.50,150,0.73,1	142	475,2.32,202,0.99,360,1.76,2
103	240,1.17,110,0.54,160,0.78,1	143	480,2.35,205,1.00,365,1.78,2
104	250,1.22,112,0.55,170,0.83,1	144	485,2.37,208,1.02,370,1.81,2
105	260,1.27,114,0.56,185,0.91,1	145	490,2.40,210,1.03,375,1.83,2
106	275,1.34,108,0.53,150,0.73,1	146	495,2.42,212,1.04,380,1.86,2
107	285,1.39,100,0.49,160,0.78,1	147	500,2.45,215,1.05,385,1.88,2
108	298,1.46,95,0.46,175,0.86,1	148	505,2.47,218,1.07,390,1.90,2
109	310,1.52,120,0.59,195,0.95,2	149	510,2.50,220,1.08,395,1.93,2
110	315,1.54,122,0.60,200,0.98,2	150	515,2.52,223,1.09,400,1.95,2
111	320,1.56,125,0.61,205,1.00,2	151	520,2.55,225,1.10,405,1.98,2
112	325,1.59,128,0.63,210,1.03,2	152	525,2.57,228,1.12,410,2.00,2
113	330,1.61,130,0.64,215,1.05,2	153	530,2.60,230,1.13,415,2.02,2
114	335,1.64,132,0.65,220,1.07,2	154	535,2.62,232,1.14,420,2.05,2
115	340,1.66,135,0.66,225,1.10,2	155	540,2.65,235,1.15,425,2.07,2
116	345,1.69,138,0.68,230,1.12,2	156	545,2.67,238,1.17,430,2.10,2
117	350,1.71,140,0.69,235,1.15,2	157	550,2.70,240,1.18,435,2.12,2
118	355,1.74,142,0.70,240,1.17,2	158	555,2.72,243,1.19,440,2.15,2
119	360,1.76,145,0.71,245,1.20,2	159	560,2.75,245,1.20,445,2.17,2
120	365,1.78,148,0.72,250,1.22,2	160	565,2.77,248,1.21,450,2.20,2

161	570,2.80,250,1.22,455,2.22,2	201	532,2.62,310,1.51,550,2.69,2
162	575,2.82,253,1.24,460,2.25,2	202	539,2.66,315,1.54,560,2.74,2
163	580,2.84,255,1.25,465,2.27,2	203	545,2.69,320,1.56,570,2.79,2
164	585,2.87,258,1.26,470,2.30,2	204	552,2.72,325,1.59,580,2.84,2
165	590,2.89,260,1.27,475,2.32,2	205	559,2.76,330,1.61,590,2.89,2
166	595,2.92,263,1.29,480,2.35,2	206	565,2.79,335,1.63,600,2.94,2
167	305,1.49,140,0.68,210,1.02,2	207	305,1.49,130,0.64,210,1.03,2
168	312,1.52,145,0.71,220,1.07,2	208	310,1.52,128,0.63,215,1.05,2
169	318,1.55,150,0.73,230,1.12,2	209	315,1.54,135,0.66,220,1.07,2
170	325,1.59,155,0.76,240,1.17,2	210	318,1.56,138,0.67,225,1.10,2
171	331,1.62,160,0.78,250,1.22,2	211	320,1.57,140,0.68,230,1.12,2
172	338,1.65,165,0.81,260,1.27,2	212	325,1.59,145,0.71,235,1.15,2
173	345,1.69,170,0.83,270,1.32,2	213	330,1.61,150,0.73,240,1.17,2
174	352,1.72,175,0.85,280,1.37,2	214	335,1.64,152,0.74,245,1.20,2
175	359,1.76,180,0.88,290,1.42,2	215	338,1.65,155,0.76,250,1.22,2
176	365,1.79,185,0.90,300,1.47,2	216	340,1.66,158,0.77,255,1.25,2
177	372,1.82,190,0.93,310,1.52,2	217	345,1.69,160,0.78,260,1.27,2
178	379,1.86,195,0.95,320,1.57,2	218	350,1.71,165,0.80,265,1.30,2
179	385,1.89,200,0.98,330,1.61,2	219	352,1.72,168,0.82,270,1.32,2
180	392,1.92,205,1.00,340,1.66,2	220	355,1.74,170,0.83,275,1.35,2
181	399,1.96,210,1.02,350,1.71,2	221	358,1.75,173,0.85,280,1.37,2
182	405,1.99,215,1.05,360,1.76,2	222	360,1.76,175,0.86,285,1.40,2
183	412,2.02,220,1.07,370,1.81,2	223	362,1.77,178,0.87,290,1.42,2
184	419,2.06,225,1.10,380,1.86,2	224	365,1.79,180,0.88,295,1.45,2
185	425,2.09,230,1.12,390,1.91,2	225	368,1.80,183,0.90,300,1.47,2
186	432,2.12,235,1.15,400,1.96,2	226	370,1.81,185,0.91,305,1.49,2
187	439,2.16,240,1.17,410,2.00,2	227	372,1.82,188,0.92,310,1.52,2
188	445,2.19,245,1.20,420,2.05,2	228	375,1.83,190,0.93,315,1.54,2
189	452,2.22,250,1.22,430,2.10,2	229	378,1.85,193,0.95,320,1.57,2
190	459,2.26,255,1.25,440,2.15,2	230	380,1.86,195,0.96,325,1.59,2
191	465,2.29,260,1.27,450,2.20,2	231	382,1.87,198,0.97,330,1.61,2
192	472,2.32,265,1.29,460,2.25,2	232	385,1.88,200,0.98,335,1.64,2
193	479,2.36,270,1.32,470,2.30,2	233	388,1.90,203,1.00,340,1.66,2
194	485,2.39,275,1.34,480,2.35,2	234	390,1.91,205,1.01,345,1.69,2
195	492,2.42,280,1.37,490,2.40,2	235	392,1.92,208,1.02,350,1.71,2
196	499,2.46,285,1.39,500,2.45,2	236	395,1.93,210,1.03,355,1.74,2
197	505,2.49,290,1.41,510,2.50,2	237	398,1.95,213,1.05,360,1.76,2
198	512,2.52,295,1.44,520,2.55,2	238	400,1.96,215,1.06,365,1.79,2
199	519,2.56,300,1.46,530,2.60,2	239	402,1.97,218,1.07,370,1.81,2
200	525,2.59,305,1.49,540,2.64,2	240	405,1.98,220,1.08,375,1.83,2

241	408,2.00,223,1.10,380,1.86,2	281	187,0.91,83,0.41,148,0.72,1
242	410,2.01,225,1.11,385,1.88,2	282	187,0.91,83,0.41,148,0.72,1
243	412,2.02,228,1.12,390,1.91,2	283	186,0.91,83,0.41,149,0.73,1
244	415,2.03,230,1.13,395,1.93,2	284	186,0.91,83,0.41,149,0.73,1
245	418,2.05,233,1.15,400,1.96,2	285	186,0.91,83,0.41,148,0.72,1
246	420,2.06,235,1.16,405,1.98,2	286	186,0.91,83,0.41,148,0.72,1
247	422,2.07,238,1.17,410,2.00,2	287	187,0.91,83,0.41,148,0.72,1
248	425,2.08,240,1.18,415,2.03,2	288	187,0.91,83,0.41,148,0.72,1
249	428,2.09,243,1.19,420,2.06,2	289	187,0.91,83,0.41,148,0.72,1
250	430,2.10,245,1.20,425,2.08,2	290	187,0.91,82,0.40,147,0.72,1
251	432,2.11,248,1.22,430,2.10,2	291	188,0.92,82,0.40,148,0.72,1
252	435,2.12,250,1.23,435,2.13,2	292	188,0.92,82,0.40,148,0.72,1
253	438,2.14,253,1.24,440,2.15,2	293	188,0.92,82,0.40,148,0.72,1
254	440,2.15,255,1.25,445,2.18,2	294	187,0.91,82,0.40,147,0.72,1
255	445,2.17,258,1.26,450,2.20,2	295	187,0.91,83,0.41,148,0.72,1
256	217,1.06,93,0.45,185,0.90,1	296	210,1.03,80,0.39,50,0.24,1
257	216,1.06,92,0.45,184,0.90,1	297	205,1.00,78,0.38,55,0.27,1
258	215,1.05,92,0.45,185,0.90,1	298	198,0.97,85,0.42,60,0.29,1
259	215,1.05,92,0.45,183,0.89,1	299	190,0.93,90,0.44,70,0.34,1
260	215,1.05,92,0.45,183,0.89,1	300	180,0.88,82,0.40,65,0.32,1
261	214,1.05,92,0.45,183,0.89,1	301	175,0.86,60,0.29,40,0.19,1
262	214,1.05,91,0.44,183,0.89,1	302	160,0.78,70,0.34,45,0.22,1
263	213,1.04,92,0.45,182,0.89,1	303	155,0.76,72,0.35,50,0.24,1
264	213,1.04,91,0.44,182,0.89,1	304	150,0.73,65,0.32,58,0.28,1
265	212,1.04,91,0.44,181,0.88,1	305	140,0.68,60,0.29,55,0.27,1
266	210,1.03,92,0.45,181,0.88,1	306	130,0.63,58,0.28,50,0.24,1
267	213,1.04,91,0.44,180,0.88,1	307	125,0.61,55,0.27,45,0.22,1
268	212,1.04,91,0.44,180,0.88,1	308	120,0.59,50,0.24,40,0.19,1
269	211,1.03,91,0.44,180,0.88,1	309	115,0.56,48,0.23,35,0.17,1
270	210,1.03,91,0.44,179,0.87,1	310	110,0.54,45,0.22,30,0.15,1
271	209,1.02,91,0.44,179,0.87,1	311	200,0.98,90,0.44,85,0.42,1
272	210,1.03,91,0.44,179,0.87,1	312	195,0.95,92,0.45,80,0.39,1
273	209,1.02,91,0.44,178,0.87,1	313	185,0.90,88,0.43,70,0.34,1
274	205,1.00,90,0.44,177,0.87,1	314	170,0.83,75,0.37,65,0.32,1
275	207,1.01,92,0.45,178,0.87,1	315	168,0.82,73,0.36,68,0.33,1
276	190,0.93,83,0.41,149,0.73,1	316	165,0.80,71,0.35,60,0.29,1
277	190,0.93,83,0.41,149,0.73,1	317	158,0.77,69,0.34,58,0.28,1
278	189,0.92,83,0.41,148,0.72,1	318	152,0.74,64,0.31,55,0.27,1
279	188,0.92,83,0.41,148,0.72,1	319	148,0.72,62,0.30,52,0.25,1
280	187,0.91,83,0.41,149,0.73,1	320	142,0.69,59,0.29,50,0.24,1

321	136,0.66,57,0.28,47,0.23,1	361	205,1.00,78,0.38,66,0.32,1
322	132,0.64,54,0.26,42,0.20,1	362	215,1.05,90,0.44,80,0.39,1
323	128,0.62,49,0.24,38,0.18,1	363	218,1.06,92,0.45,82,0.40,1
324	122,0.60,46,0.22,35,0.17,1	364	214,1.04,90,0.44,85,0.42,1
325	118,0.58,44,0.21,33,0.16,1	365	208,1.02,88,0.43,83,0.41,1
326	190,0.93,70,0.34,40,0.20,1	366	200,0.98,82,0.40,70,0.34,1
327	200,0.98,80,0.39,50,0.24,1	367	195,0.95,80,0.39,72,0.35,1
328	180,0.88,65,0.32,55,0.27,1	368	185,0.90,75,0.37,65,0.32,1
329	175,0.85,60,0.29,48,0.23,1	369	178,0.87,72,0.35,63,0.31,1
330	165,0.81,62,0.30,52,0.25,1	370	165,0.81,60,0.29,51,0.25,1
331	150,0.73,55,0.27,45,0.22,1	371	170,0.83,62,0.30,50,0.24,1
332	160,0.78,50,0.24,35,0.17,1	372	160,0.78,55,0.27,45,0.22,1
333	158,0.77,53,0.26,38,0.19,1	373	158,0.77,53,0.26,40,0.20,1
334	162,0.79,57,0.28,41,0.20,1	374	152,0.74,50,0.24,38,0.19,1
335	168,0.82,59,0.29,44,0.22,1	375	180,0.88,69,0.34,59,0.29,1
336	172,0.84,61,0.30,43,0.21,1	376	178,0.87,68,0.33,57,0.28,1
337	188,0.92,72,0.35,58,0.28,1	377	175,0.85,65,0.32,55,0.27,1
338	195,0.95,75,0.37,60,0.29,1	378	172,0.84,63,0.31,54,0.26,1
339	205,1.00,82,0.40,65,0.32,1	379	168,0.82,59,0.29,49,0.24,1
340	210,1.02,85,0.42,70,0.34,1	380	165,0.81,55,0.27,46,0.23,1
341	215,1.05,90,0.44,72,0.35,1	381	155,0.76,50,0.24,42,0.21,1
342	212,1.04,88,0.43,75,0.37,1	382	150,0.73,45,0.22,39,0.19,1
343	207,1.01,83,0.41,78,0.38,1	383	142,0.69,44,0.21,36,0.18,1
344	202,0.99,79,0.39,68,0.33,1	384	138,0.67,40,0.20,34,0.17,1
345	198,0.97,76,0.38,66,0.32,1	385	132,0.65,38,0.18,30,0.15,1
346	155,0.76,52,0.25,36,0.18,1	386	128,0.63,36,0.17,28,0.14,1
347	148,0.72,48,0.23,30,0.15,1	387	120,0.59,32,0.15,25,0.12,1
348	142,0.69,45,0.22,28,0.14,1	388	118,0.58,31,0.15,24,0.12,1
349	138,0.67,44,0.21,33,0.16,1	389	115,0.56,30,0.14,22,0.11,1
350	132,0.65,40,0.20,29,0.14,1	390	180,0.88,70,0.34,60,0.29,1
351	125,0.61,38,0.18,27,0.13,1	391	182,0.89,72,0.35,62,0.30,1
352	130,0.63,42,0.19,31,0.15,1	392	185,0.90,75,0.37,65,0.32,1
353	135,0.66,47,0.22,32,0.16,1	393	190,0.93,78,0.38,67,0.33,1
354	140,0.68,50,0.24,35,0.17,1	394	195,0.95,80,0.39,70,0.34,1
355	145,0.71,55,0.27,39,0.19,1	395	200,0.98,85,0.42,75,0.37,1
356	170,0.83,60,0.29,43,0.21,1	396	205,1.00,88,0.43,78,0.38,1
357	178,0.87,62,0.30,47,0.23,1	397	210,1.02,90,0.44,80,0.39,1
358	185,0.90,68,0.33,55,0.27,1	398	215,1.05,92,0.45,82,0.40,1
359	192,0.94,70,0.34,58,0.28,1	399	218,1.06,93,0.46,85,0.42,1
360	198,0.97,73,0.36,62,0.30,1	400	237,1.16,86,0.42,78,0.38,1

401	261,1.28,93,0.45,69,0.34,1	441	241,1.18,90,0.44,89,0.44,1
402	253,1.24,82,0.40,80,0.39,1	442	256,1.26,91,0.44,78,0.38,1
403	243,1.19,89,0.44,74,0.36,1	443	298,1.46,94,0.46,73,0.36,1
404	218,1.07,90,0.44,92,0.45,1	444	260,1.27,80,0.39,95,0.46,1
405	225,1.10,87,0.43,84,0.41,1	445	214,1.05,85,0.42,86,0.42,1
406	298,1.46,94,0.46,75,0.37,1	446	236,1.15,82,0.40,68,0.33,1
407	210,1.03,85,0.42,81,0.40,1	447	293,1.43,93,0.45,70,0.34,1
408	289,1.41,88,0.43,96,0.47,1	448	241,1.18,84,0.41,69,0.34,1
409	276,1.35,91,0.44,73,0.36,1	449	211,1.03,91,0.44,71,0.35,1
410	238,1.16,92,0.45,77,0.38,1	450	265,1.30,89,0.44,87,0.43,1
411	284,1.39,83,0.41,66,0.32,1	451	226,1.11,94,0.46,92,0.45,1
412	240,1.17,80,0.39,98,0.48,1	452	266,1.30,87,0.43,80,0.39,1
413	221,1.08,87,0.43,88,0.43,1	453	273,1.34,83,0.41,98,0.48,1
414	299,1.46,84,0.41,79,0.39,1	454	257,1.26,82,0.40,73,0.36,1
415	233,1.14,95,0.46,67,0.33,1	455	298,1.46,95,0.46,88,0.43,1
416	270,1.32,82,0.40,85,0.42,1	456	243,1.19,92,0.45,100,0.49,1
417	291,1.42,90,0.44,95,0.46,1	457	213,1.04,87,0.43,72,0.35,1
418	263,1.29,93,0.45,72,0.35,1	458	296,1.45,85,0.42,84,0.41,1
419	254,1.24,86,0.42,97,0.47,1	459	229,1.12,93,0.45,99,0.48,1
420	247,1.21,89,0.44,70,0.34,1	460	284,1.39,80,0.39,74,0.36,1
421	218,1.07,84,0.41,89,0.44,1	461	291,1.42,90,0.44,88,0.43,1
422	267,1.31,94,0.46,100,0.49,1	462	268,1.31,81,0.40,86,0.42,1
423	285,1.39,85,0.42,82,0.40,1	463	237,1.16,84,0.41,79,0.39,1
424	293,1.43,92,0.45,91,0.44,1	464	250,1.22,88,0.43,78,0.38,1
425	269,1.31,91,0.44,93,0.45,1	465	298,1.46,93,0.45,66,0.32,1
426	278,1.36,86,0.42,77,0.38,1	466	292,1.43,86,0.42,97,0.47,1
427	214,1.05,88,0.43,74,0.36,1	467	236,1.15,91,0.44,69,0.34,1
428	262,1.28,82,0.40,84,0.41,1	468	260,1.27,94,0.46,82,0.40,1
429	215,1.05,95,0.46,67,0.33,1	469	215,1.05,95,0.46,77,0.38,1
430	288,1.41,93,0.45,81,0.40,1	470	270,1.32,89,0.44,96,0.47,1
431	257,1.26,89,0.44,71,0.35,1	471	249,1.22,80,0.39,67,0.33,1
432	293,1.43,85,0.42,90,0.44,1	472	295,1.44,93,0.45,90,0.44,1
433	230,1.12,94,0.46,98,0.48,1	473	257,1.26,80,0.39,96,0.47,1
434	278,1.36,88,0.43,75,0.37,1	474	294,1.44,92,0.45,86,0.42,1
435	227,1.11,90,0.44,82,0.40,1	475	223,1.09,94,0.46,70,0.34,1
436	232,1.13,84,0.41,66,0.32,1	476	239,1.17,83,0.41,65,0.32,1
437	248,1.21,83,0.41,80,0.39,1	477	295,1.44,87,0.43,85,0.42,1
438	259,1.27,92,0.45,69,0.34,1	478	214,1.05,92,0.45,92,0.45,1
439	234,1.14,86,0.42,93,0.45,1	479	231,1.13,90,0.44,69,0.34,1
440	292,1.43,88,0.43,71,0.35,1	480	266,1.30,94,0.46,75,0.37,1

481	223,1.09,82,0.40,87,0.43,1	521	369,1.80,102,0.50,115,0.56,2
482	271,1.32,80,0.39,81,0.40,1	522	377,1.84,104,0.51,119,0.58,2
483	263,1.29,89,0.44,70,0.34,1	523	390,1.91,107,0.52,131,0.64,2
484	230,1.12,95,0.46,76,0.37,1	524	426,2.08,108,0.53,134,0.66,2
485	248,1.21,92,0.45,83,0.41,1	525	439,2.14,100,0.49,122,0.60,2
486	214,1.05,93,0.45,100,0.49,1	526	364,1.78,95,0.46,106,0.52,2
487	276,1.35,84,0.41,85,0.42,1	527	379,1.85,96,0.47,111,0.54,2
488	294,1.44,89,0.44,76,0.37,1	528	391,1.92,99,0.48,125,0.61,2
489	267,1.31,90,0.44,90,0.44,1	529	409,2.00,103,0.50,133,0.65,2
490	208,1.02,82,0.40,84,0.41,1	530	427,2.08,110,0.54,135,0.66,2
491	290,1.41,93,0.45,72,0.35,1	531	445,2.17,108,0.53,140,0.69,2
492	248,1.21,85,0.42,87,0.43,1	532	451,2.21,107,0.52,137,0.67,2
493	392,1.92,101,0.49,112,0.55,2	533	358,1.75,101,0.49,96,0.47,2
494	407,1.99,97,0.47,120,0.59,2	534	366,1.79,98,0.48,101,0.49,2
495	374,1.83,96,0.47,118,0.58,2	535	374,1.83,102,0.50,115,0.56,2
496	421,2.06,103,0.50,133,0.65,2	536	392,1.92,109,0.53,123,0.60,2
497	439,2.14,108,0.53,137,0.67,2	537	405,1.98,110,0.54,127,0.62,2
498	363,1.78,110,0.54,100,0.49,2	538	419,2.05,96,0.47,118,0.58,2
499	371,1.81,105,0.51,109,0.53,2	539	436,2.13,105,0.51,134,0.66,2
500	397,1.94,102,0.50,121,0.59,2	540	450,2.20,108,0.53,139,0.68,2
501	411,2.01,97,0.47,126,0.62,2	541	361,1.77,100,0.49,97,0.48,2
502	430,2.10,95,0.46,129,0.63,2	542	370,1.81,103,0.50,105,0.51,2
503	366,1.79,98,0.48,110,0.54,2	543	383,1.87,99,0.48,113,0.55,2
504	355,1.74,99,0.48,107,0.52,2	544	395,1.93,97,0.47,120,0.59,2
505	446,2.18,107,0.52,138,0.68,2	545	412,2.02,110,0.54,128,0.63,2
506	441,2.16,109,0.53,136,0.66,2	546	429,2.09,105,0.51,121,0.59,2
507	375,1.83,104,0.51,118,0.58,2	547	444,2.17,107,0.52,137,0.67,2
508	383,1.87,103,0.50,124,0.61,2	548	355,1.74,106,0.52,99,0.48,2
509	401,1.96,100,0.49,132,0.65,2	549	362,1.77,104,0.51,102,0.50,2
510	417,2.04,108,0.53,139,0.68,2	550	381,1.86,108,0.53,119,0.58,2
511	428,2.09,106,0.52,128,0.63,2	551	397,1.94,110,0.54,128,0.63,2
512	412,2.02,97,0.47,110,0.54,2	552	417,2.04,101,0.49,135,0.66,2
513	356,1.74,101,0.49,98,0.48,2	553	430,2.10,99,0.48,122,0.60,2
514	364,1.78,95,0.46,103,0.50,2	554	446,2.18,104,0.51,133,0.65,2
515	372,1.82,97,0.47,112,0.55,2	555	451,2.21,97,0.47,137,0.67,2
516	381,1.86,100,0.49,116,0.57,2	556	363,1.78,110,0.54,106,0.52,2
517	395,1.93,108,0.53,127,0.62,2	557	372,1.82,109,0.53,108,0.53,2
518	432,2.11,103,0.50,135,0.66,2	558	389,1.90,108,0.53,117,0.57,2
519	448,2.19,110,0.54,138,0.68,2	559	404,1.98,103,0.50,129,0.63,2
520	451,2.21,109,0.53,140,0.69,2	560	421,2.06,95,0.46,131,0.64,2

561	437,2.13,98,0.48,135,0.66,2	601	326,1.59,103,0.50,113,0.55,2
562	448,2.19,101,0.49,139,0.68,2	602	325,1.59,104,0.51,118,0.58,2
563	360,1.76,100,0.49,95,0.46,2	603	324,1.58,102,0.50,109,0.53,2
564	371,1.81,102,0.50,102,0.50,2	604	323,1.58,101,0.49,110,0.54,2
565	389,1.90,97,0.47,114,0.56,2	605	322,1.57,100,0.49,117,0.57,2
566	401,1.96,104,0.51,125,0.61,2	606	321,1.57,102,0.50,119,0.58,2
567	416,2.04,110,0.54,132,0.65,2	607	320,1.56,104,0.51,115,0.56,2
568	434,2.12,109,0.53,138,0.68,2	608	319,1.56,103,0.50,111,0.54,2
569	451,2.21,108,0.53,140,0.69,2	609	318,1.55,101,0.49,118,0.58,2
570	359,1.76,96,0.47,97,0.48,2	610	317,1.55,102,0.50,116,0.57,2
571	369,1.80,101,0.49,103,0.50,2	611	316,1.54,103,0.50,115,0.56,2
572	386,1.89,105,0.51,121,0.59,2	612	315,1.54,101,0.49,113,0.55,2
573	398,1.94,103,0.50,126,0.62,2	613	314,1.53,102,0.50,118,0.58,2
574	413,2.03,98,0.48,132,0.65,2	614	313,1.53,104,0.51,119,0.58,2
575	437,2.13,106,0.52,137,0.67,2	615	312,1.52,103,0.50,111,0.54,2
576	450,2.20,110,0.54,140,0.69,2	616	311,1.52,102,0.50,110,0.54,2
577	352,1.72,103,0.50,112,0.55,2	617	310,1.52,100,0.49,116,0.57,2
578	351,1.72,104,0.51,113,0.55,2	618	309,1.51,101,0.49,117,0.57,2
579	350,1.71,102,0.50,115,0.56,2	619	308,1.51,102,0.50,112,0.55,2
580	349,1.71,103,0.50,111,0.54,2	620	307,1.50,105,0.51,118,0.58,2
581	347,1.70,102,0.50,118,0.58,2	621	306,1.50,104,0.51,115,0.56,2
582	346,1.69,101,0.49,117,0.57,2	622	305,1.49,102,0.50,113,0.55,2
583	345,1.69,100,0.49,113,0.55,2	623	304,1.49,103,0.50,116,0.57,2
584	344,1.68,102,0.50,119,0.58,2	624	303,1.48,104,0.51,119,0.58,2
585	343,1.68,101,0.49,110,0.54,2	625	302,1.48,101,0.49,117,0.57,2
586	341,1.67,104,0.51,115,0.56,2	626	301,1.47,103,0.50,114,0.56,2
587	340,1.66,103,0.50,118,0.58,2	627	268,1.31,84,0.41,81,0.40,1
588	338,1.65,102,0.50,111,0.54,2	628	257,1.26,90,0.44,92,0.45,1
589	339,1.66,101,0.49,116,0.57,2	629	250,1.22,93,0.45,66,0.32,1
590	337,1.65,100,0.49,113,0.55,2	630	238,1.16,92,0.45,70,0.34,1
591	336,1.64,101,0.49,118,0.58,2	631	266,1.30,89,0.44,87,0.43,1
592	334,1.63,102,0.50,117,0.57,2	632	225,1.10,81,0.40,97,0.47,1
593	335,1.64,101,0.49,110,0.54,2	633	226,1.10,95,0.46,82,0.40,1
594	333,1.63,103,0.50,112,0.55,2	634	279,1.36,93,0.45,80,0.39,1
595	332,1.62,104,0.51,119,0.58,2	635	245,1.20,82,0.40,88,0.43,1
596	330,1.61,103,0.50,111,0.54,2	636	210,1.03,85,0.42,90,0.44,1
597	329,1.61,102,0.50,115,0.56,2	637	233,1.14,92,0.45,75,0.37,1
598	331,1.62,101,0.49,118,0.58,2	638	258,1.26,84,0.41,85,0.42,1
599	328,1.60,104,0.51,119,0.58,2	639	296,1.45,95,0.46,91,0.44,1
600	327,1.60,105,0.51,116,0.57,2	640	290,1.42,83,0.40,78,0.38,1

641	221,1.08,94,0.46,99,0.48,1
642	200,0.98,89,0.44,71,0.35,1
643	243,1.19,90,0.44,84,0.41,1
644	297,1.45,84,0.41,96,0.47,1
645	278,1.36,90,0.44,84,0.41,1
646	262,1.28,91,0.44,90,0.44,1
647	314,1.54,96,0.47,77,0.38,2
648	351,1.72,109,0.53,74,0.36,2
649	349,1.71,103,0.50,99,0.48,2
650	405,1.98,102,0.50,79,0.39,2
651	438,2.14,110,0.54,97,0.47,2
652	332,1.62,100,0.49,81,0.40,2
653	377,1.84,101,0.49,92,0.45,2
654	344,1.68,95,0.46,75,0.37,2
655	420,2.06,106,0.52,99,0.48,2
656	389,1.90,97,0.47,98,0.48,2
657	365,1.78,108,0.53,83,0.41,2
658	412,2.01,100,0.49,79,0.39,2
659	318,1.56,109,0.53,87,0.42,2
660	351,1.72,98,0.48,94,0.46,2
661	430,2.10,106,0.52,73,0.36,2
662	337,1.64,104,0.51,82,0.40,2
663	403,1.97,95,0.46,88,0.43,2
664	369,1.80,110,0.54,92,0.45,2
665	327,1.59,101,0.49,96,0.47,2
666	295,1.44,92,0.45,88,0.43,1
667	298,1.46,90,0.44,87,0.43,1
668	297,1.45,93,0.46,89,0.43,1
669	299,1.46,94,0.46,90,0.44,1
670	296,1.45,92,0.45,91,0.45,1
671	298,1.46,95,0.46,86,0.42,1
672	297,1.45,94,0.46,88,0.43,1
673	294,1.44,93,0.46,90,0.44,1
674	293,1.43,92,0.45,89,0.43,1
675	295,1.44,91,0.45,87,0.43,1
676	297,1.45,90,0.44,92,0.45,1
677	298,1.46,93,0.46,91,0.45,1
678	296,1.45,94,0.46,90,0.44,1
679	299,1.46,93,0.46,88,0.43,1
680	298,1.46,92,0.45,89,0.43,1
681	297,1.45,94,0.46,87,0.43,1
682	295,1.44,95,0.46,90,0.44,1
683	296,1.45,93,0.46,91,0.45,1
684	298,1.46,94,0.46,92,0.45,1
685	297,1.45,93,0.46,88,0.43,1

Script Data Train Python

```
1 # === TRAINING MODEL KNN SENSOR GAS ===
2 # Sistem Otomasi Deteksi Kebersihan Kandang Kambing
3 # Menggunakan Deret Sensor Gas dan Algoritma K-Nearest Neighbors (KNN)
4
5 import pandas as pd
6 from sklearn.model_selection import train_test_split
7 from sklearn.preprocessing import StandardScaler
8 from sklearn.neighbors import KNeighborsClassifier
9 from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
10 import seaborn as sns
11 import matplotlib.pyplot as plt
12 import joblib
13
14 # === 1. BACA DATASET ===
15 # Format file: MQ135,Volt135,MQ137,Volt137,MQ4,Volt4,Label
16 # Gunakan koma (,) sebagai pemisah
17 data = pd.read_csv('data_sensor.txt')
18
19 print("\n=== 5 Data Pertama ===")
20 print(data.head())
21
22 # === 2. PISAHKAN FITUR & LABEL ===
23 # Kita hanya pakai nilai analog (MQ135, MQ137, MQ4) untuk klasifikasi
24 X = data[['MQ135', 'MQ137', 'MQ4']]
25 y = data['Label']
26
27 # === 3. NORMALISASI DATA (STANDARISASI) ===
28 # Penting agar semua fitur punya skala yang seimbang
29 scaler = StandardScaler()
30 X_scaled = scaler.fit_transform(X)
31
32 # === 4. PEMBAGIAN DATA TRAIN & TEST ===
33 X_train, X_test, y_train, y_test = train_test_split(
34     X_scaled, y, test_size=0.3, random_state=42, stratify=y
35 )
36
37 # === 5. INISIALISASI & LATIH MODEL KNN ===
38 # K = 3 dipilih karena hasilnya paling stabil untuk dataset kecil
39 knn = KNeighborsClassifier(n_neighbors=3)
40 knn.fit(X_train, y_train)
```

```

41
42 # === 6. EVALUASI MODEL ===
43 y_pred = knn.predict(X_test)
44 acc = accuracy_score(y_test, y_pred)
45
46 print("\n=== HASIL EVALUASI ===")
47 print(f"Akurasi Model: {acc * 100:.2f}%")
48 print("\nClassification Report:")
49 print(classification_report(y_test, y_pred, target_names=['Bersih (1)', 'Kotor (2)']))
50
51 print("\nConfusion Matrix:")
52 cm = confusion_matrix(y_test, y_pred)
53 print(cm)
54
55 # === 7. VISUALISASI CONFUSION MATRIX ===
56 plt.figure(figsize=(5, 4))
57 sns.heatmap(cm, annot=True, cmap='Blues', fmt='g',
58             xticklabels=['Pred Bersih', 'Pred Kotor'],
59             yticklabels=['Akt Bersih', 'Akt Kotor'])
60 plt.title("Confusion Matrix KNN (Deteksi Kebersihan Kandang)")
61 plt.xlabel("Prediksi")
62 plt.ylabel("Aktual")
63 plt.tight_layout()
64 plt.show()
65
66 # === 8. SIMPAN MODEL & SCALER ===
67 joblib.dump(knn, 'model_knn.pkl')
68 joblib.dump(scaler, 'scaler.pkl')
69
70 print("\n☑ Model dan scaler berhasil disimpan sebagai:")
71 print("- model_knn.pkl")
72 print("- scaler.pkl")
73
74 print("\nSelesai training! Model siap digunakan untuk prediksi realtime.")
75

```

Script Real Time Predict Python

```
1  # === REALTIME PREDIKSI SENSOR GAS (BERSIH / KOTOR) ===
2
3  import serial
4  import joblib
5  import re
6  import pandas as pd
7  import time
8
9  # === KONFIGURASI SERIAL ===
10 port = 'COM3' # sesuaikan
11 baud = 9600
12 ser = serial.Serial(port, baud, timeout=1)
13
14 # === LOAD MODEL KNN & SCALER ===
15 model = joblib.load('model_knn.pkl')
16 scaler = joblib.load('scaler.pkl')
17
18 print("Sistem sudah siap membaca data realtime...\n")
19
20 while True:
21     try:
22         line = ser.readline().decode('utf-8').strip()
23         if not line:
24             continue
25
26         # Format: "MQ135=1.25 MQ137=1.40 MQ4=1.62"
27         match = re.findall(
28             r"MQ135=(\d+\.\d+)\s+MQ137=(\d+\.\d+)\s+MQ4=(\d+\.\d+)",
29             line
30         )
31
32         if not match:
33             continue
34
35         v135, v137, v4 = map(float, match[0])
36
37         # Konversi ke angka analog (opsional)
38         a135 = int((v135 / 5.0) * 1023)
39         a137 = int((v137 / 5.0) * 1023)
40         a4 = int((v4 / 5.0) * 1023)
```

```

41
42     # Siapkan data prediksi
43     X_test = pd.DataFrame([[a135, a137, a4]], columns=['MQ135', 'MQ137', 'MQ4'])
44     X_scaled = scaler.transform(X_test)
45
46     # Prediksi
47     pred = model.predict(X_scaled)[0]
48     kondisi = "BERSIH" if pred == 1 else "KOTOR"
49
50     # === OUTPUT RAPI UNTUK CMD ===
51     print(
52         f"MQ135={a135} ({v135:.2f}V) | "
53         f"MQ137={a137} ({v137:.2f}V) | "
54         f"MQ4={a4} ({v4:.2f}V) ==> STATUS: {kondisi}"
55     )
56
57     # Kirim balik ke Arduino
58     ser.write((kondisi + "\n").encode())
59
60     time.sleep(1) # jeda 1 detik agar enak dibaca
61
62 except KeyboardInterrupt:
63     print("\nProgram dihentikan.")
64     ser.close()
65     break
66

```

Script Arduino

```
1  #include <Wire.h>
2  #include <LiquidCrystal_I2C.h>
3
4  LiquidCrystal_I2C lcd(0x27, 20, 4);
5
6  int relayPin = 2;
7
8  void setup() {
9      Serial.begin(9600);
10     lcd.init();
11     lcd.backlight();
12
13     pinMode(relayPin, OUTPUT);
14     digitalWrite(relayPin, LOW);
15
16     lcd.setCursor(0, 0);
17     lcd.print("Mode: Realtime KNN");
18     delay(1000);
19     lcd.clear();
20 }
21
22 void loop() {
23     int mq135 = analogRead(A0);
24     int mq137 = analogRead(A1);
25     int mq4    = analogRead(A2);
26
27     float v135 = mq135 * 5.0 / 1023.0;
28     float v137 = mq137 * 5.0 / 1023.0;
29     float v4    = mq4    * 5.0 / 1023.0;
30
31     // === KIRIM FORMAT KE PYTHON ===
32     Serial.print("MQ135="); Serial.print(v135, 2);
33     Serial.print(" MQ137="); Serial.print(v137, 2);
```

```

33 Serial.print(" MQ137="); Serial.print(v137, 2);
34 Serial.print(" MQ4="); Serial.println(v4, 2);
35
36 // === TAMPILKAN KE LCD SECARA RAPI ===
37 lcd.setCursor(0, 0);
38 lcd.print("MQ135: ");
39 lcd.print(mq135);
40 lcd.print(" (");
41 lcd.print(v135, 2);
42 lcd.print("V) ");
43
44 lcd.setCursor(0, 1);
45 lcd.print("MQ137: ");
46 lcd.print(mq137);
47 lcd.print(" (");
48 lcd.print(v137, 2);
49 lcd.print("V) ");
50
51 lcd.setCursor(0, 2);
52 lcd.print("MQ4 : ");
53 lcd.print(mq4);
54 lcd.print(" (");
55 lcd.print(v4, 2);
56 lcd.print("V) ");
57
58 // === TERIMA HASIL KLASIFIKASI DARI PYTHON ===
59 if (Serial.available()) {
60     String status = Serial.readStringUntil('\n');
61     status.trim();
62
63     lcd.setCursor(0, 3);
64     lcd.print("STATUS: ");

```

```
63     lcd.setCursor(0, 3);
64     lcd.print("STATUS: ");
65     lcd.print(status);
66     lcd.print("    ");
67
68     if (status == "KOTOR") {
69         digitalWrite(relayPin, HIGH);
70     } else {
71         digitalWrite(relayPin, LOW);
72     }
73 }
74
75 delay(1000);
76 }
77
78
```

Dokumentasi Pengujian



