Appendix: Cacophony Mapper

A. Fitbit placement
B. Sound anlalysis (number-amplitude)
C. Sound analysis (FFT)
D. Application structure
E. Interview with a nurse
F. Programming: Java for Android
G. User test: SUS(System Usability Scale) Survey
H. User test data

Fitbit placement: wrist-upper outer arm (14/02/2019)

time	HR wrist	HR u.o.arm	difference
11:50-11:55	91	90	1
11:55-12:00	72	74	2
12:00-12:05	82	80	2
12:05-12:10	82	82	0
12:10-12:15	79	87	8
12:15-12:20	113	99	14
12:20-12:25	82	85	3
12:25-12:30	76	79	3
12:30-12:35	76	74	2
12:35-12:40	71	69	2
12:40-12:45	69	71	2
12:45-12:50	70	67	3
12:50-12:55	70	69	1
12:55-13:00	71	66	5
13:00-13:05	73	70	3
13:05-13:10	71	79	8
13:10-13:15	71	72	1
13:15-13:20	72	65	7
13:20-13:25	71	70	1
13:25-13:30	72	72	0
13:30-13:35	93	89	4
13:35-13:40	88	85	3
13:40-13:45	69	70	1
13:45-13:50	70	70	0
13:50-13:55	69	69	0
13:55-14:00	69	69	0
14:00-14:05	68	68	0
14:05-14:10	69	69	0
14:10-14:15	67	67	0
14:15-14:20	67	68	1
14:20-14:25	67	67	0
14:25-14:30	83	81	2
14:30-14:35	118	101	17
14:35-14:40	106	91	15
14:40-14:45	71	66	5
14:45-14:50	64	64	0
14:50-14:55	65	66	1
14:55-15:00	67	72	5
15:00-15:05	76	75	1
15:05-15:10	74	70	4
15:10-15:15	69	68	1
15:15-15:20	74	74	0
15:20-15:25	83	84	1
15:25-15:30	75	74	1
15:30-15:35	74	73	1
15:35-15:40	78	79	1
15:40-15:45	76	79	3
15:45-15:50	76	75	1
15:50-15:55	80	80	0
15:55-16:00	73	72	1
16:00-16:05	73	71	2
16:05-16:10	69	69	0
16:10-16:15	68	69	1
16:15-16:20	67	67	0
16:20-16:25	68	68	0
16:25-16:30	89	88	1
16:30-16:35	90	88	2
16:35-16:40	78	81	3
16:40-16:45	82	80	2
16:45-16:50	80	76	4
16:50-16:55	85	111	26
16:55-17:00	102	117	15
17:00-17:05	106	122	16
17:05-17:10	89	89	0
17:10-17:15	78	78	0
17:15-17:20	78	79	1
17:20-17:25	78	78	0
17:25-17:30	77	80	3
17:30-17:35	81	83	2
17:35-17:40	81	79	2
17:40-17:45	80	80	0
17:45-17:50	80	80	0
17:50-17:55	85	85	0
17:55-18:00	81	82	1
18:00-18:05	90	91	1

Sum difference
1

Fitbit placement: wrist-neck (15/02/2019)

time	HR wrist	HR u.o.arm	difference
7:40-7:45	80	73	7
7:45-7:50	87	78	9
7:50-7:55	76	75	1
7:55-8:00	75	74	1
8:00-8:05	79	85	6
8:05-8:10	84	101	17
8:10-8:15	79	102	23
8:15-8:20	80	88	8
8:20-8:25	81	81	0
8:25-8:30	101	119	18
8:30-8:35	77	76	1
8:35-8:40	69	70	1
8:40-8:45	70	68	2
8:45-8:50	68	68	0
8:50-8:55	68	68	0
8:55-9:00	69	69	0
9:00-9:05	73	71	2
9:05-9:10	79	72	7
9:10-9:15	84	91	7
9:15-9:20	75	67	8
9:20-9:25	73	72	1
9:25-9:30	68	68	0
9:30-9:35	71	70	1
9:35-9:40	72	69	3
9:40-9:45	74	72	2
9:45-9:50	74	111	37
9:50-9:55	69	71	2
9:55-10:00	68	70	2
10:00-10:05	70	68	2
10:05-10:10	69	69	0
10:10-10:15	73	BLANK	#VALUE!
10:15-10:20	69	71	2
10:20-10:25	67	73	6
10:25-10:30	67	75	8
10:30-10:35	72	109	37
10:35-10:40	72	120	48
10:40-10:45	67	106	39
10:45-10:50	67	75	8
10:50-10:55	65	66	1
10:55-11:00	66	69	3
11:00-11:05	69	71	2
11:05-11:10	65	64	1
11:10-11:15	70	79	9
11:15-11:20	63	71	8
11:20-11:25	66	75	9
11:25-11:30	63	79	16
11:30-11:35	65	67	2
11:35-11:40	71	132	61
11:40-11:45	62	85	23
11:45-11:50	64	99	35
11:50-11:55	64	100	36
11:55-12:00	62	62	0
12:00-12:05	62	76	14
12:05-12:10	69	75	6
12:10-12:15	93	125	32
12:15-12:20	86	120	34
12:20-12:25	75	120	45
12:25-12:30	73	97	24
12:30-12:35	75	102	27
12:35-12:40	73	103	30
12:40-12:45	74	95	21
12:45-12:50	75	99	24
12:50-12:55	80	75	5
12:55-13:00	73	75	2
13:00-13:05	71	86	15
13:05-13:10	71	101	30
13:10-13:15	70	111	41
13:15-13:20	82	118	36
13:20-13:25	101	125	24
13:25-13:30	76	92	16
13:30-13:35	73	94	21
13:35-13:40	75	102	27
13:40-13:45	73	72	1
13:45-13:50	73	71	2
13:50-13:55	79	66	13
13:55-14:00	79	73	6
14:00-14:05	81	81	0
14:05-14:10	77	90	13
14:10-14:15	79	81	2
14:15-14:20	83	86	3
14:20-14:25	86	114	28
14:25-14:30	74	BLANK	#VALUE!
14:30-14:35	75	73	2

Sum difference
7

Fitbit placement: wrist-ear (16/02/2019)

time	HR wrist	HR u.o.arm	difference
15:55-16:00	88	91	3
16:00-16:05	83	84	1
16:05-16:10	75	77	2
16:10-16:15	71	75	4
16:15-16:20	72	73	1
16:20-16:25	75	78	3
16:25-16:30	81	86	5
16:30-16:35	76	75	1
16:35-16:40	75	75	0
16:40-16:45	78	78	0
16:45-16:50	79	77	2
16:50-16:55	80	78	2
16:55-17:00	78	77	1
17:00-17:05	87	93	6
17:05-17:10	76	76	0
17:10-17:15	74	74	0
17:15-17:20	73	72	1
17:20-17:25	75	72	3
17:25-17:30	73	71	2
17:30-17:35	72	70	2
17:35-17:40	74	70	4
17:40-17:45	76	74	2
17:45-17:50	75	74	1
17:50-17:55	74	72	2
17:55-18:00	73	72	1
18:00-18:05	75	74	1
18:5-18:10	72	74	2
18:10-18:15	77	77	0
18:15-18:20	84	81	3
18:20-18:25	76	82	6
18:25-18:30	71	73	2
18:30-18:35	74	74	0
18:35-18:40	77	76	1
18:40-18:45	80	77	3
18:45-18:50	73	75	2
18:50-18:55	75	75	0
18:55-19:00	79	78	1
19:00-19:05	79	77	2
19:05-19:10	80	77	3
19:10-19:15	85	87	2
19:15-19:20	87	81	6
19:20-19:25	82	81	1
19:25-19:30	80	78	2
19:30-19:35	79	79	0
19:35-19:40	82	78	4
19:40-19:45	81	78	3
19:45-19:50	87	83	4
19:50-19:55	86	84	2
19:55-20:00	84	82	2
20:00-20:05	83	81	2
20:05-20:10	81	83	2
20:10-20:15	82	81	1
20:15-20:20	84	82	2
20:20-20:25	83	83	0
20:25-20:30	84	82	2
20:30-20:35	83	83	0
20:35-20:40	83	81	2
20:40-20:45	79	79	0
20:45-20:50	82	83	1

time	HR wrist	HR u.o.arm	difference
20:50-20:55	86	83	3
20:55-21:00	80	79	1
21:00-21:05	80	76	4
21:05-21:10	78	78	0
21:10-21:15	77	77	0
21:15-21:20	78	77	1
21:20-21:25	78	77	1
21:25-21:30	77	77	0
21:30-21:35	76	76	0
21:35-21:40	81	81	0
21:40-21:45	79	78	1
21:45-21:50	82	81	1
21:50-21:55	85	84	1
21:55-22:00	82	77	5
22:00-22:05	82	85	3

Sum difference
3

Fitbit placement: wrist-chest pocket (17/02/2019)

time	HR wrist	HR u.o.arm	difference
13:15-13:20	82	118	36
13:20-13:25	83	120	37
13:25-13:30	84	121	37
13:30-13:35	85	118	33
13:35-13:40	94	116	22
13:40-13:45	101	127	26
13:45-13:50	105	126	21
13:50-13:55	77	126	49
13:55-14:00	72	77	5
14:00-14:05	77	80	3
14:05-14:10	75	102	27
14:10-14:15	81	88	7
14:15-14:20	79	78	1
14:20-14:25	80	83	3
14:25-14:30	81	98	17
14:30-14:35	87	120	33
14:35-14:40	77	68	9
14:40-14:45	79	104	25
14:45-14:50	76	BLANK	#VALUE!
14:50-14:55	76	73	3
14:55-15:00	76	70	6
15:00-15:05	77	BLANK	#VALUE!
15:05-15:10	77	70	7
15:10-15:15	80	115	35
15:15-15:20	76	98	22
15:20-15:25	74	75	1
15:25-15:30	76	72	4
15:30-15:35	77	68	9
15:35-15:40	77	71	6
15:40-15:45	80	89	9
15:45-15:50	80	93	13
15:50-15:55	78	69	9
15:55-16:00	82	57	25
16:00-16:05	78	59	19
16:05-16:10	80	78	2
16:10-16:15	76	72	4
16:15-16:20	74	69	5
16:20-16:25	78	94	16
16:25-16:30	82	106	24
16:30-16:35	84	114	30
16:35-16:40	75	107	32
16:45-16:50	71	BLANK	#VALUE!
16:50-16:55	72	75	3
16:55-17:00	72	70	2
17:00-17:05	76	72	4
17:05-17:10	77	83	6
17:10-17:15	84	119	35
17:15-17:20	89	120	31
17:20-17:25	74	BLANK	#VALUE!
17:25-17:30	74	99	25
17:30-17:35	75	64	11
17:35-17:40	75	62	13
17:40-17:45	76	74	2
17:45-17:50	74	71	3
17:50-17:55	74	BLANK	#VALUE!
17:55-18:00	74	79	5
18:00-18:05	73	72	1
18:5-18:10	82	106	24
18:10-18:15	92	126	34
18:15-18:20	102	127	25
18:20-18:25	92	126	34
18:25-18:30	121	129	8
18:30-18:35	109	126	17
18:35-18:40	82	121	39

Sum difference
36

Fitbit placement: wrist-pants pocket (21/02/2019)

time	HR wrist	HR u.o.arm	difference
12:05-12:10	114	103	11
12:10-12:15	98	104	6
12:15-12:20	83	110	27
12:20-12:25	99	124	25
12:25-12:30	95	125	30
12:30-12:35	79	126	47
12:35-12:40	74	BLANK	#VALUE!
12:40-12:45	77	77	0
12:45-12:50	87	85	2
12:50-12:55	83	65	18
12:55-13:00	83	66	17
13:00-13:05	82	70	12
13:05-13:10	85	67	18
13:10-13:15	85	63	22
13:15-13:20	85	74	11
13:20-13:25	94	96	2
13:25-13:30	81	105	24
13:30-13:35	77	78	1
13:35-13:40	80	75	5
13:40-13:45	84	106	22
13:45-13:50	80	111	31
13:50-13:55	81	100	19
13:55-14:00	80	BLANK	#VALUE!
14:00-14:05	79	70	9
14:05-14:10	79	66	13
14:10-14:15	79	65	14
14:15-14:20	80	65	15
14:20-14:25	79	65	14
14:25-14:30	81	65	16
14:30-14:35	81	64	17
14:35-14:40	82	57	25
14:40-14:45	80	83	3
14:45-14:50	79	72	7
14:50-14:55	80	54	26
14:55-15:00	78	57	21
15:00-15:05	77	61	16
15:05-15:10	90	118	28
15:10-15:15	115	126	11
15:15-15:20	91	110	19
15:20-15:25	92	109	17
15:25-15:30	83	101	18
15:30-15:35	81	BLANK	#VALUE!
15:35-15:40	80	86	6
15:40-15:45	88	85	3
15:45-15:50	80	66	14
15:50-15:55	83	65	18
15:55-16:00	80	69	11
16:00-16:05	81	69	12
16:05-16:10	86	67	19
16:10-16:15	84	71	13
16:15-16:20	85	68	17
16:20-16:25	84	70	14
16:25-16:30	84	68	16
16:30-16:35	84	59	25
16:35-16:40	89	61	28
16:45-16:50	86	107	21
16:50-16:55	81	100	19
16:55-17:00	83	BLANK	#VALUE!
17:00-17:05	85	95	10
17:05-17:10	86	93	7
17:10-17:15	82	93	11
17:15-17:20	83	91	8
17:20-17:25	81	86	5
17:25-17:30	81	83	2

Sum difference
11

Fitbit placement: wrist-ankle (22/02/2019)

time	HR wrist	HR u.o.arm	difference
11:50-11:55	103	106	3
11:55-12:00	87	93	6
12:00-12:05	92	96	4
12:05-12:10	113	117	4
12:10-12:15	98	113	15
12:15-12:20	76	77	1
12:20-12:25	74	74	0
12:25-12:30	75	75	0
12:30-12:35	73	74	1
12:35-12:40	76	77	1
12:40-12:45	74	88	14
12:45-12:50	84	83	1
12:50-12:55	84	84	0
12:55-13:00	82	83	1
13:00-13:05	82	81	1
13:05-13:10	79	80	1
13:10-13:15	79	80	1
13:15-13:20	78	78	0
13:20-13:25	76	75	1
13:25-13:30	75	76	1
13:30-13:35	82	78	4
13:35-13:40	81	74	7
13:40-13:45	79	82	3
13:45-13:50	80	81	1
13:50-13:55	78	78	0
13:55-14:00	80	82	2
14:00-14:05	80	82	2
14:05-14:10	78	81	3
14:10-14:15	80	85	5
14:15-14:20	77	87	10
14:20-14:25	82	84	2
14:25-14:30	79	81	2
14:30-14:35	80	81	1
14:35-14:40	78	80	2
14:40-14:45	74	77	3
14:45-14:50	76	75	1
14:50-14:55	85	82	3
14:55-15:00	112	123	11
15:00-15:05	100	104	4
15:05-15:10	100	123	23
15:10-15:15	107	117	10
15:15-15:20	102	122	20
15:20-15:25	101	120	19
15:25-15:30	113	121	8
15:30-15:35	94	97	3
15:35-15:40	82	83	1
15:40-15:45	79	81	2
15:45-15:50	82	83	1
15:50-15:55	79	79	0
15:55-16:00	79	80	1
16:00-16:05	88	88	0
16:05-16:10	89	89	0
16:10-16:15	83	83	0
16:15-16:20	83	81	2
16:20-16:25	87	80	7
16:25-16:30	76	78	2
16:30-16:35	77	77	0
16:35-16:40	78	79	1
16:45-16:50	83	77	6

time	HR wrist	HR u.o.arm	difference
16:50-16:55	79	84	5
16:55-17:00	75	75	0
17:00-17:05	76	78	2
17:05-17:10	76	77	1
17:10-17:15	76	80	4
17:15-17:20	81	85	4
17:20-17:25	81	82	1
17:25-17:30	81	81	0
17:30-17:35	83	83	0
17:35-17:40	79	79	0
17:40-17:45	77	77	0
17:45-17:50	76	77	1
17:50-17:55	75	75	0
17:55-18:00	76	77	1
18:00-18:05	75	79	4
18:5-18:10	77	78	1
18:10-18:15	77	77	0
18:15-18:20	77	76	1
18:20-18:25	78	77	1
18:25-18:30	79	80	1
18:30-18:35	72	74	2
18:35-18:40	75	74	1
18:40-18:45	74	74	0
18:45-18:50	74	76	2
18:50-18:55	75	76	1
18:55-19:00	73	72	1
19:00-19:05	74	74	0
19:05-19:10	74	75	1
19:10-19:15	74	77	3
19:15-19:20	76	77	1
19:20-19:25	77	78	1
19:25-19:30	74	78	4
19:30-19:35	73	74	1
19:35-19:40	73	76	3
19:40-19:45	73	75	2
19:45-19:50	74	77	3
19:50-19:55	73	75	2
19:55-20:00	74	74	0
20:00-20:05	76	75	1
20:05-20:10	76	76	0
20:10-20:15	93	107	14
20:15-20:20	98	121	23
20:20-20:25	95	126	31
20:25-20:30	109	127	18

Sum difference
3

Fitbit placement: wrist-chest (flesh) (23/02/2019)

time	HR wrist	HR u.o.arm	difference
14:40-14:45	100	109	9
14:45-14:50	90	89	1
14:50-14:55	126	111	15
14:55-15:00	114	107	7
15:00-15:05	119	110	9
15:05-15:10	98	97	1
15:10-15:15	77	75	2
15:15-15:20	74	74	0
15:20-15:25	84	81	3
15:25-15:30	81	81	0
15:30-15:35	79	80	1
15:35-15:40	88	84	4
15:40-15:45	73	70	3
15:45-15:50	71	71	0
15:50-15:55	71	71	0
15:55-16:00	70	70	0
16:00-16:05	70	72	2
16:05-16:10	116	106	10
16:10-16:15	131	116	15
16:15-16:20	125	120	5
16:20-16:25	129	108	21
16:25-16:30	115	103	12
16:30-16:35	82	80	2
16:35-16:40	84	82	2
16:45-16:50	73	74	1
16:50-16:55	77	72	5
16:55-17:00	79	80	1
17:00-17:05	82	83	1
17:05-17:10	81	85	4
17:10-17:15	79	80	1
17:15-17:20	86	86	0
17:20-17:25	83	83	0
17:25-17:30	90	88	2
17:30-17:35	89	88	1
17:35-17:40	86	86	0
17:40-17:45	87	87	0
17:45-17:50	98	93	5
17:50-17:55	103	100	3
17:55-18:00	100	101	1
18:00-18:05	84	84	0
18:5-18:10	84	81	3
18:10-18:15	78	76	2
18:15-18:20	79	78	1
18:20-18:25	90	97	7
18:25-18:30	102	107	5
18:30-18:35	110	109	1
18:35-18:40	106	97	9
18:40-18:45	102	98	4
18:45-18:50	104	92	12
18:50-18:55	118	104	14
18:55-19:00	97	101	4
19:00-19:05	121	105	16
19:05-19:10	108	99	9
19:10-19:15	104	91	13
19:15-19:20	82	87	5
19:20-19:25	81	89	8
19:25-19:30	93	86	7
19:30-19:35	109	97	12
19:35-19:40	130	124	6
19:40-19:45	118	112	6
19:45-19:50	77	76	1
19:50-19:55	76	71	5
19:55-20:00	80	74	6
20:00-20:05	76	74	2
20:05-20:10	75	73	2
20:10-20:15	76	76	0
20:15-20:20	80	79	1
20:20-20:25	77	75	2
20:25-20:30	80	82	2
20:30-20:35	79	87	8
20:35-20:40	81	79	2
20:40-20:45	83	82	1
20:45-20:50	81	83	2
20:50-20:55	75	76	1
20:55-21:00	79	79	0
21:00-21:05	76	74	2
21:05-21:10	75	79	4
21:10-21:15	79	81	2
21:15-21:20	82	81	1
21:20-21:25	81	84	3
21:25-21:30	116	103	13
21:30-21:35	81	81	0
21:35-21:40	75	77	2
21:40-21:45	73	75	2
21:45-21:50	75	76	1
21:50-21:55	76	78	2
21:55-22:00	75	75	0
22:00-22:05	79	80	1
22:05-22:10	125	117	8
22:10-22:15	126	115	11
22:15-22:20	105	99	6
22:20-22:25	87	91	4

Sum difference
9

Fitbit placement: wrist-wrist(palm side) (28/02/2019)

time	HR wrist	HR u.o.arm	difference
8:50-8:55	83	80	3
8:55-9:00	91	92	1
9:00-9:05	88	97	9
9:05-9:10	101	122	21
9:10-9:15	79	82	3
9:15-9:20	71	72	1
9:20-9:25	70	71	1
9:25-9:30	69	73	4
9:30-9:35	77	74	3
9:35-9:40	78	81	3
9:40-9:45	78	79	1
9:45-9:50	88	92	4
9:50-9:55	84	90	6
9:55-10:00	82	82	0
10:00-10:05	83	82	1
10:05-10:10	83	84	1
10:10-10:15	82	78	4
10:15-10:20	85	81	4
10:20-10:25	87	84	3
10:25-10:30	87	86	1
10:30-10:35	86	85	1
10:35-10:40	86	82	4
10:40-10:45	84	84	0
10:45-10:50	85	84	1
10:50-10:55	85	86	1
10:55-11:00	86	84	2
11:00-11:05	82	80	2
11:05-11:10	87	85	2
11:10-11:15	87	93	6
11:15-11:20	84	84	0
11:20-11:25	84	84	0
11:25-11:30	81	82	1
11:30-11:35	81	82	1
11:35-11:40	81	82	1
11:40-11:45	81	81	0
11:45-11:50	82	80	2
11:50-11:55	79	79	0
11:55-12:00	78	79	1
12:00-12:05	78	76	2
12:05-12:10	79	78	1
12:10-12:15	88	90	2
12:15-12:20	85	83	2
12:20-12:25	76	77	1
12:25-12:30	77	76	1
12:30-12:35	79	78	1
12:35-12:40	78	82	4
12:40-12:45	92	93	1
12:45-12:50	82	89	7
12:50-12:55	82	82	0
12:55-13:00	79	78	1
13:00-13:05	79	79	0
13:05-13:10	78	77	1
13:10-13:15	80	81	1
13:15-13:20	82	81	1
13:20-13:25	81	80	1
13:25-13:30	82	81	1
13:30-13:35	80	79	1
13:35-13:40	78	79	1
13:40-13:45	73	81	8
13:45-13:50	80	80	0
13:50-13:55	79	75	4
13:55-14:00	81	81	0
14:00-14:05	82	82	0
14:05-14:10	85	81	4
14:10-14:15	79	82	3
14:15-14:20	80	84	4
14:20-14:25	87	88	1
14:25-14:30	83	84	1
14:30-14:35	84	81	3
14:35-14:40	76	77	1

Sum difference
2.25

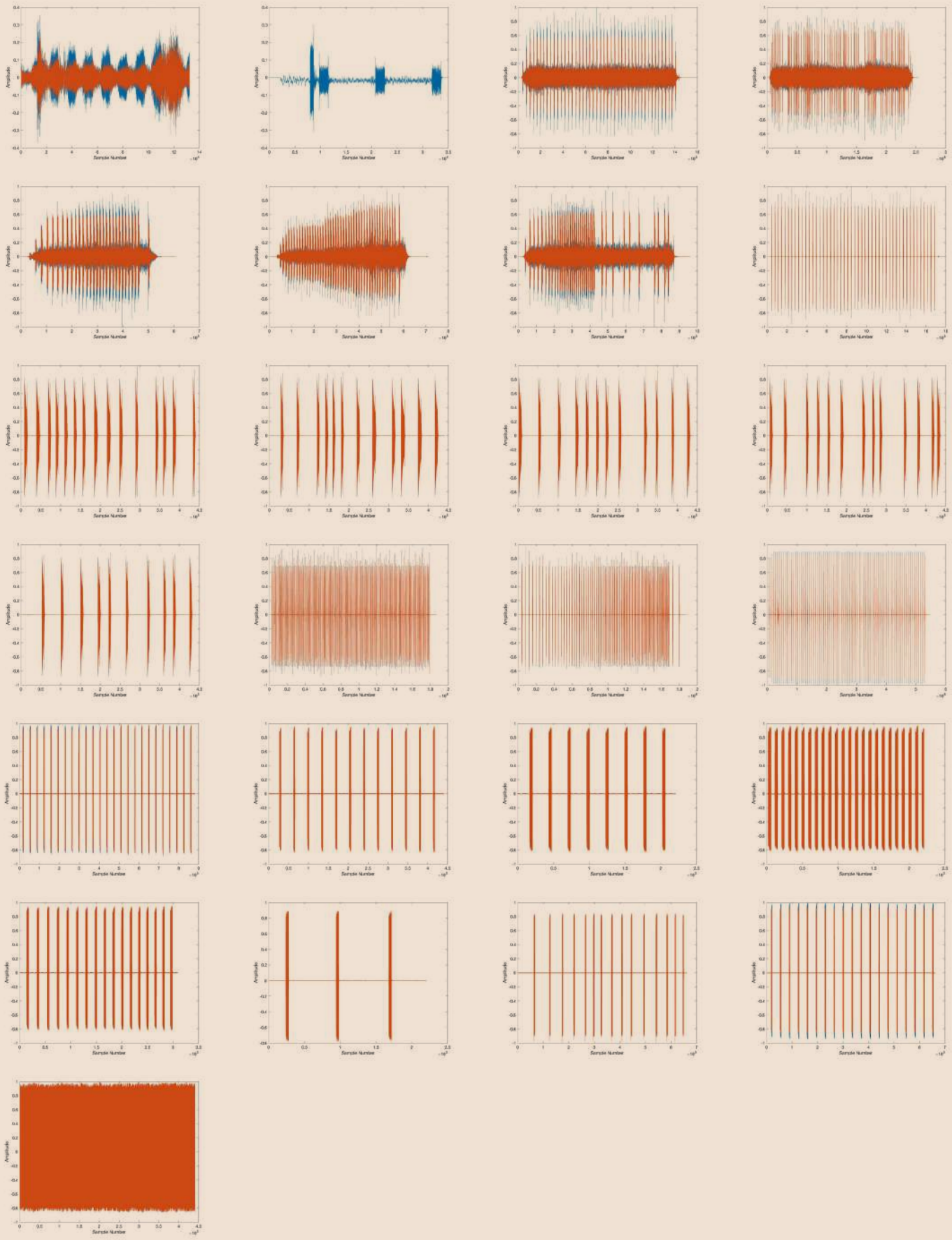
Fitbit placement: wrist-upper inner arm (29/02/2019)

time	HR wrist	HR u.o.arm	difference
11:10-11:15	91	87	4
11:15-11:20	92	88	4
11:20-11:25	105	102	3
11:25-11:30	91	82	9
11:30-11:35	72	72	0
11:35-11:40	72	72	0
11:40-11:45	77	73	4
11:45-11:50	83	80	3
11:50-11:55	82	81	1
11:55-12:00	82	82	0
12:00-12:05	79	81	2
12:05-12:10	79	80	1
12:10-12:15	80	81	1
12:15-12:20	79	79	0
12:20-12:25	79	80	1
12:25-12:30	78	82	4
12:30-12:35	76	79	3
12:35-12:40	80	81	1
12:40-12:45	77	78	1
12:45-12:50	83	80	3
12:50-12:55	72	71	1
12:55-13:00	77	76	1
13:00-13:05	76	77	1
13:05-13:10	73	76	3
13:10-13:15	78	78	0
13:15-13:20	74	73	1
13:20-13:25	76	77	1
13:25-13:30	77	77	0
13:30-13:35	88	86	2
13:35-13:40	75	74	1
13:40-13:45	78	77	1
13:45-13:50	78	78	0
13:50-13:55	77	78	1
13:55-14:00	77	77	0
14:00-14:05	78	78	0
14:05-14:10	75	78	3
14:10-14:15	78	78	0
14:15-14:20	79	80	1
14:20-14:25	77	80	3
14:25-14:30	80	84	4
14:30-14:35	86	88	2
14:35-14:40	94	93	1
14:40-14:45	90	86	4
14:45-14:50	79	82	3
14:50-14:55	81	83	2
14:55-15:00	81	82	1
15:00-15:05	81	86	5
15:05-15:10	81	82	1
15:10-15:15	80	80	0
15:15-15:20	78	78	0
15:20-15:25	74	76	2
15:25-15:30	77	77	0
15:30-15:35	77	77	0
15:35-15:40	81	81	0
15:40-15:45	82	80	2
15:45-15:50	77	76	1
15:50-15:55	76	79	3
15:55-16:00	79	79	0
16:00-16:05	77	75	2
16:05-16:10	76	78	2
16:10-16:15	75	78	3
16:15-16:20	77	77	0
16:20-16:25	75	75	0
16:25-16:30	76	76	0
16:30-16:35	75	76	1
16:35-16:40	76	79	3
16:40-16:45	79	79	0
16:45-16:50	84	85	1
16:50-16:55	68	75	7
16:55-17:00	75	75	0
17:00-17:05	74	74	0
17:05-17:10	75	76	1
17:10-17:15	73	74	1
17:15-17:20	76	77	1
17:20-17:25	72	73	1
17:25-17:30	73	75	2
17:30-17:35	73	75	2
17:35-17:40	79	80	1

Sum difference
4

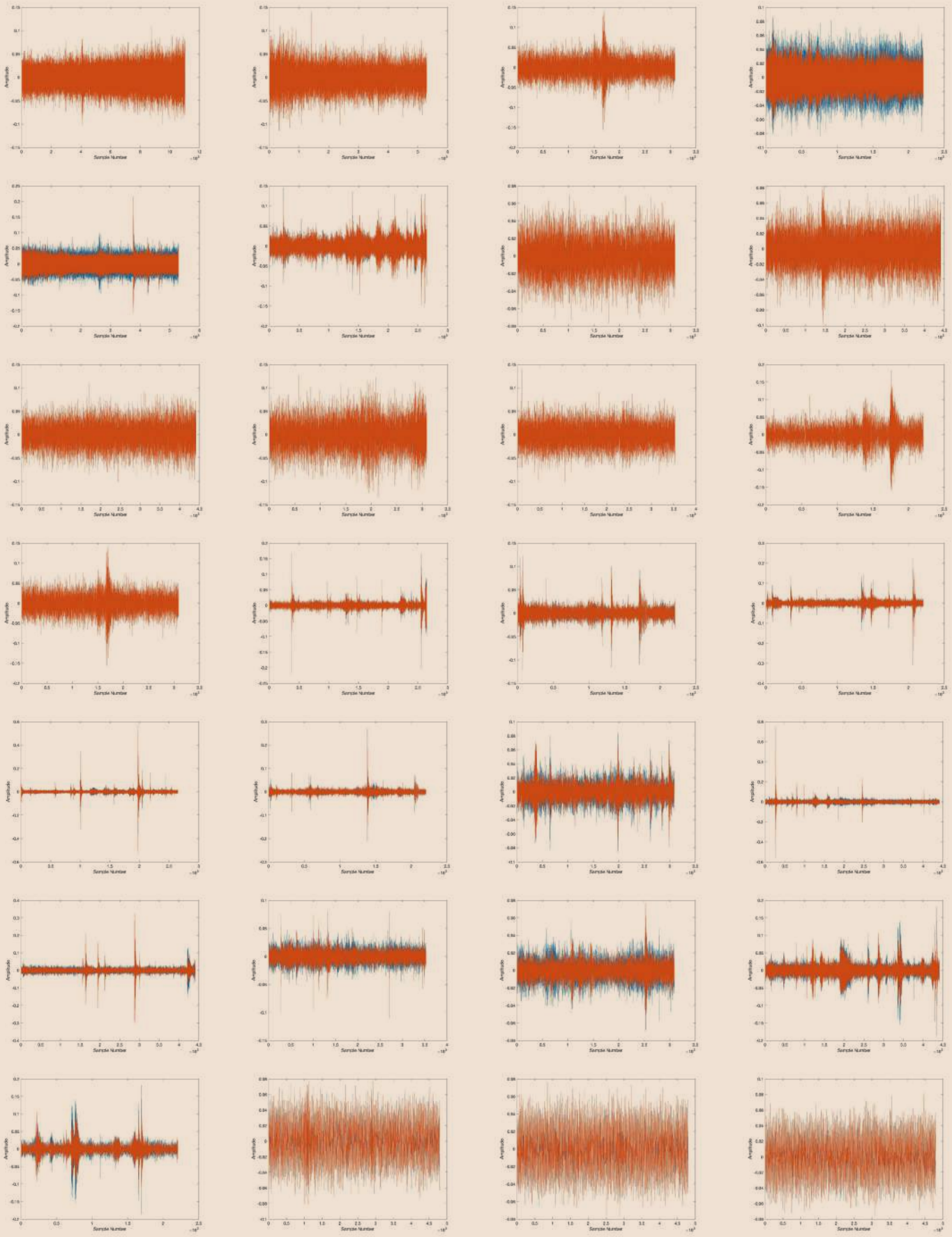
Sound Analysis: Alarm

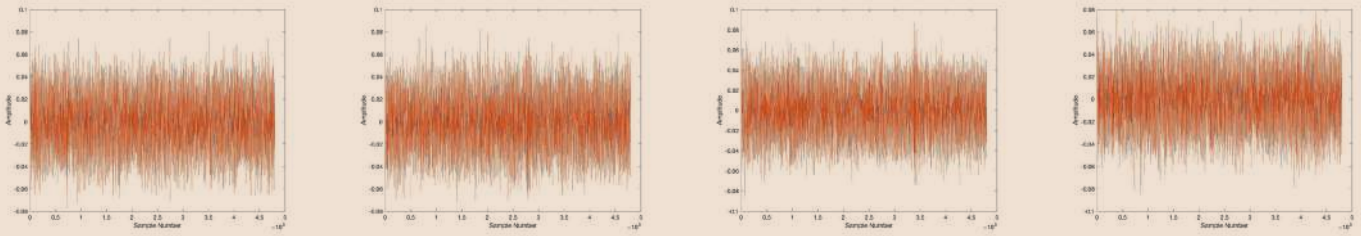
Matlab Audio Signal Analysis with 25 samples



Sound Analysis: Background

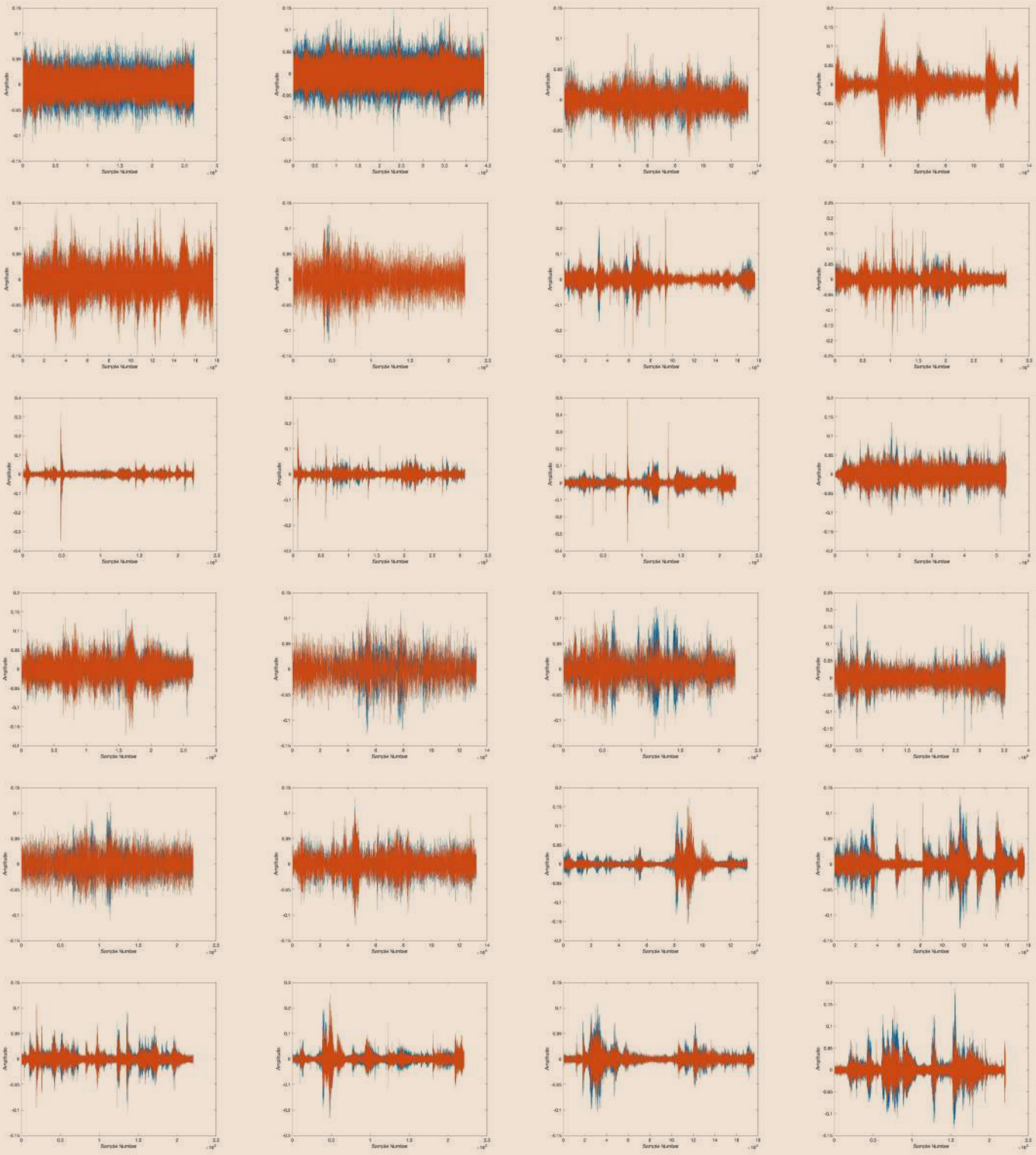
Matlab Audio Signal Analysis with 32 samples

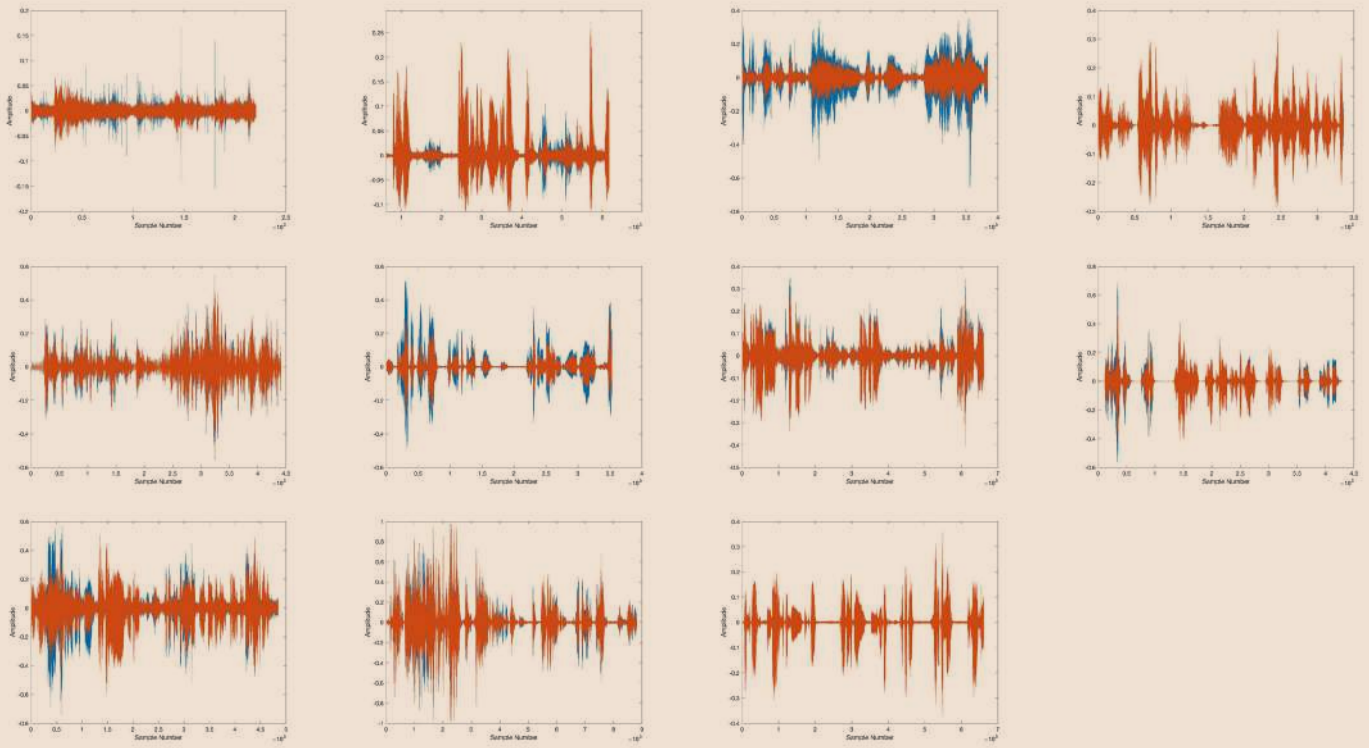




Sound Analysis: Conversation

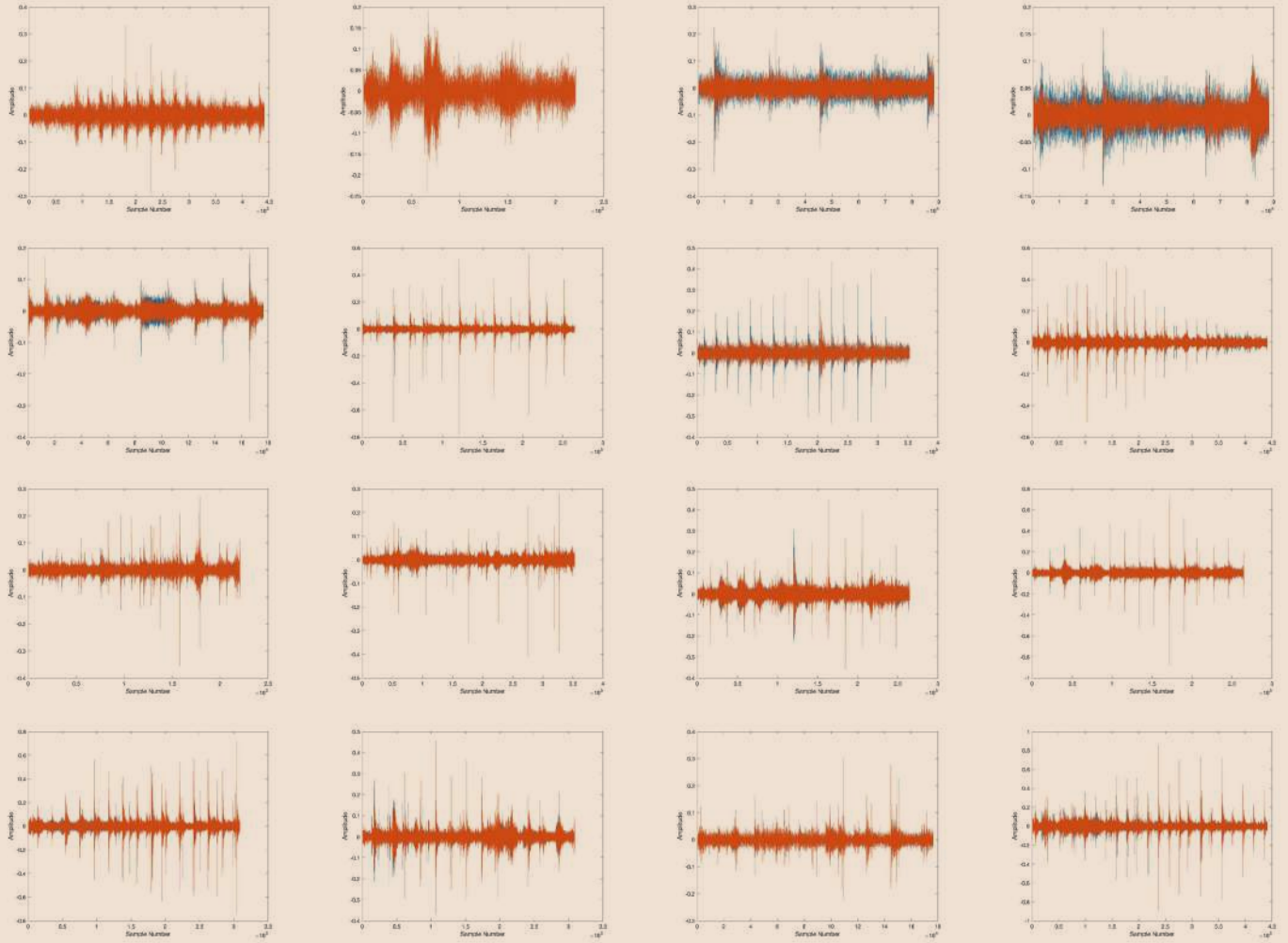
Matlab Audio Signal Analysis with 35 samples

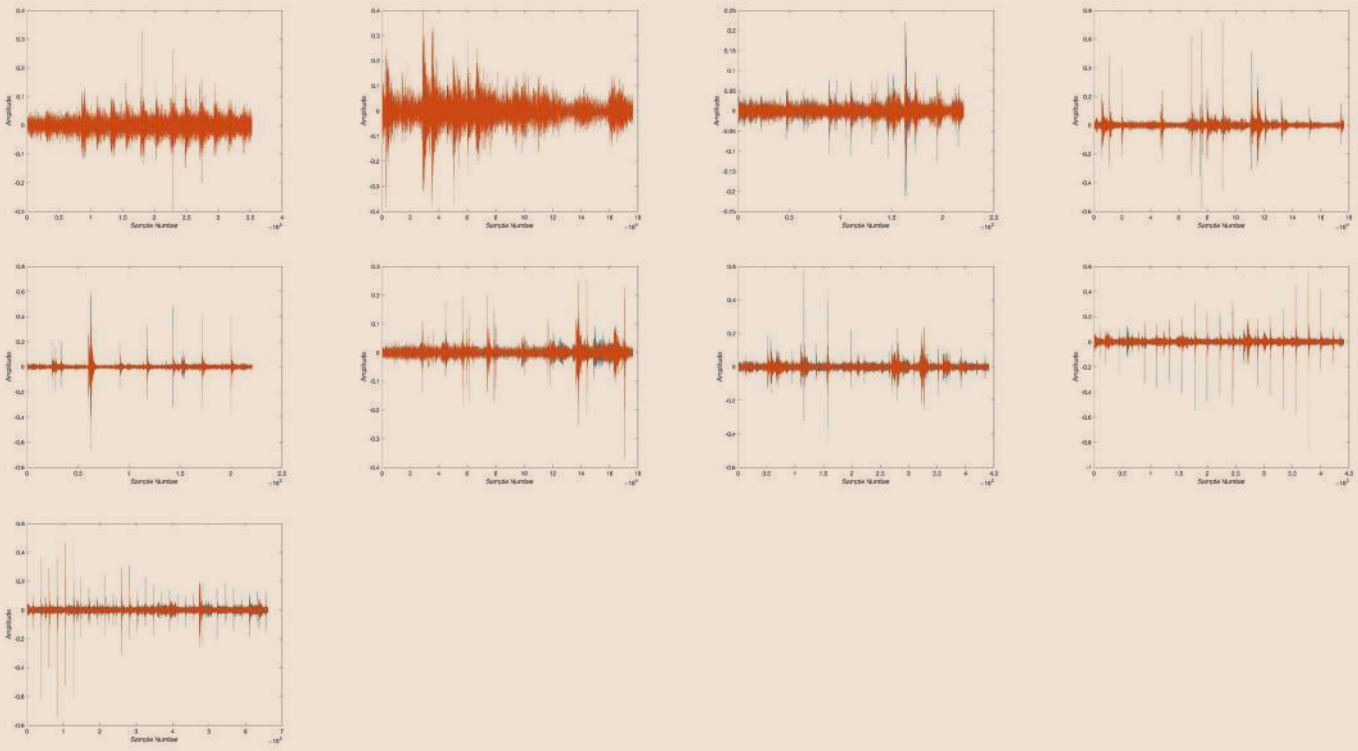




Sound Analysis: Footsteps

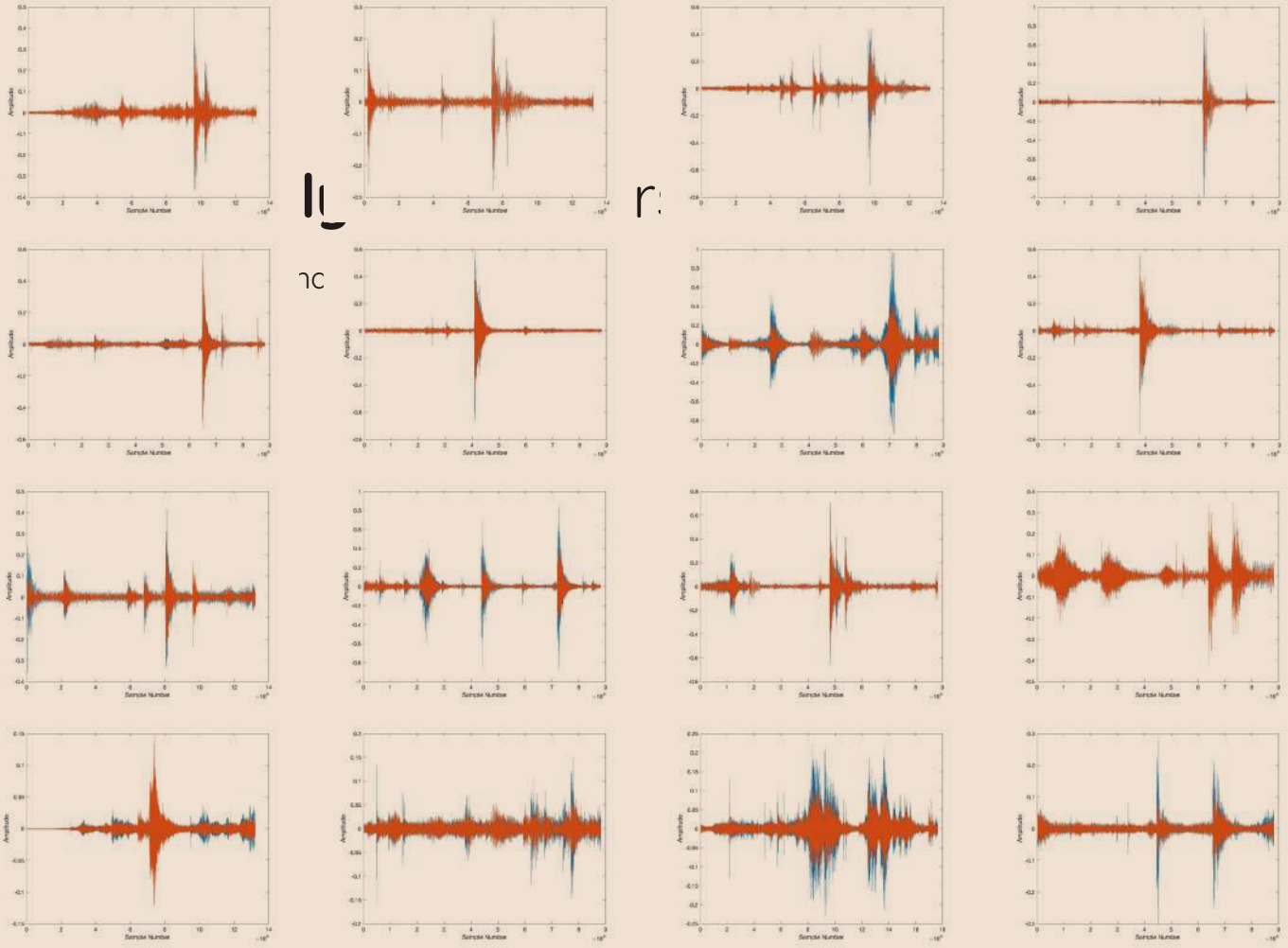
Matlab Audio Signal Analysis with 25 samples

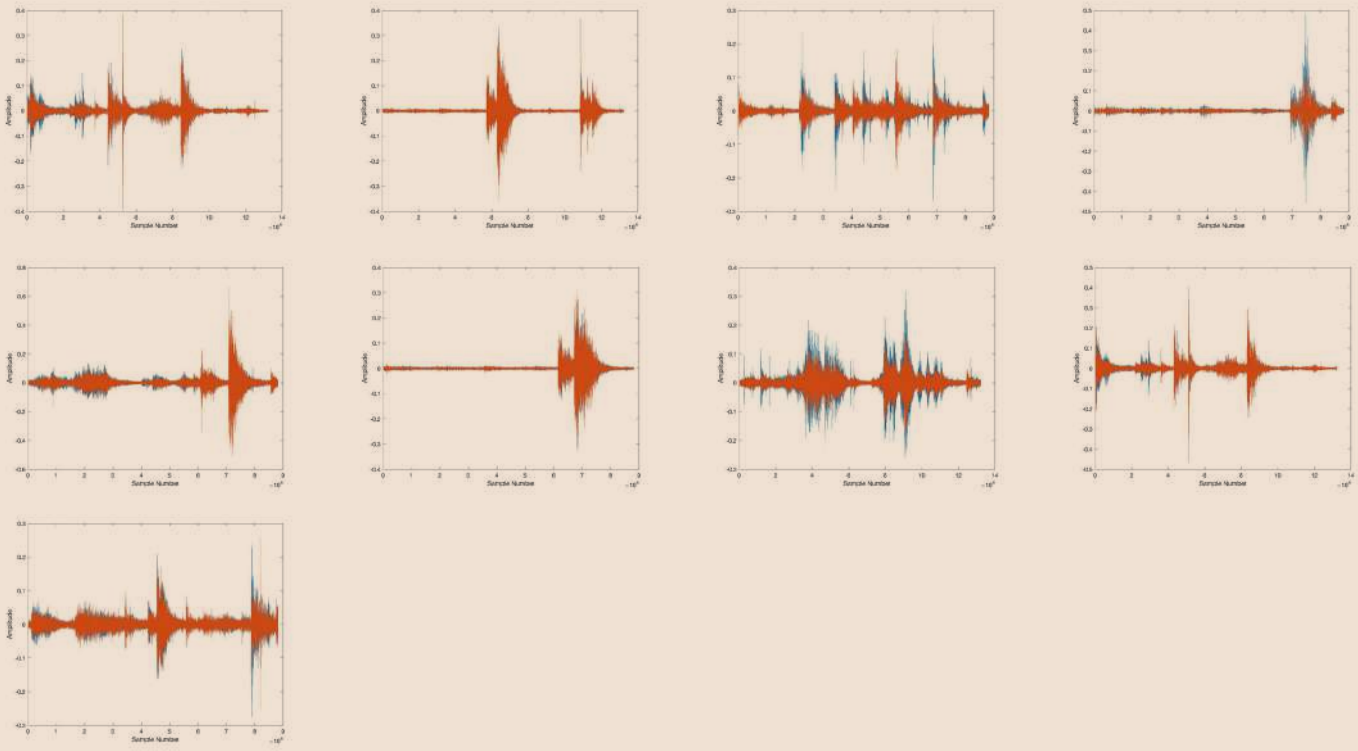




Sound Analysis: Objects clashing

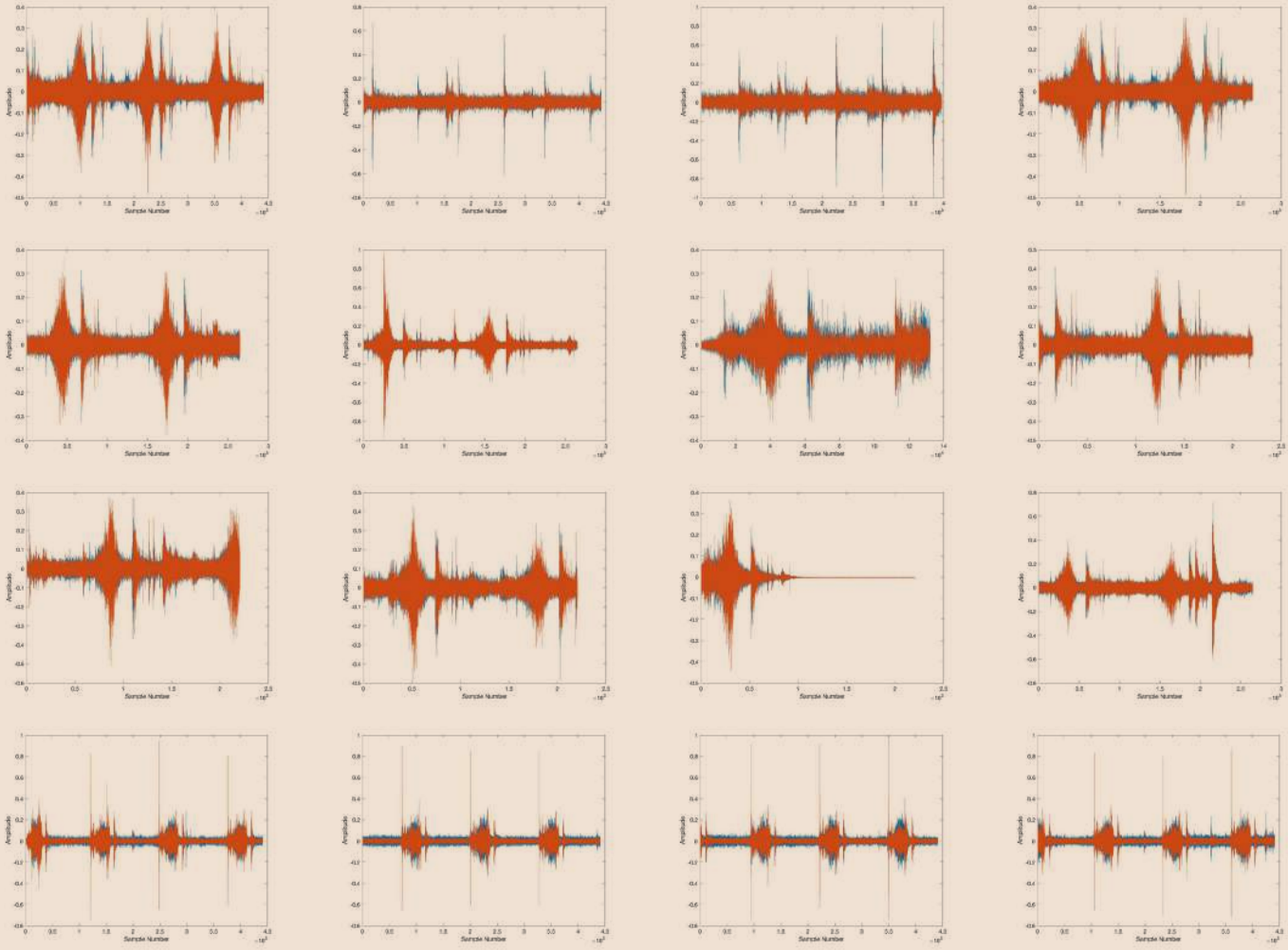
Matlab Audio Signal Analysis with 25 samples

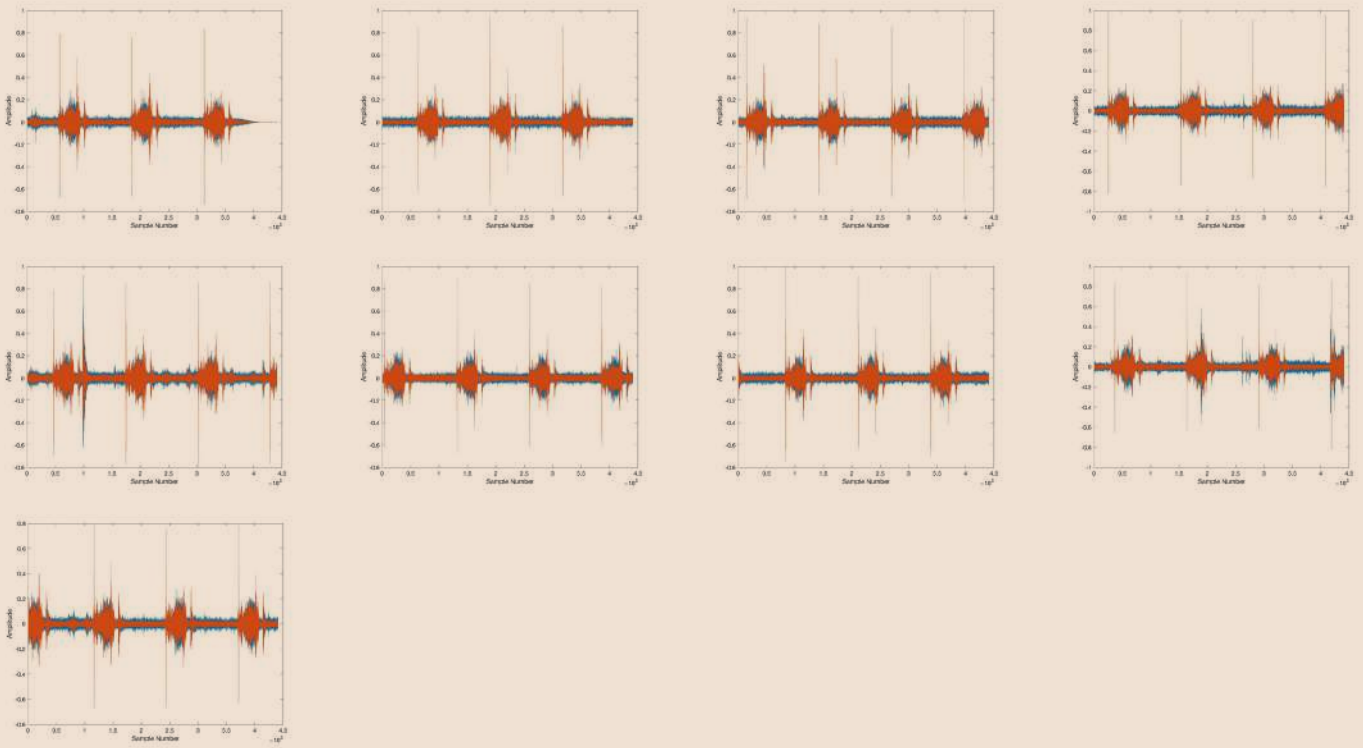




Sound Analysis: Ventilator

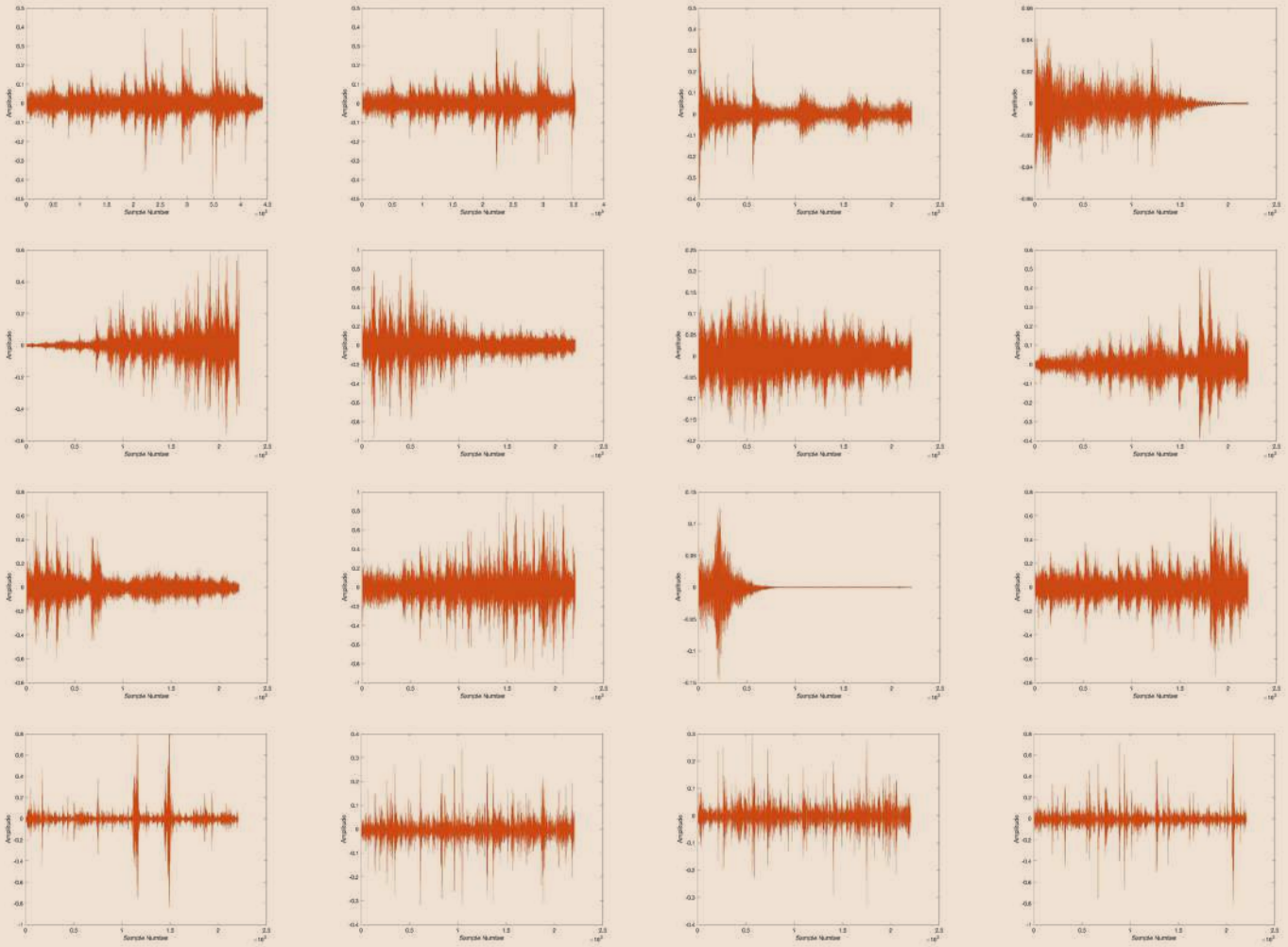
Matlab Audio Signal Analysis with 25 samples

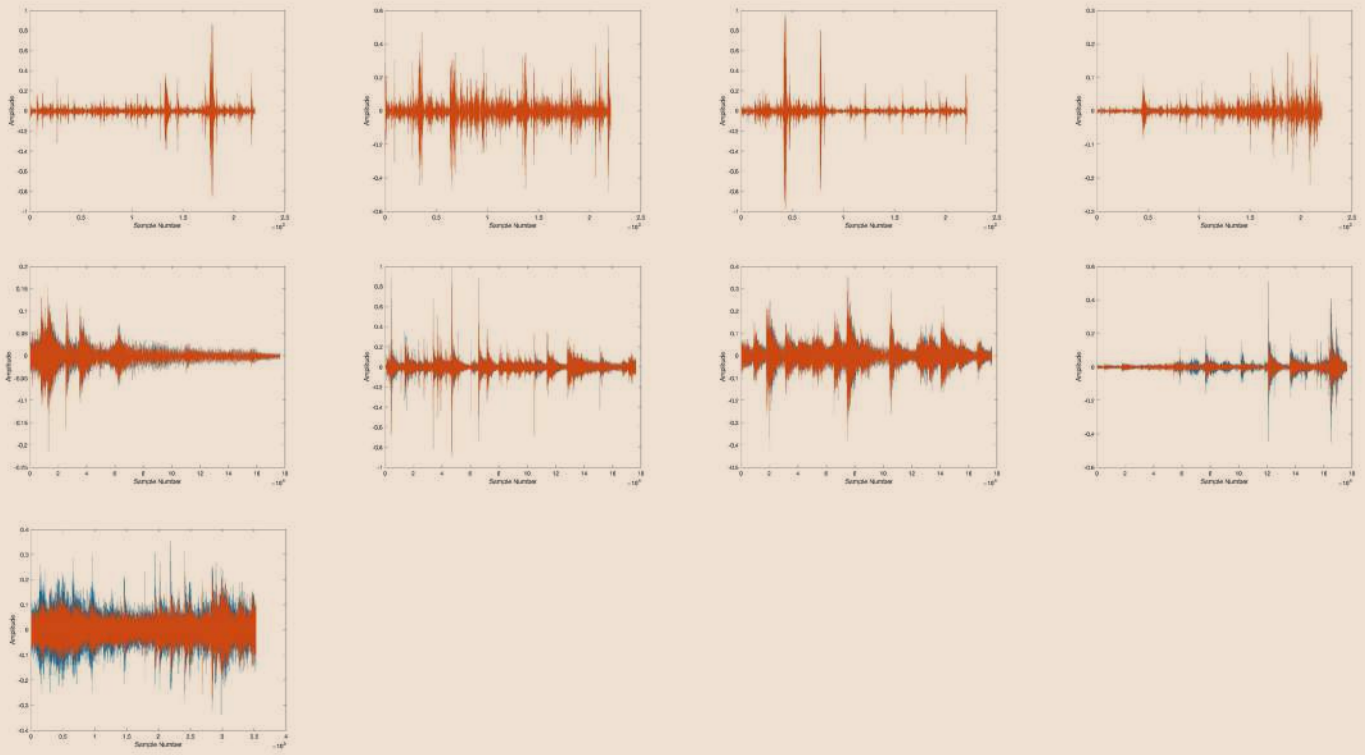




Sound Analysis: Trolley

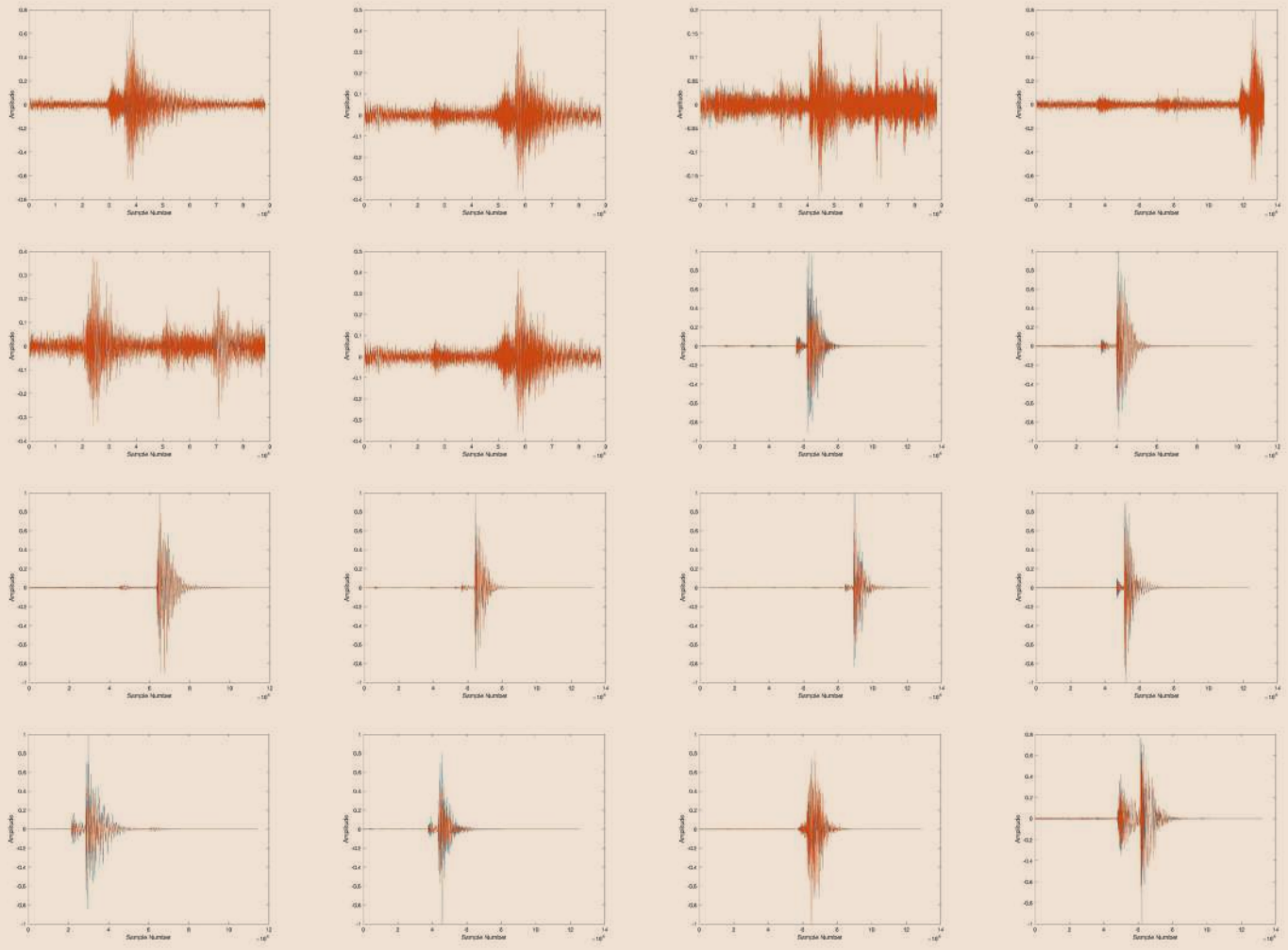
Matlab Audio Signal Analysis with 25 samples

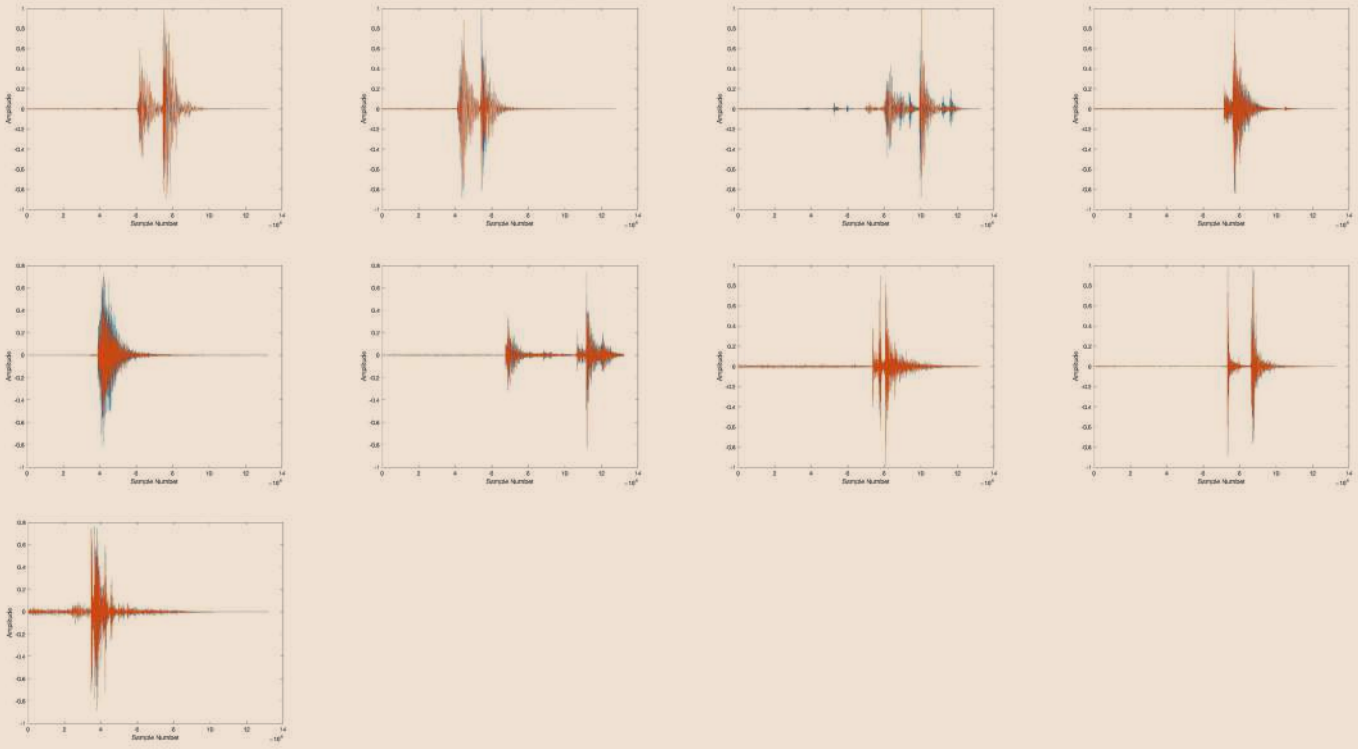




Sound Analysis: Door slam

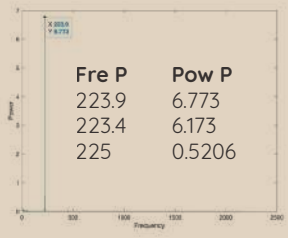
Matlab Audio Signal Analysis with 25 samples



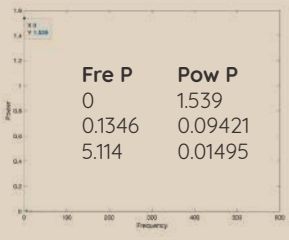


Sound Analysis: Alarm

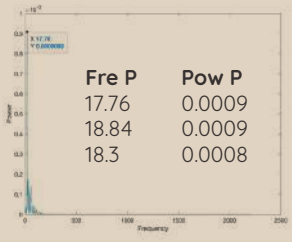
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



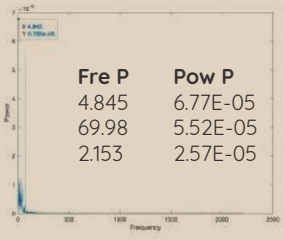
Fre P	Pow P
223.9	6.773
223.4	6.173
225	0.5206



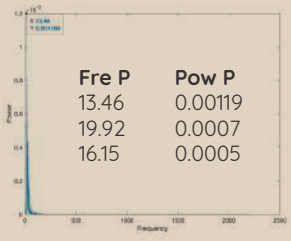
Fre P	Pow P
0	1.539
0.1346	0.09421
5.114	0.01495



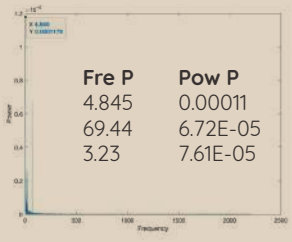
Fre P	Pow P
17.76	0.0009
18.84	0.0009
18.3	0.0008



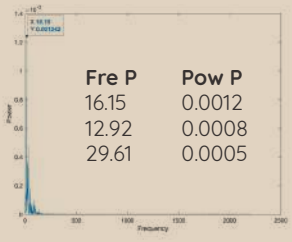
Fre P	Pow P
4.845	6.77E-05
69.98	5.52E-05
2.153	2.57E-05



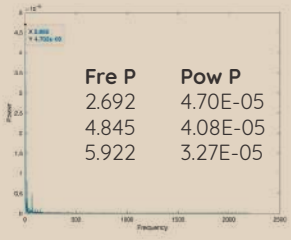
Fre P	Pow P
13.46	0.00119
19.92	0.0007
16.15	0.0005



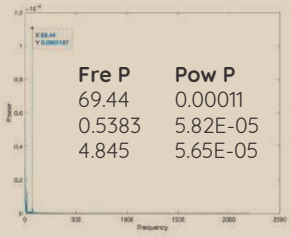
Fre P	Pow P
4.845	0.00011
69.44	6.72E-05
3.23	7.61E-05



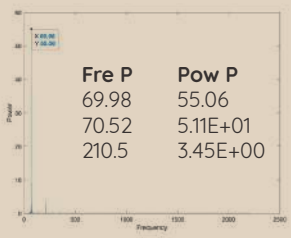
Fre P	Pow P
16.15	0.0012
12.92	0.0008
29.61	0.0005



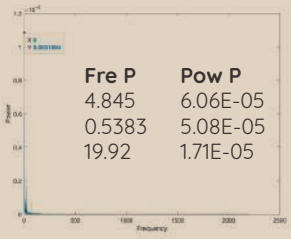
Fre P	Pow P
2.692	4.70E-05
4.845	4.08E-05
5.922	3.27E-05



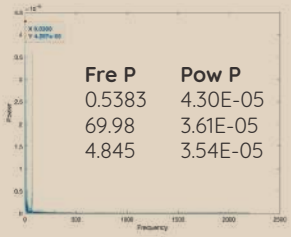
Fre P	Pow P
69.44	0.00011
0.5383	5.82E-05
4.845	5.65E-05



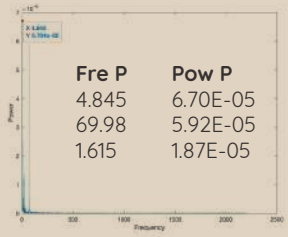
Fre P	Pow P
69.98	55.06
70.52	5.11E+01
210.5	3.45E+00



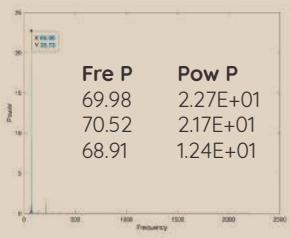
Fre P	Pow P
4.845	6.06E-05
0.5383	5.08E-05
19.92	1.71E-05



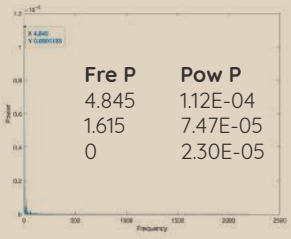
Fre P	Pow P
0.5383	4.30E-05
69.98	3.61E-05
4.845	3.54E-05



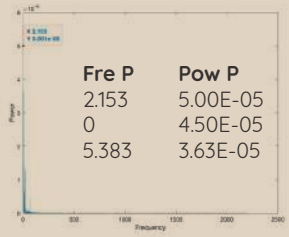
Fre P	Pow P
4.845	6.70E-05
69.98	5.92E-05
1.615	1.87E-05



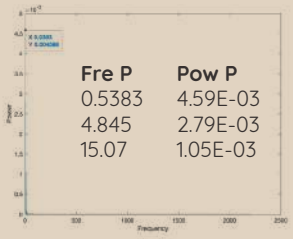
Fre P	Pow P
69.98	2.27E+01
70.52	2.17E+01
68.91	1.24E+01



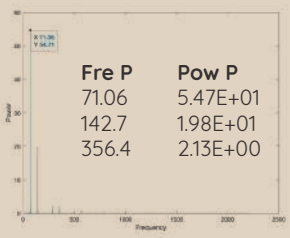
Fre P	Pow P
4.845	1.12E-04
1.615	7.47E-05
0	2.30E-05



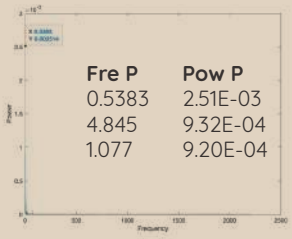
Fre P	Pow P
2.153	5.00E-05
0	4.50E-05
5.383	3.63E-05



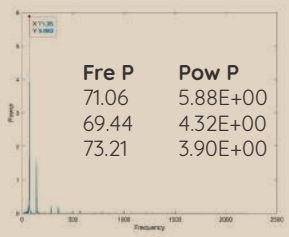
Fre P	Pow P
0.5383	4.59E-03
4.845	2.79E-03
15.07	1.05E-03



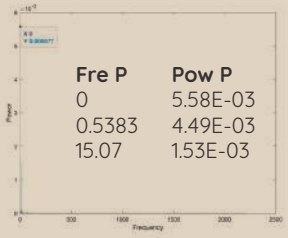
Fre P	Pow P
71.06	5.47E+01
142.7	1.98E+01
356.4	2.13E+00



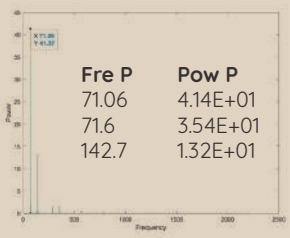
Fre P	Pow P
0.5383	2.51E-03
4.845	9.32E-04
1.077	9.20E-04



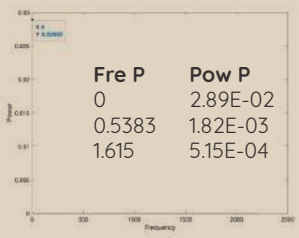
Fre P	Pow P
71.06	5.88E+00
69.44	4.32E+00
73.21	3.90E+00



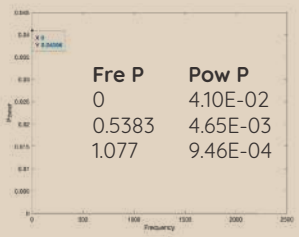
Fre P	Pow P
0	5.58E-03
0.5383	4.49E-03
15.07	1.53E-03



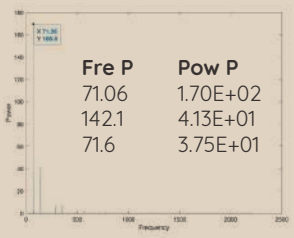
Fre P	Pow P
71.06	4.14E+01
71.6	3.54E+01
142.7	1.32E+01



Fre P	Pow P
0	2.89E-02
0.5383	1.82E-03
1.615	5.15E-04



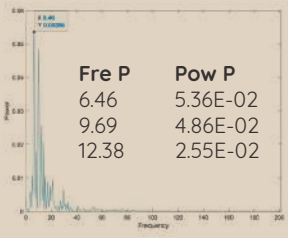
Fre P	Pow P
0	4.10E-02
0.5383	4.65E-03
1.077	9.46E-04



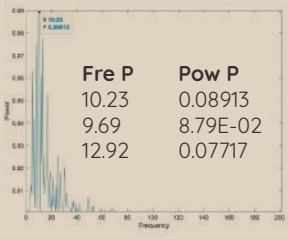
Fre P	Pow P
71.06	1.70E+02
142.1	4.13E+01
71.6	3.75E+01

Sound Analysis: Background

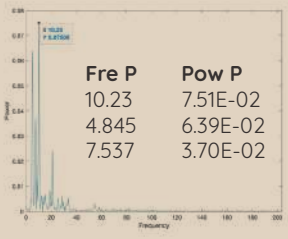
Matlab FFT(Fast Fourier Transform) Analysis with 32 samples



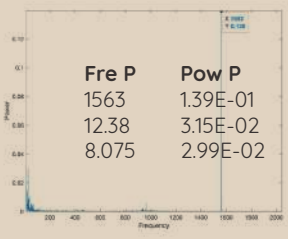
Fre P	Pow P
6.46	5.36E-02
9.69	4.86E-02
12.38	2.55E-02



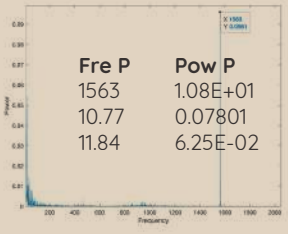
Fre P	Pow P
10.23	0.08913
9.69	8.79E-02
12.92	0.07717



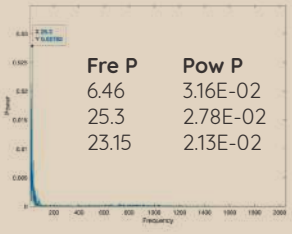
Fre P	Pow P
10.23	7.51E-02
4.845	6.39E-02
7.537	3.70E-02



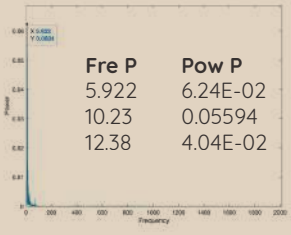
Fre P	Pow P
1563	1.39E-01
12.38	3.15E-02
8.075	2.99E-02



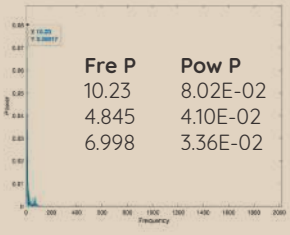
Fre P	Pow P
1563	1.08E+01
10.77	0.07801
11.84	6.25E-02



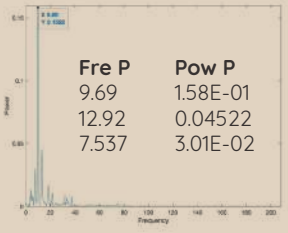
Fre P	Pow P
6.46	3.16E-02
25.3	2.78E-02
23.15	2.13E-02



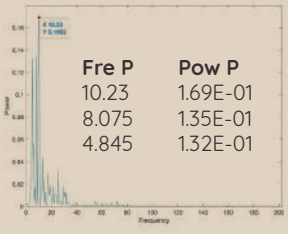
Fre P	Pow P
5.922	6.24E-02
10.23	0.05594
12.38	4.04E-02



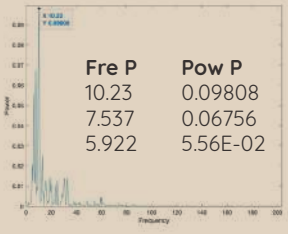
Fre P	Pow P
10.23	8.02E-02
4.845	4.10E-02
6.998	3.36E-02



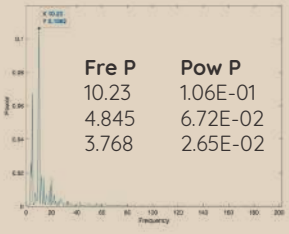
Fre P	Pow P
9.69	1.58E-01
12.92	0.04522
7.537	3.01E-02



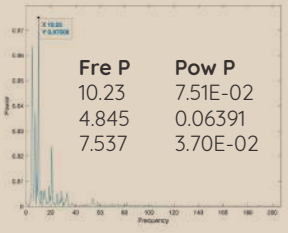
Fre P	Pow P
10.23	1.69E-01
8.075	1.35E-01
4.845	1.32E-01



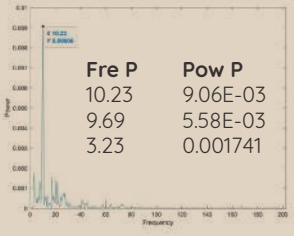
Fre P	Pow P
10.23	0.09808
7.537	0.06756
5.922	5.56E-02



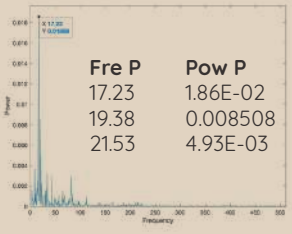
Fre P	Pow P
10.23	1.06E-01
4.845	6.72E-02
3.768	2.65E-02



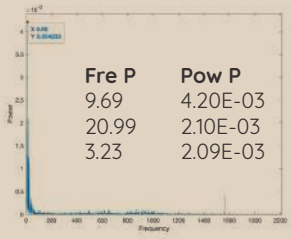
Fre P	Pow P
10.23	7.51E-02
4.845	0.06391
7.537	3.70E-02



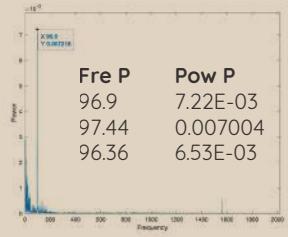
Fre P	Pow P
10.23	9.06E-03
9.69	5.58E-03
3.23	0.001741



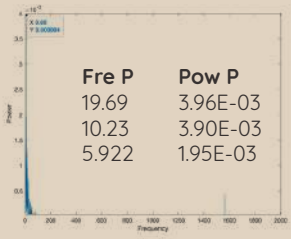
Fre P	Pow P
17.23	1.86E-02
19.38	0.008508
21.53	4.93E-03



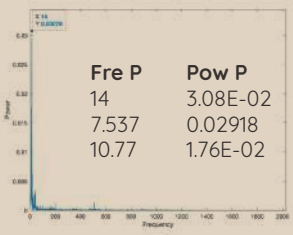
Fre P	Pow P
9.69	4.20E-03
20.99	2.10E-03
3.23	2.09E-03



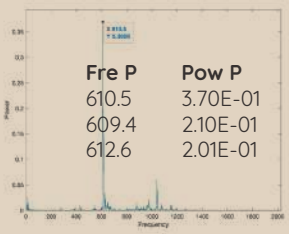
Fre P	Pow P
96.9	7.22E-03
97.44	0.007004
96.36	6.53E-03



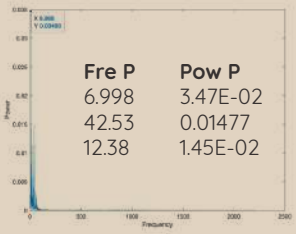
Fre P	Pow P
19.69	3.96E-03
10.23	3.90E-03
5.922	1.95E-03



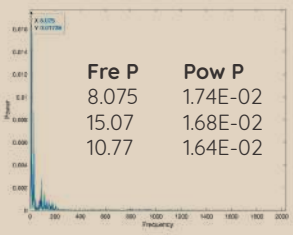
Fre P	Pow P
14	3.08E-02
7.537	0.02918
10.77	1.76E-02



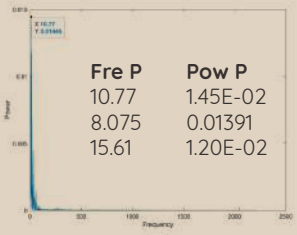
Fre P	Pow P
610.5	3.70E-01
609.4	2.10E-01
612.6	2.01E-01



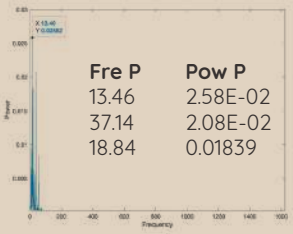
Fre P	Pow P
6.998	3.47E-02
42.53	0.01477
12.38	1.45E-02



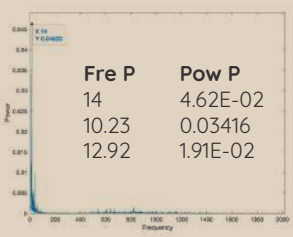
Fre P	Pow P
8.075	1.74E-02
15.07	1.68E-02
10.77	1.64E-02



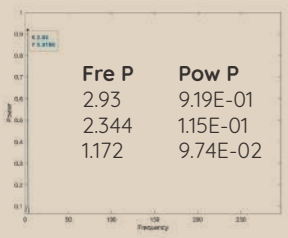
Fre P	Pow P
10.77	1.45E-02
8.075	0.01391
15.61	1.20E-02



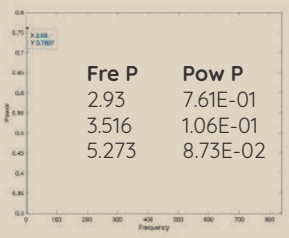
Fre P	Pow P
13.46	2.58E-02
37.14	2.08E-02
18.84	0.01839



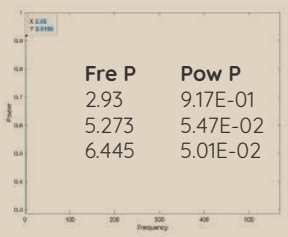
Fre P	Pow P
14	4.62E-02
10.23	0.03416
12.92	1.91E-02



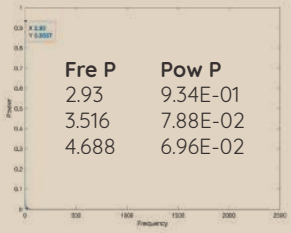
Fre P	Pow P
2.93	9.19E-01
2.344	1.15E-01
1.172	9.74E-02



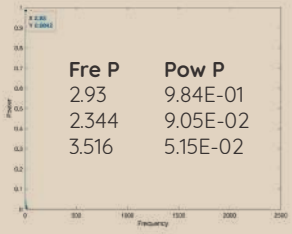
Fre P	Pow P
2.93	7.61E-01
3.516	1.06E-01
5.273	8.73E-02



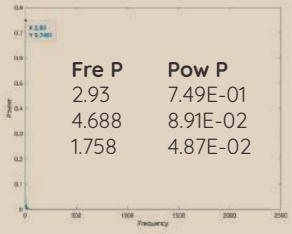
Fre P	Pow P
2.93	9.17E-01
5.273	5.47E-02
6.445	5.01E-02



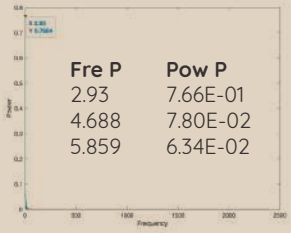
Fre P	Pow P
2.93	9.34E-01
3.516	7.88E-02
4.688	6.96E-02



Fre P	Pow P
2.93	9.84E-01
2.344	9.05E-02
3.516	5.15E-02



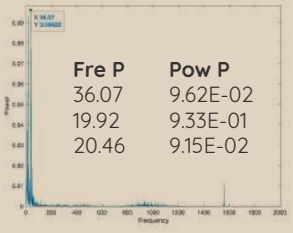
Fre P	Pow P
2.93	7.49E-01
4.688	8.91E-02
1.758	4.87E-02



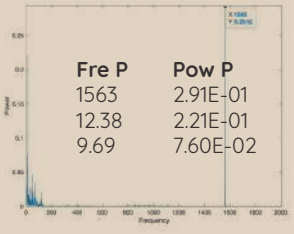
Fre P	Pow P
2.93	7.66E-01
4.688	7.80E-02
5.859	6.34E-02

Sound Analysis: Conversation

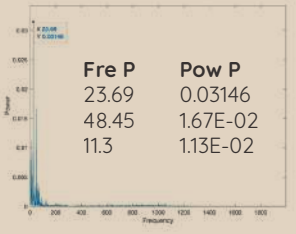
Matlab FFT(Fast Fourier Transform) Analysis with 35 samples



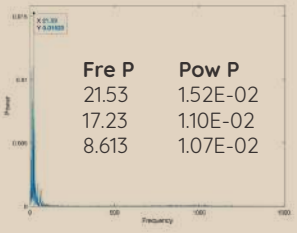
Fre P	Pow P
36.07	9.62E-02
19.92	9.33E-01
20.46	9.15E-02



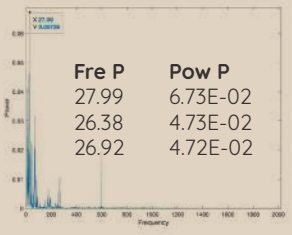
Fre P	Pow P
1563	2.91E-01
12.38	2.21E-01
9.69	7.60E-02



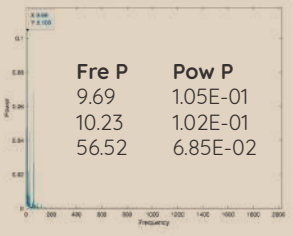
Fre P	Pow P
23.69	0.03146
48.45	1.67E-02
11.3	1.13E-02



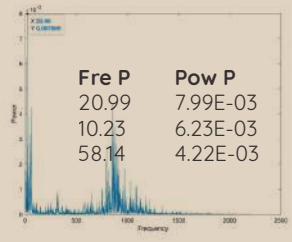
Fre P	Pow P
21.53	1.52E-02
17.23	1.10E-02
8.613	1.07E-02



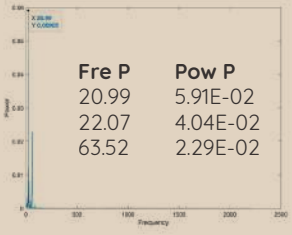
Fre P	Pow P
27.99	6.73E-02
26.38	4.73E-02
26.92	4.72E-02



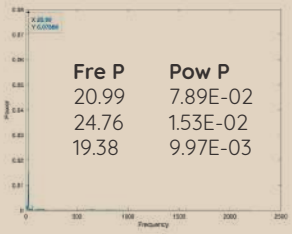
Fre P	Pow P
9.69	1.05E-01
10.23	1.02E-01
56.52	6.85E-02



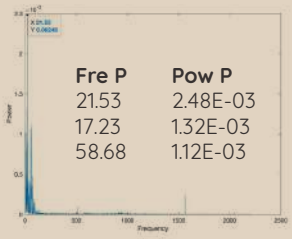
Fre P	Pow P
20.99	7.99E-03
10.23	6.23E-03
58.14	4.22E-03



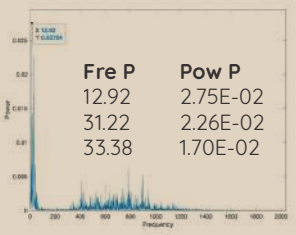
Fre P	Pow P
20.99	5.91E-02
22.07	4.04E-02
63.52	2.29E-02



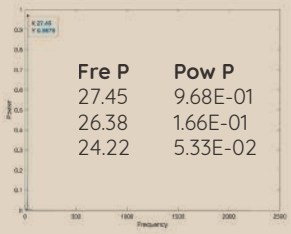
Fre P	Pow P
20.99	7.89E-02
24.76	1.53E-02
19.38	9.97E-03



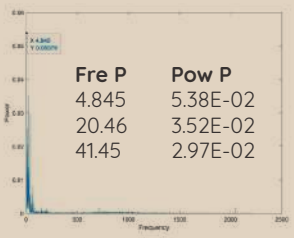
Fre P	Pow P
21.53	2.48E-03
17.23	1.32E-03
58.68	1.12E-03



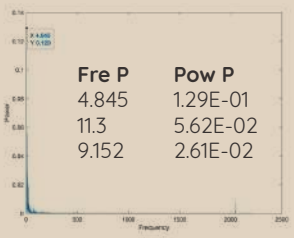
Fre P	Pow P
12.92	2.75E-02
31.22	2.26E-02
33.38	1.70E-02



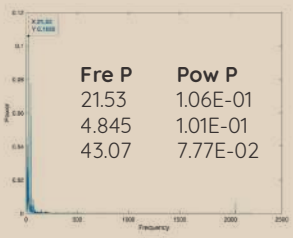
Fre P	Pow P
27.45	9.68E-01
26.38	1.66E-01
24.22	5.33E-02



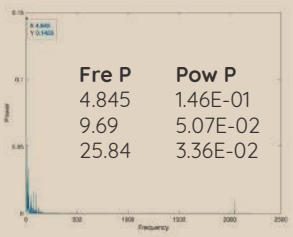
Fre P	Pow P
4.845	5.38E-02
20.46	3.52E-02
41.45	2.97E-02



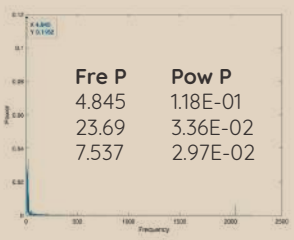
Fre P	Pow P
4.845	1.29E-01
11.3	5.62E-02
9.152	2.61E-02



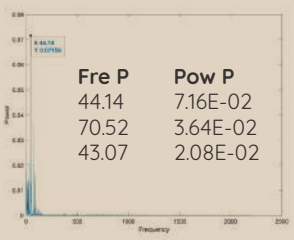
Fre P	Pow P
21.53	1.06E-01
4.845	1.01E-01
43.07	7.77E-02



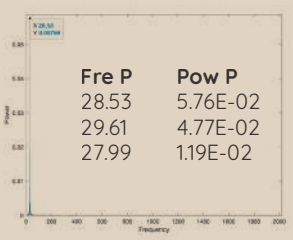
Fre P	Pow P
4.845	1.46E-01
9.69	5.07E-02
25.84	3.36E-02



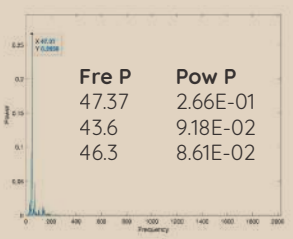
Fre P	Pow P
4.845	1.18E-01
23.69	3.36E-02
7.537	2.97E-02



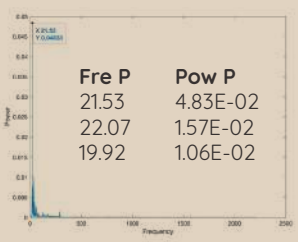
Fre P	Pow P
44.14	7.16E-02
70.52	3.64E-02
43.07	2.08E-02



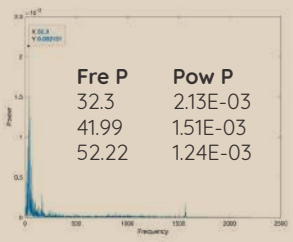
Fre P	Pow P
28.53	5.76E-02
29.61	4.77E-02
27.99	1.19E-02



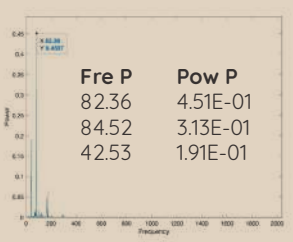
Fre P	Pow P
47.37	2.66E-01
43.6	9.18E-02
46.3	8.61E-02



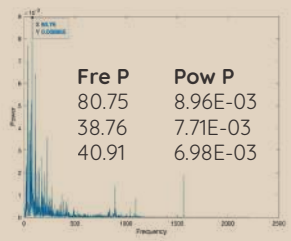
Fre P	Pow P
21.53	4.83E-02
22.07	1.57E-02
19.92	1.06E-02



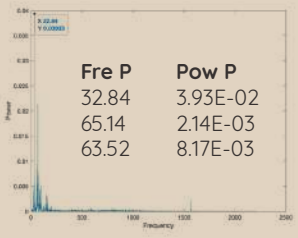
Fre P	Pow P
32.3	2.13E-03
41.99	1.51E-03
52.22	1.24E-03



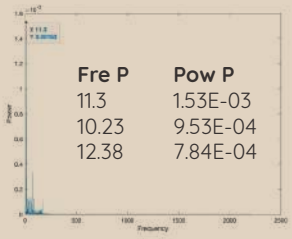
Fre P	Pow P
82.36	4.51E-01
84.52	3.13E-01
42.53	1.91E-01



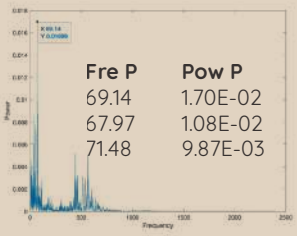
Fre P	Pow P
80.75	8.96E-03
38.76	7.71E-03
40.91	6.98E-03



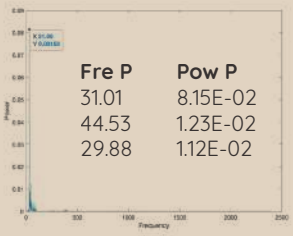
Fre P	Pow P
32.84	3.93E-02
65.14	2.14E-03
63.52	8.17E-03



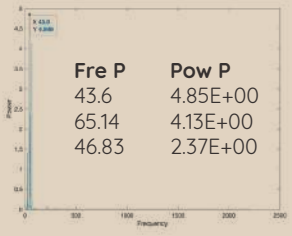
Fre P	Pow P
11.3	1.53E-03
10.23	9.53E-04
12.38	7.84E-04



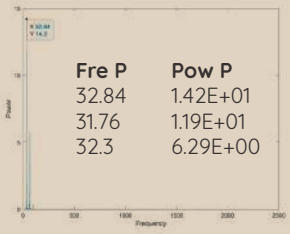
Fre P	Pow P
69.14	1.70E-02
67.97	1.08E-02
71.48	9.87E-03



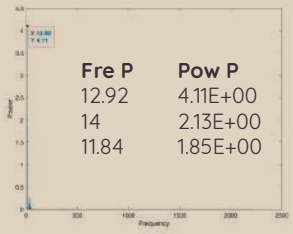
Fre P	Pow P
31.01	8.15E-02
44.53	1.23E-02
29.88	1.12E-02



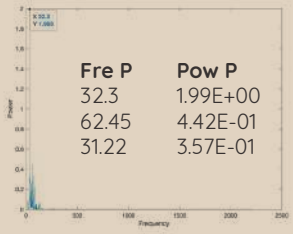
Fre P	Pow P
43.6	4.85E+00
65.14	4.13E+00
46.83	2.37E+00



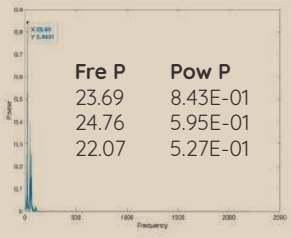
Fre P	Pow P
32.84	1.42E+01
31.76	1.19E+01
32.3	6.29E+00



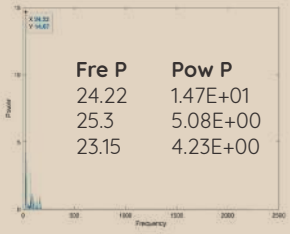
Fre P	Pow P
12.92	4.11E+00
14	2.13E+00
11.84	1.85E+00



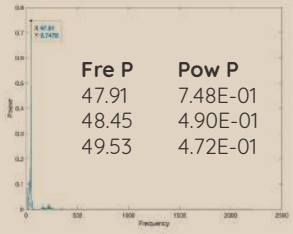
Fre P	Pow P
32.3	1.99E+00
62.45	4.42E-01
31.22	3.57E-01



Fre P	Pow P
23.69	8.43E-01
24.76	5.95E-01
22.07	5.27E-01



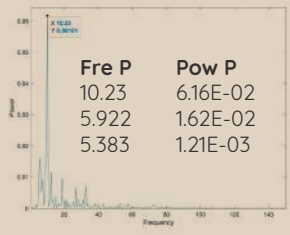
Fre P	Pow P
24.22	1.47E+01
25.3	5.08E+00
23.15	4.23E+00



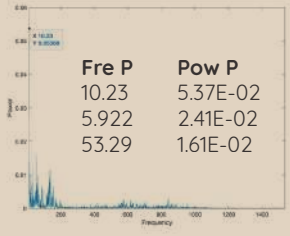
Fre P	Pow P
47.91	7.48E-01
48.45	4.90E-01
49.53	4.72E-01

Sound Analysis: Footsteps

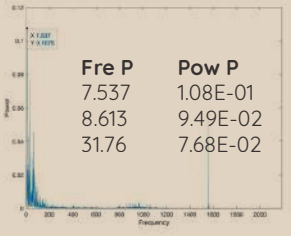
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



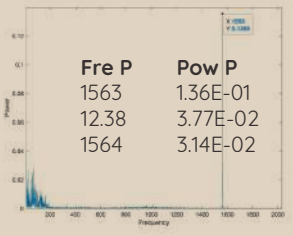
Fre P	Pow P
10.23	6.16E-02
5.922	1.62E-02
5.383	1.21E-03



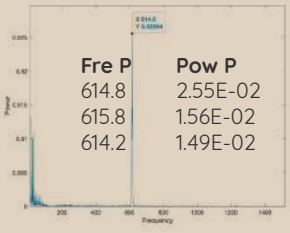
Fre P	Pow P
10.23	5.37E-02
5.922	2.41E-02
53.29	1.61E-02



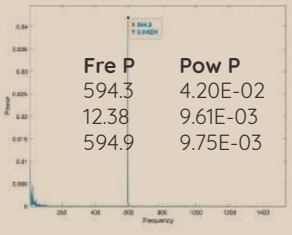
Fre P	Pow P
7.537	1.08E-01
8.613	9.49E-02
31.76	7.68E-02



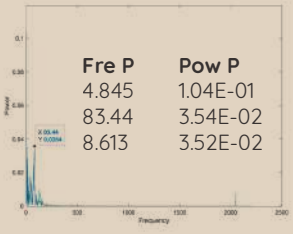
Fre P	Pow P
1563	1.36E-01
12.38	3.77E-02
1564	3.14E-02



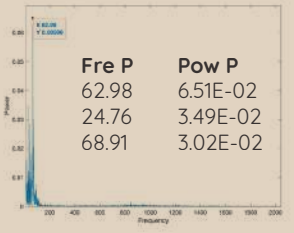
Fre P	Pow P
614.8	2.55E-02
615.8	1.56E-02
614.2	1.49E-02



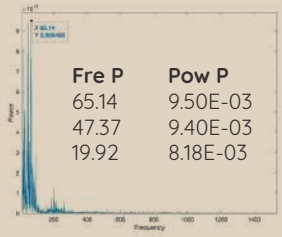
Fre P	Pow P
594.3	4.20E-02
12.38	9.61E-03
594.9	9.75E-03



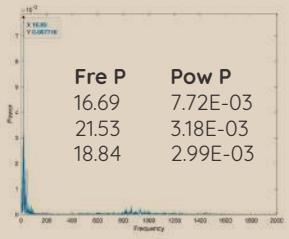
Fre P	Pow P
4.845	1.04E-01
83.44	3.54E-02
8.613	3.52E-02



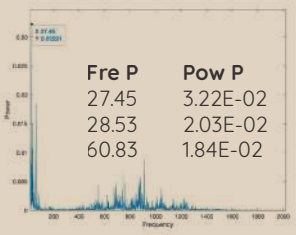
Fre P	Pow P
62.98	6.51E-02
24.76	3.49E-02
68.91	3.02E-02



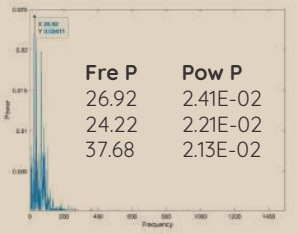
Fre P	Pow P
65.14	9.50E-03
47.37	9.40E-03
19.92	8.18E-03



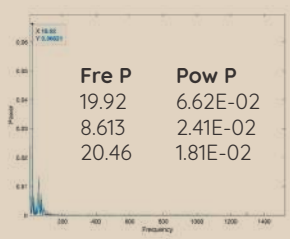
Fre P	Pow P
16.69	7.72E-03
21.53	3.18E-03
18.84	2.99E-03



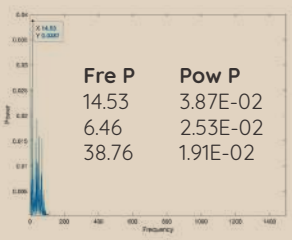
Fre P	Pow P
27.45	3.22E-02
28.53	2.03E-02
60.83	1.84E-02



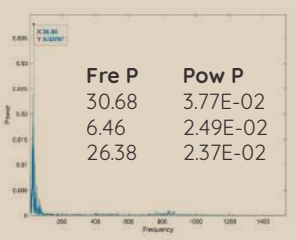
Fre P	Pow P
26.92	2.41E-02
24.22	2.21E-02
37.68	2.13E-02



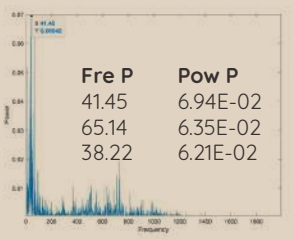
Fre P	Pow P
19.92	6.62E-02
8.613	2.41E-02
20.46	1.81E-02



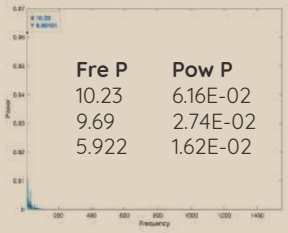
Fre P	Pow P
14.53	3.87E-02
6.46	2.53E-02
38.76	1.91E-02



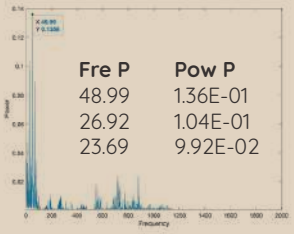
Fre P	Pow P
30.68	3.77E-02
6.46	2.49E-02
26.38	2.37E-02



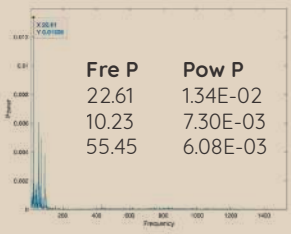
Fre P	Pow P
41.45	6.94E-02
65.14	6.35E-02
38.22	6.21E-02



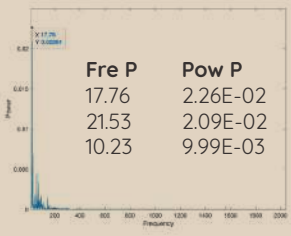
Fre P	Pow P
10.23	6.16E-02
9.69	2.74E-02
5.922	1.62E-02



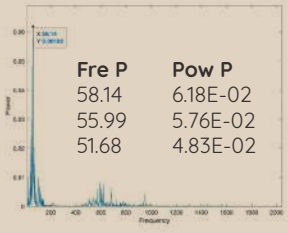
Fre P	Pow P
48.99	1.36E-01
26.92	1.04E-01
23.69	9.92E-02



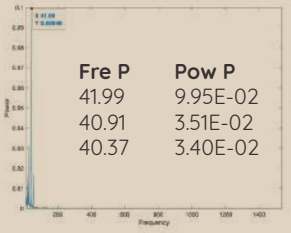
Fre P	Pow P
22.61	1.34E-02
10.23	7.30E-03
55.45	6.08E-03



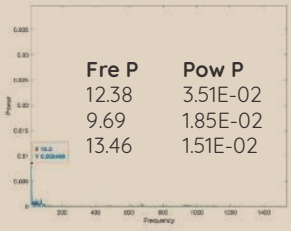
Fre P	Pow P
17.76	2.26E-02
21.53	2.09E-02
10.23	9.99E-03



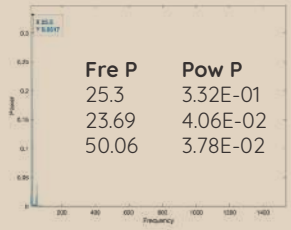
Fre P	Pow P
58.14	6.18E-02
55.99	5.76E-02
51.68	4.83E-02



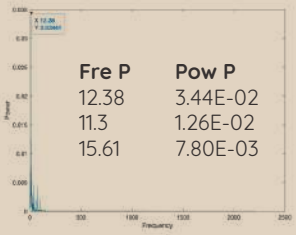
Fre P	Pow P
41.99	9.95E-02
40.91	3.51E-02
40.37	3.40E-02



Fre P	Pow P
12.38	3.51E-02
9.69	1.85E-02
13.46	1.51E-02



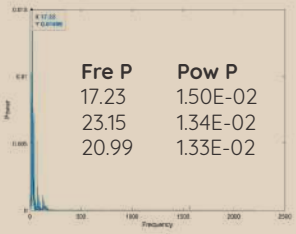
Fre P	Pow P
25.3	3.32E-01
23.69	4.06E-02
50.06	3.78E-02



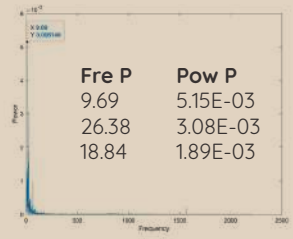
Fre P	Pow P
12.38	3.44E-02
11.3	1.26E-02
15.61	7.80E-03

Sound Analysis: Objects clashing

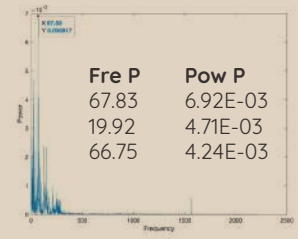
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



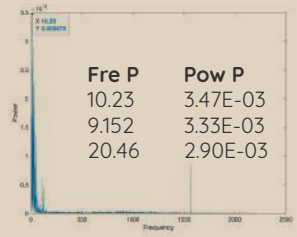
Fre P	Pow P
17.23	1.50E-02
23.15	1.34E-02
20.99	1.33E-02



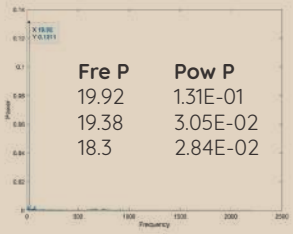
Fre P	Pow P
9.69	5.15E-03
26.38	3.08E-03
18.84	1.89E-03



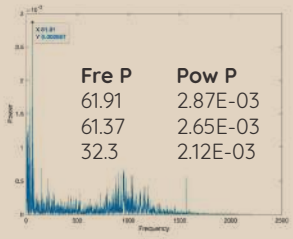
Fre P	Pow P
67.83	6.92E-03
19.92	4.71E-03
66.75	4.24E-03



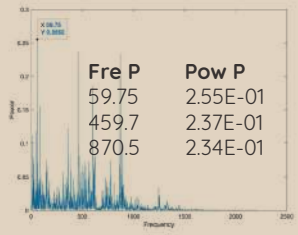
Fre P	Pow P
10.23	3.47E-03
9.152	3.33E-03
20.46	2.90E-03



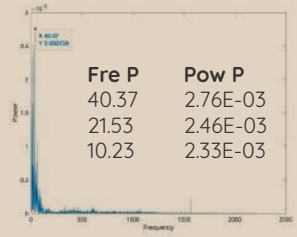
Fre P	Pow P
19.92	1.31E-01
19.38	3.05E-02
18.3	2.84E-02



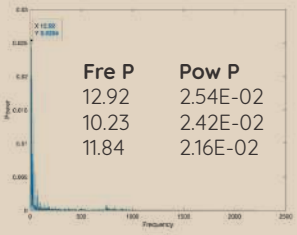
Fre P	Pow P
61.91	2.87E-03
61.37	2.65E-03
32.3	2.12E-03



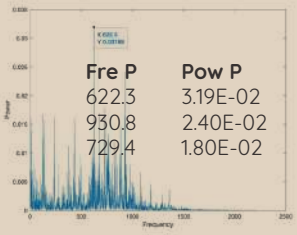
Fre P	Pow P
59.75	2.55E-01
459.7	2.37E-01
870.5	2.34E-01



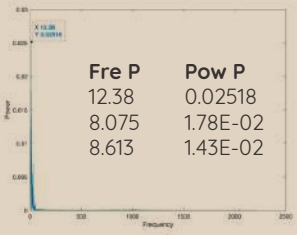
Fre P	Pow P
40.37	2.76E-03
21.53	2.46E-03
10.23	2.33E-03



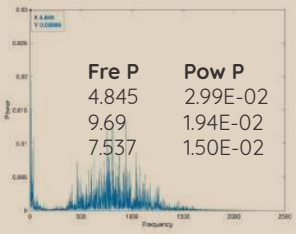
Fre P	Pow P
12.92	2.54E-02
10.23	2.42E-02
11.84	2.16E-02



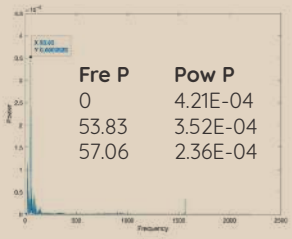
Fre P	Pow P
622.3	3.19E-02
930.8	2.40E-02
729.4	1.80E-02



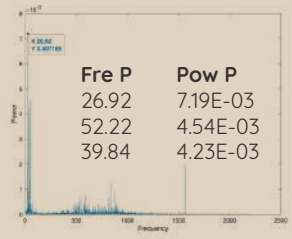
Fre P	Pow P
12.38	0.02518
8.075	1.78E-02
8.613	1.43E-02



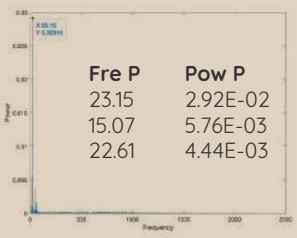
Fre P	Pow P
4.845	2.99E-02
9.69	1.94E-02
7.537	1.50E-02



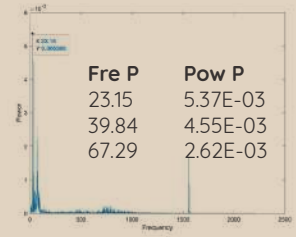
Fre P	Pow P
0	4.21E-04
53.83	3.52E-04
57.06	2.36E-04



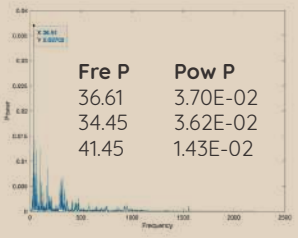
Fre P	Pow P
26.92	7.19E-03
52.22	4.54E-03
39.84	4.23E-03



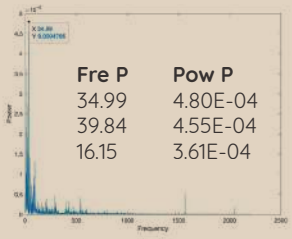
Fre P	Pow P
23.15	2.92E-02
15.07	5.76E-03
22.61	4.44E-03



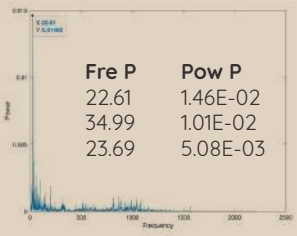
Fre P	Pow P
23.15	5.37E-03
39.84	4.55E-03
67.29	2.62E-03



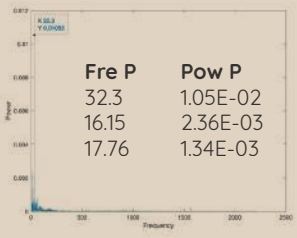
Fre P	Pow P
36.61	3.70E-02
34.45	3.62E-02
41.45	1.43E-02



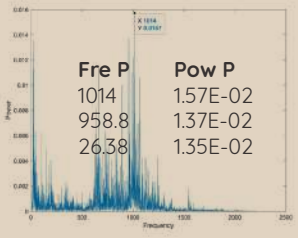
Fre P	Pow P
34.99	4.80E-04
39.84	4.55E-04
16.15	3.61E-04



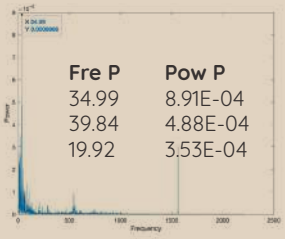
Fre P	Pow P
22.61	1.46E-02
34.99	1.01E-02
23.69	5.08E-03



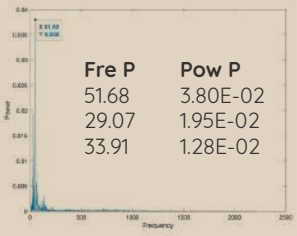
Fre P	Pow P
32.3	1.05E-02
16.15	2.36E-03
17.76	1.34E-03



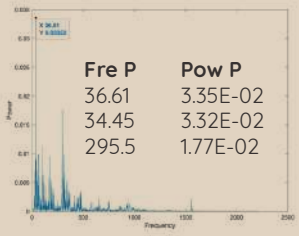
Fre P	Pow P
1014	1.57E-02
958.8	1.37E-02
26.38	1.35E-02



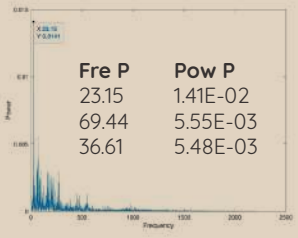
Fre P	Pow P
34.99	8.91E-04
39.84	4.88E-04
19.92	3.53E-04



Fre P	Pow P
51.68	3.80E-02
29.07	1.95E-02
33.91	1.28E-02



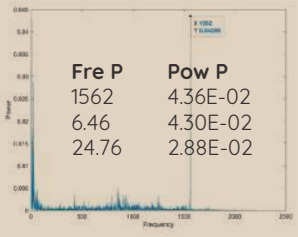
Fre P	Pow P
36.61	3.35E-02
34.45	3.32E-02
295.5	1.77E-02



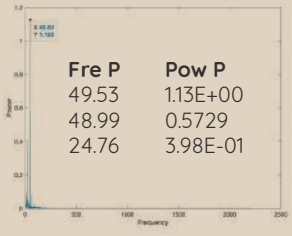
Fre P	Pow P
23.15	1.41E-02
69.44	5.55E-03
36.61	5.48E-03

Sound Analysis: Ventilator

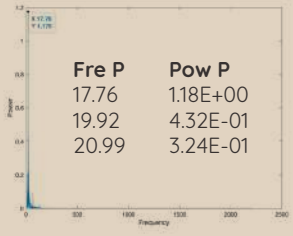
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



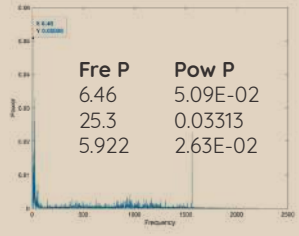
Fre P	Pow P
1562	4.36E-02
6.46	4.30E-02
24.76	2.88E-02



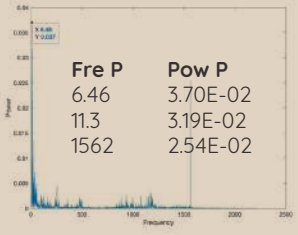
Fre P	Pow P
49.53	1.13E+00
48.99	0.5729
24.76	3.98E-01



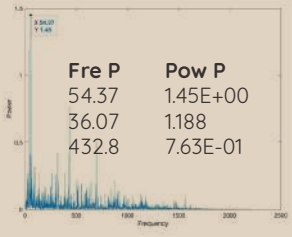
Fre P	Pow P
17.76	1.18E+00
19.92	4.32E-01
20.99	3.24E-01



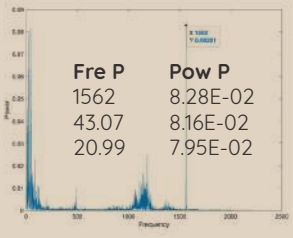
Fre P	Pow P
6.46	5.09E-02
25.3	0.03313
5.922	2.63E-02



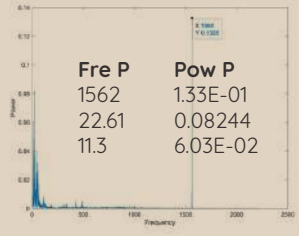
Fre P	Pow P
6.46	3.70E-02
11.3	3.19E-02
1562	2.54E-02



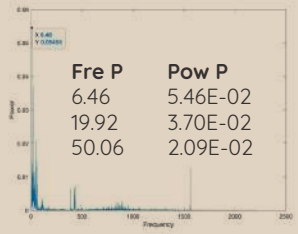
Fre P	Pow P
54.37	1.45E+00
36.07	1.188
432.8	7.63E-01



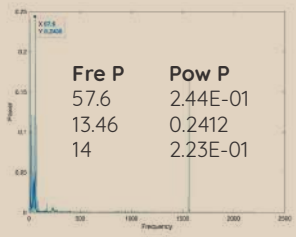
Fre P	Pow P
1562	8.28E-02
43.07	8.16E-02
20.99	7.95E-02



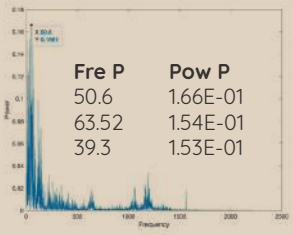
Fre P	Pow P
1562	1.33E-01
22.61	0.08244
11.3	6.03E-02



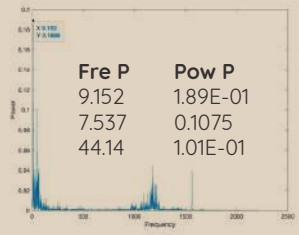
Fre P	Pow P
6.46	5.46E-02
19.92	3.70E-02
50.06	2.09E-02



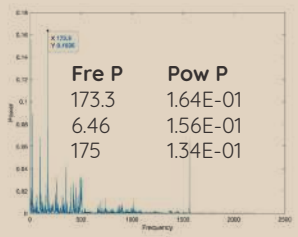
Fre P	Pow P
57.6	2.44E-01
13.46	0.2412
14	2.23E-01



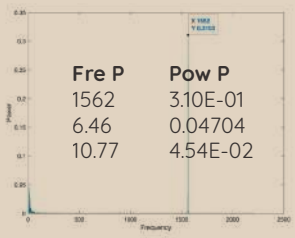
Fre P	Pow P
50.6	1.66E-01
63.52	1.54E-01
39.3	1.53E-01



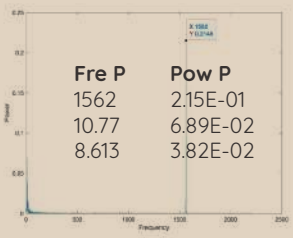
Fre P	Pow P
9.152	1.89E-01
7.537	0.1075
44.14	1.01E-01



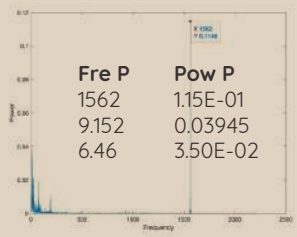
Fre P	Pow P
173.3	1.64E-01
6.46	1.56E-01
175	1.34E-01



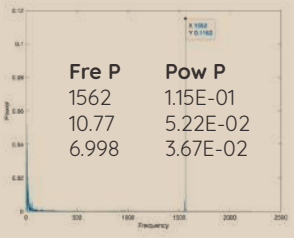
Fre P	Pow P
1562	3.10E-01
6.46	0.04704
10.77	4.54E-02



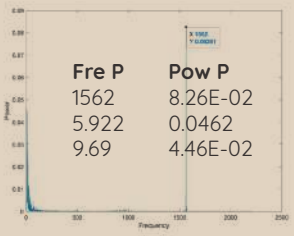
Fre P	Pow P
1562	2.15E-01
10.77	6.89E-02
8.613	3.82E-02



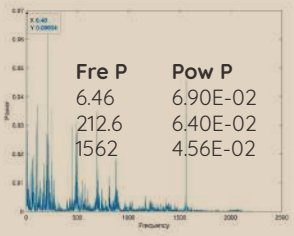
Fre P	Pow P
1562	1.15E-01
9.152	0.03945
6.46	3.50E-02



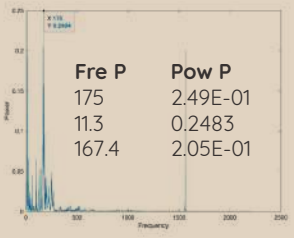
Fre P	Pow P
1562	1.15E-01
10.77	5.22E-02
6.998	3.67E-02



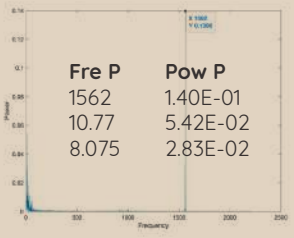
Fre P	Pow P
1562	8.26E-02
5.922	0.0462
9.69	4.46E-02



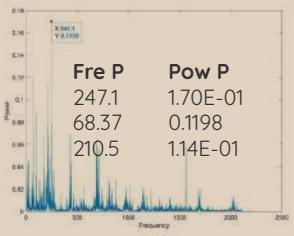
Fre P	Pow P
6.46	6.90E-02
212.6	6.40E-02
1562	4.56E-02



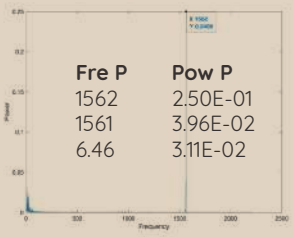
Fre P	Pow P
175	2.49E-01
11.3	0.2483
167.4	2.05E-01



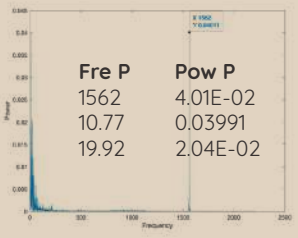
Fre P	Pow P
1562	1.40E-01
10.77	5.42E-02
8.075	2.83E-02



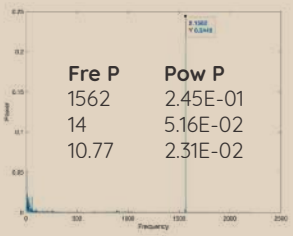
Fre P	Pow P
247.1	1.70E-01
68.37	0.1198
210.5	1.14E-01



Fre P	Pow P
1562	2.50E-01
1561	3.96E-02
6.46	3.11E-02



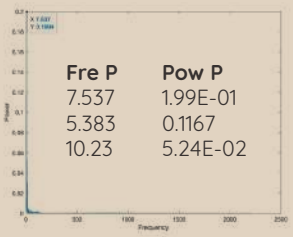
Fre P	Pow P
1562	4.01E-02
10.77	0.03991
19.92	2.04E-02



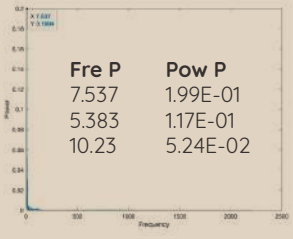
Fre P	Pow P
1562	2.45E-01
14	5.16E-02
10.77	2.31E-02

Sound Analysis: Trolley

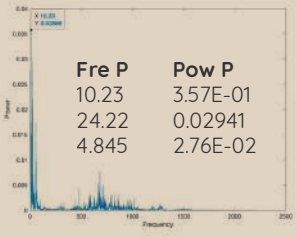
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



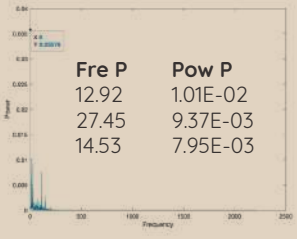
Fre P	Pow P
7.537	1.99E-01
5.383	0.1167
10.23	5.24E-02



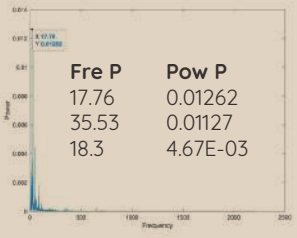
Fre P	Pow P
7.537	1.99E-01
5.383	1.17E-01
10.23	5.24E-02



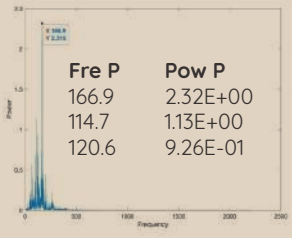
Fre P	Pow P
10.23	3.57E-01
24.22	0.02941
4.845	2.76E-02



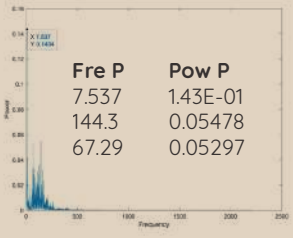
Fre P	Pow P
12.92	1.01E-02
27.45	9.37E-03
14.53	7.95E-03



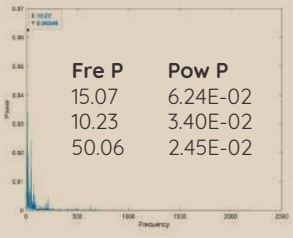
Fre P	Pow P
17.76	0.01262
35.53	0.01127
18.3	4.67E-03



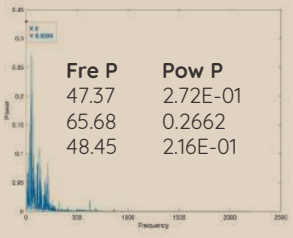
Fre P	Pow P
166.9	2.32E+00
114.7	1.13E+00
120.6	9.26E-01



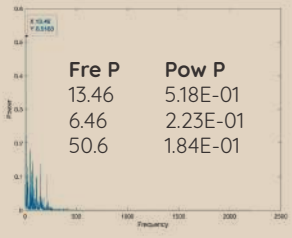
Fre P	Pow P
7.537	1.43E-01
144.3	0.05478
67.29	0.05297



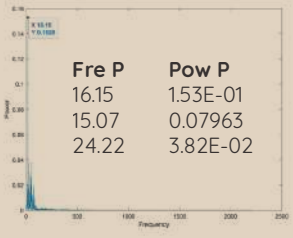
Fre P	Pow P
15.07	6.24E-02
10.23	3.40E-02
50.06	2.45E-02



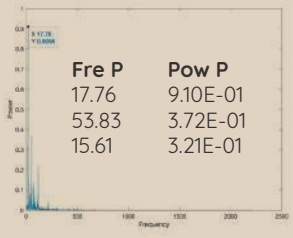
Fre P	Pow P
47.37	2.72E-01
65.68	0.2662
48.45	2.16E-01



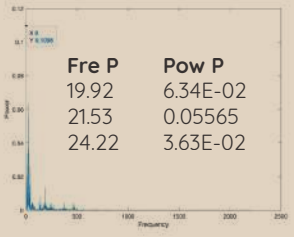
Fre P	Pow P
13.46	5.18E-01
6.46	2.23E-01
50.6	1.84E-01



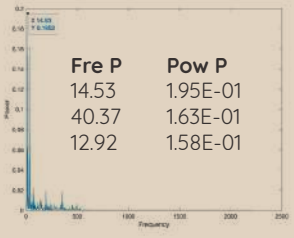
Fre P	Pow P
16.15	1.53E-01
15.07	0.07963
24.22	3.82E-02



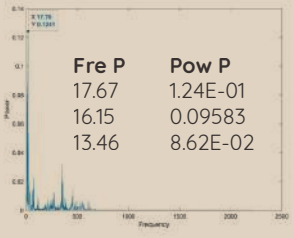
Fre P	Pow P
17.76	9.10E-01
53.83	3.72E-01
15.61	3.21E-01



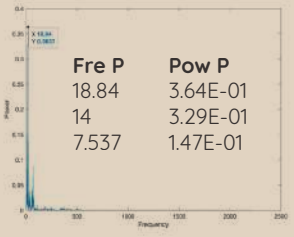
Fre P	Pow P
19.92	6.34E-02
21.53	0.05565
24.22	3.63E-02



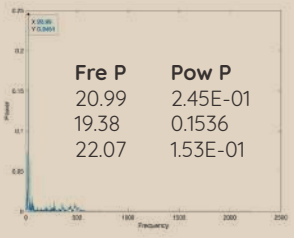
Fre P	Pow P
14.53	1.95E-01
40.37	1.63E-01
12.92	1.58E-01



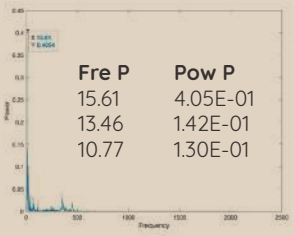
Fre P	Pow P
17.67	1.24E-01
16.15	0.09583
13.46	8.62E-02



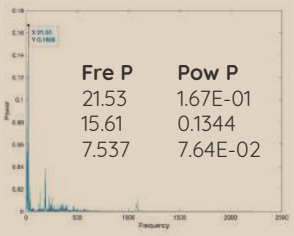
Fre P	Pow P
18.84	3.64E-01
14	3.29E-01
7.537	1.47E-01



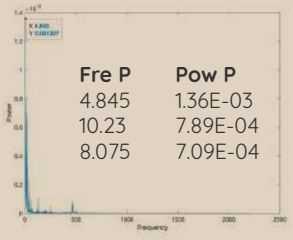
Fre P	Pow P
20.99	2.45E-01
19.38	0.1536
22.07	1.53E-01



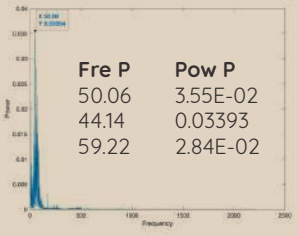
Fre P	Pow P
15.61	4.05E-01
13.46	1.42E-01
10.77	1.30E-01



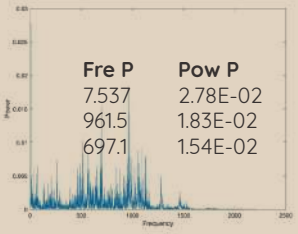
Fre P	Pow P
21.53	1.67E-01
15.61	0.1344
7.537	7.64E-02



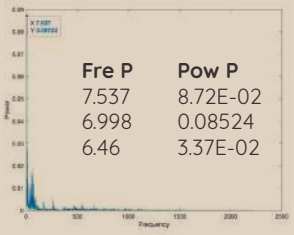
Fre P	Pow P
4.845	1.36E-03
10.23	7.89E-04
8.075	7.09E-04



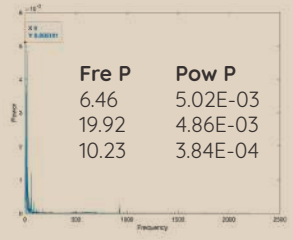
Fre P	Pow P
50.06	3.55E-02
44.14	0.03393
59.22	2.84E-02



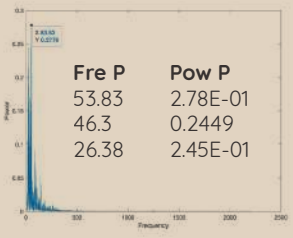
Fre P	Pow P
7.537	2.78E-02
961.5	1.83E-02
697.1	1.54E-02



Fre P	Pow P
7.537	8.72E-02
6.998	0.08524
6.46	3.37E-02



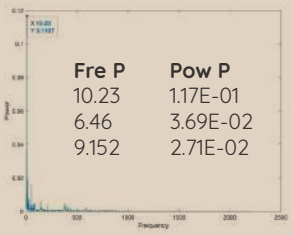
Fre P	Pow P
6.46	5.02E-03
19.92	4.86E-03
10.23	3.84E-04



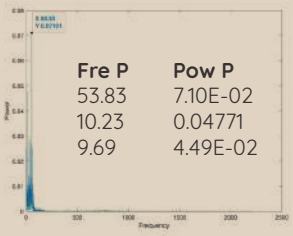
Fre P	Pow P
53.83	2.78E-01
46.3	0.2449
26.38	2.45E-01

Sound Analysis: Door slam

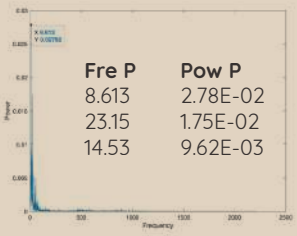
Matlab FFT(Fast Fourier Transform) Analysis with 25 samples



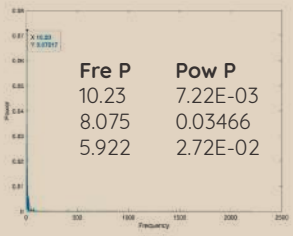
Fre P	Pow P
10.23	1.17E-01
6.46	3.69E-02
9.152	2.71E-02



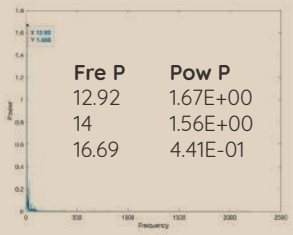
Fre P	Pow P
53.83	7.10E-02
10.23	0.04771
9.69	4.49E-02



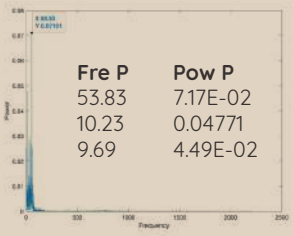
Fre P	Pow P
8.613	2.78E-02
23.15	1.75E-02
14.53	9.62E-03



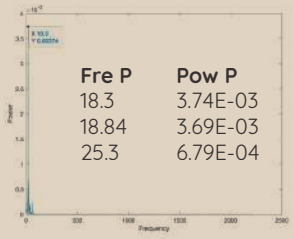
Fre P	Pow P
10.23	7.22E-03
8.075	0.03466
5.922	2.72E-02



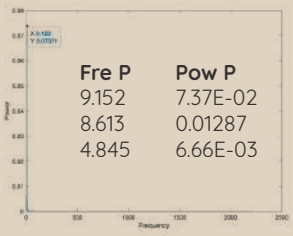
Fre P	Pow P
12.92	1.67E+00
14	1.56E+00
16.69	4.41E-01



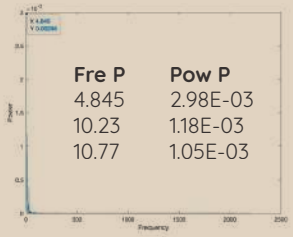
Fre P	Pow P
53.83	7.17E-02
10.23	0.04771
9.69	4.49E-02



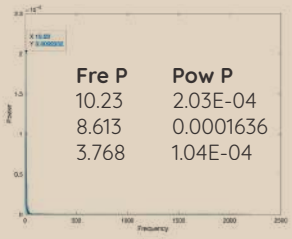
Fre P	Pow P
18.3	3.74E-03
18.84	3.69E-03
25.3	6.79E-04



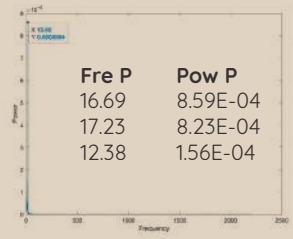
Fre P	Pow P
9.152	7.37E-02
8.613	0.01287
4.845	6.66E-03



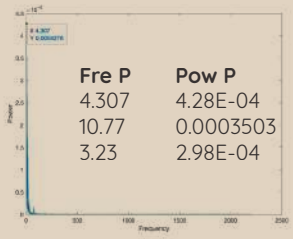
Fre P	Pow P
4.845	2.98E-03
10.23	1.18E-03
10.77	1.05E-03



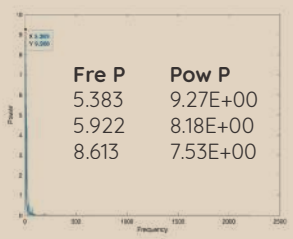
Fre P	Pow P
10.23	2.03E-04
8.613	0.0001636
3.768	1.04E-04



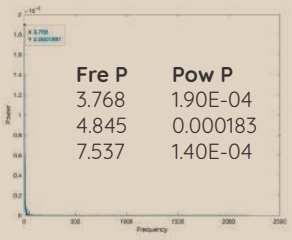
Fre P	Pow P
16.69	8.59E-04
17.23	8.23E-04
12.38	1.56E-04



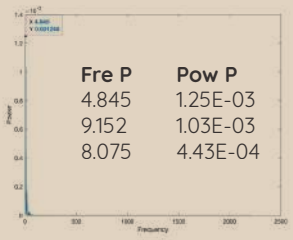
Fre P	Pow P
4.307	4.28E-04
10.77	0.0003503
3.23	2.98E-04



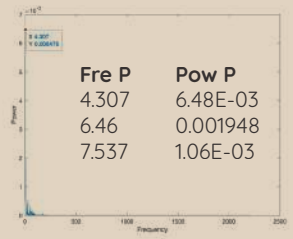
Fre P	Pow P
5.383	9.27E+00
5.922	8.18E+00
8.613	7.53E+00



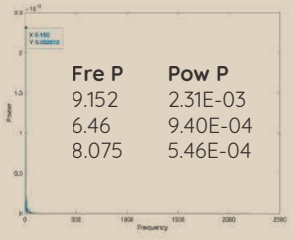
Fre P	Pow P
3.768	1.90E-04
4.845	0.000183
7.537	1.40E-04



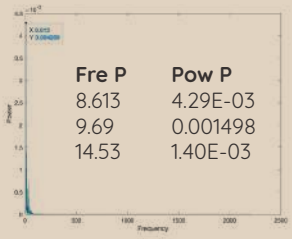
Fre P	Pow P
4.845	1.25E-03
9.152	1.03E-03
8.075	4.43E-04



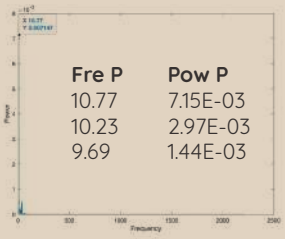
Fre P	Pow P
4.307	6.48E-03
6.46	0.001948
7.537	1.06E-03



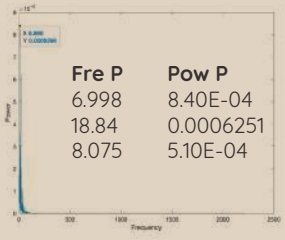
Fre P	Pow P
9.152	2.31E-03
6.46	9.40E-04
8.075	5.46E-04



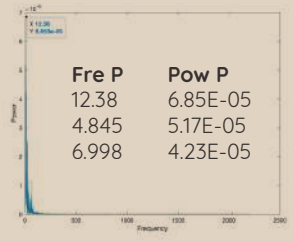
Fre P	Pow P
8.613	4.29E-03
9.69	0.001498
14.53	1.40E-03



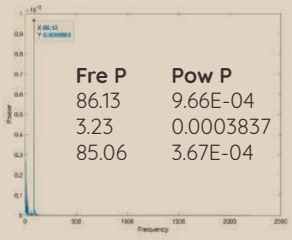
Fre P	Pow P
10.77	7.15E-03
10.23	2.97E-03
9.69	1.44E-03



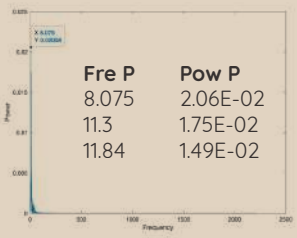
Fre P	Pow P
6.998	8.40E-04
18.84	0.0006251
8.075	5.10E-04



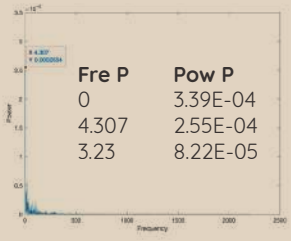
Fre P	Pow P
12.38	6.85E-05
4.845	5.17E-05
6.998	4.23E-05



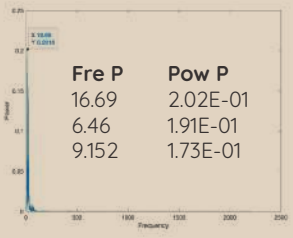
Fre P	Pow P
86.13	9.66E-04
3.23	0.0003837
85.06	3.67E-04



Fre P	Pow P
8.075	2.06E-02
11.3	1.75E-02
11.84	1.49E-02

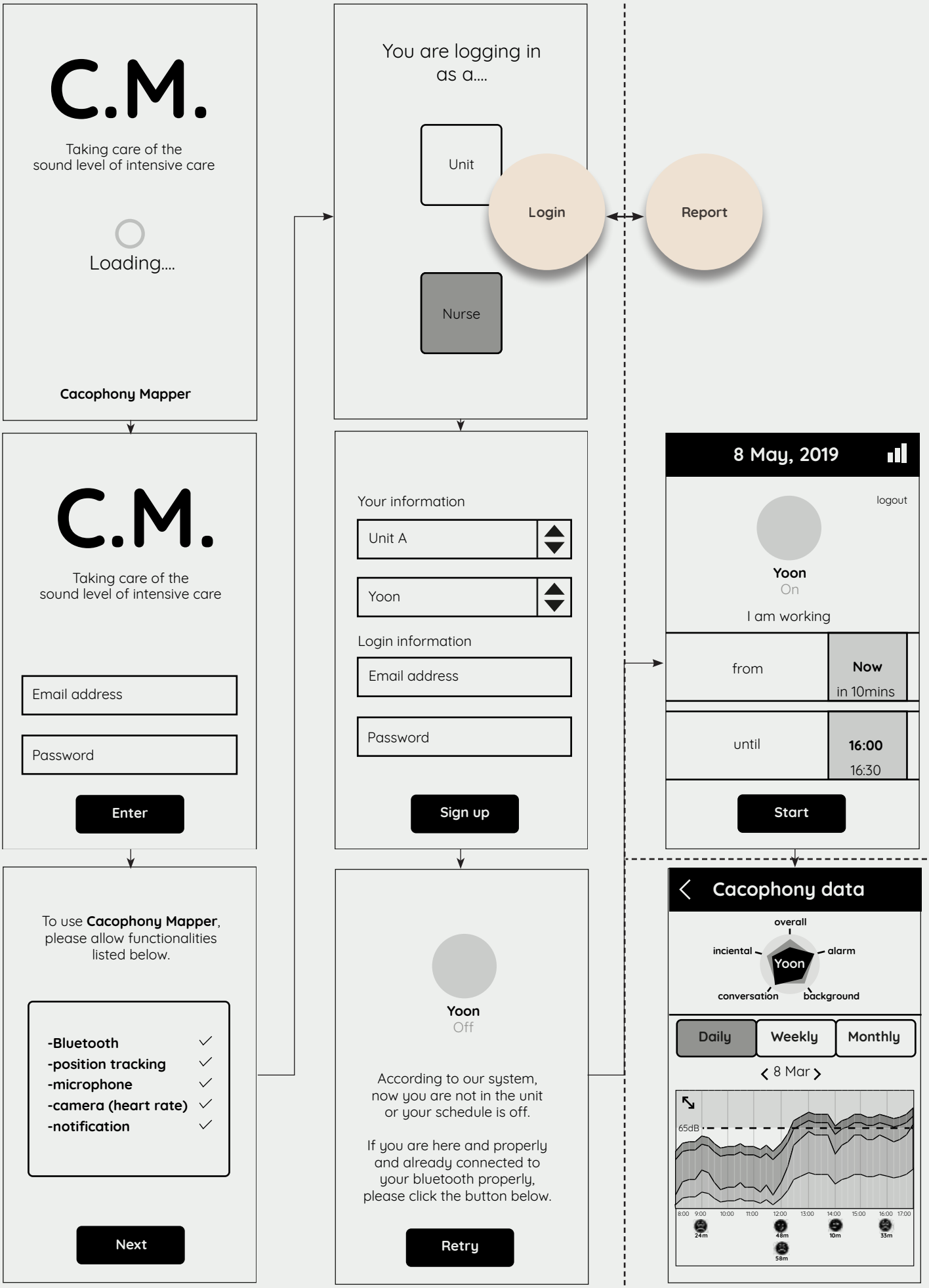


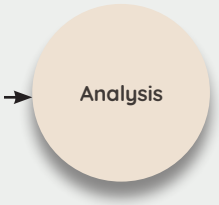
Fre P	Pow P
0	3.39E-04
4.307	2.55E-04
3.23	8.22E-05



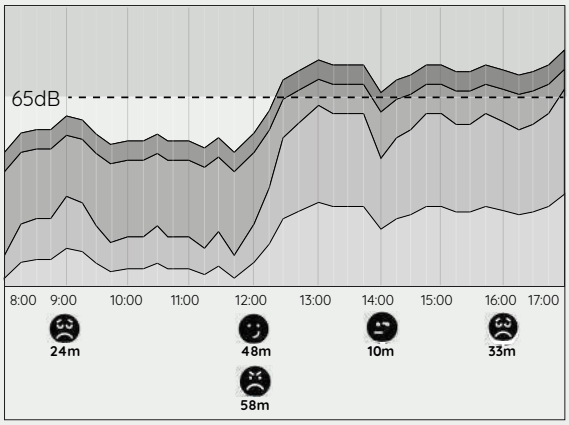
Fre P	Pow P
16.69	2.02E-01
6.46	1.91E-01
9.152	1.73E-01

Application structure: nurse mode

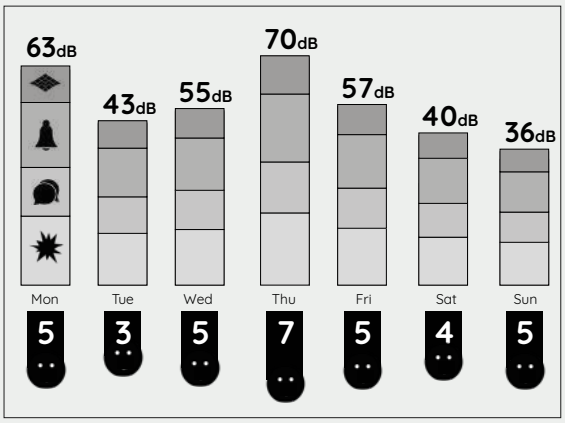




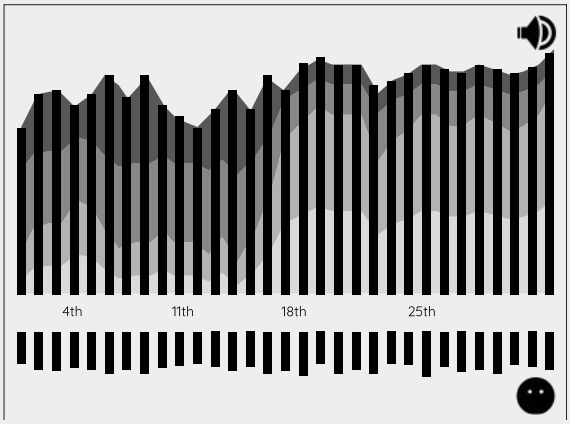
Daily

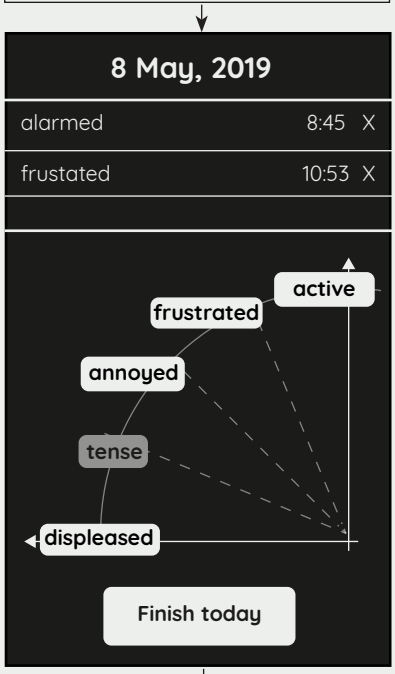


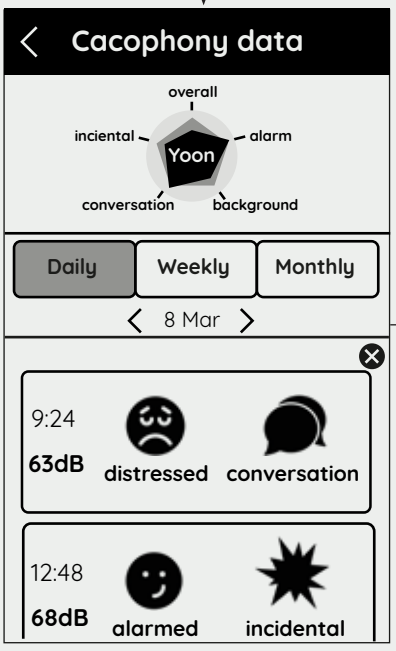
Weekly

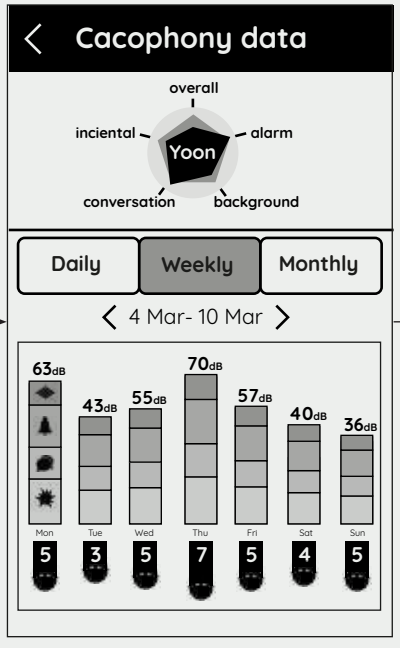


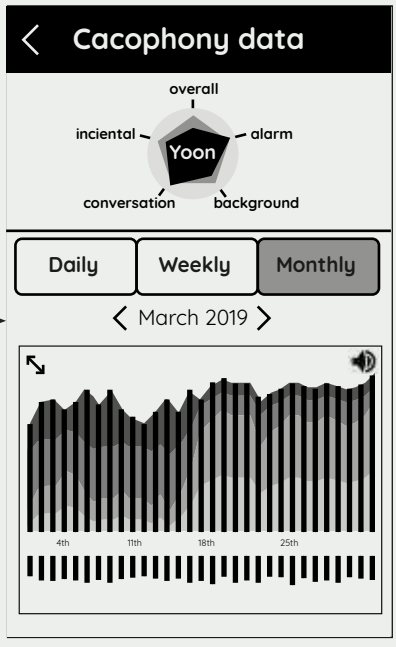
Monthly



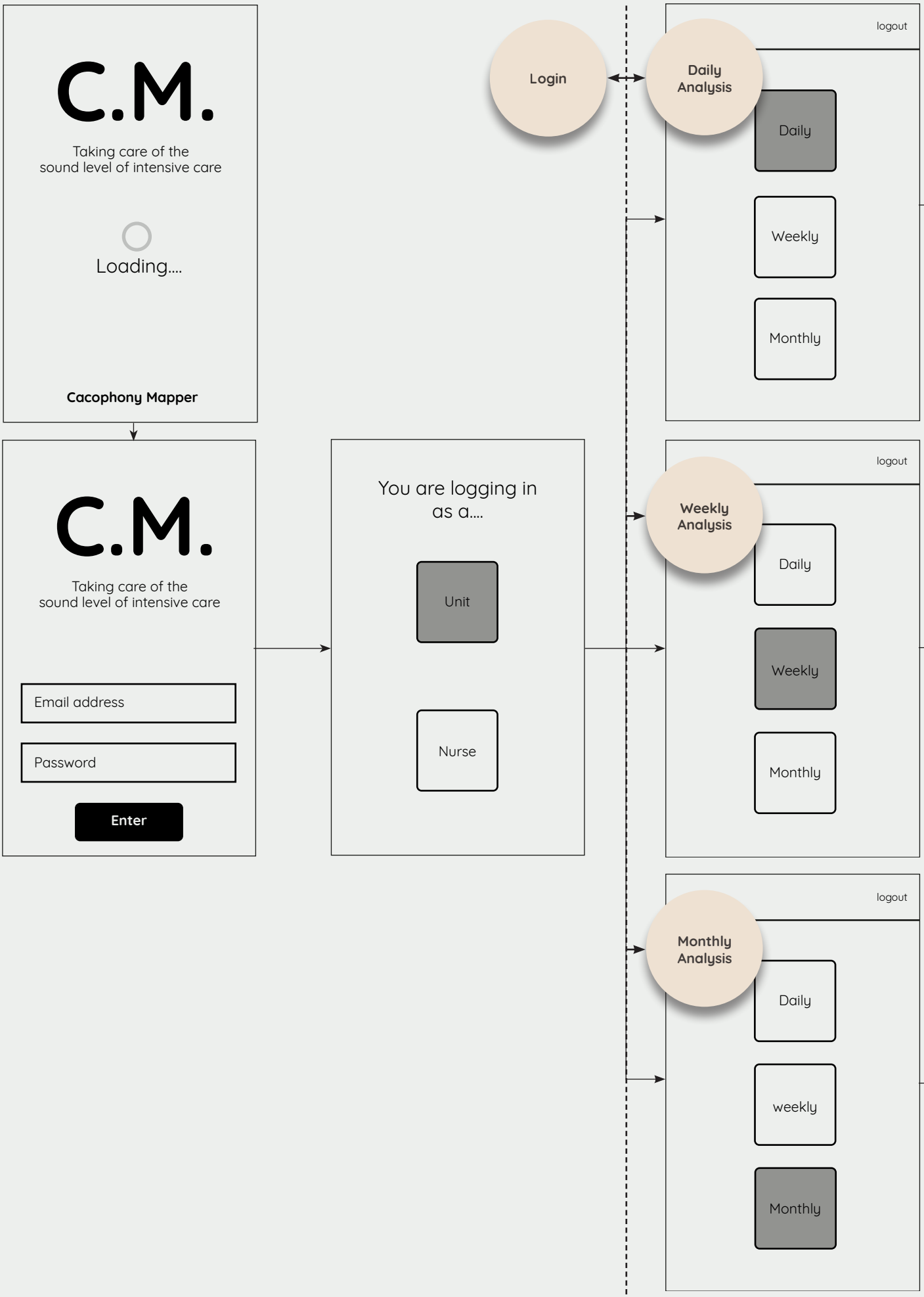


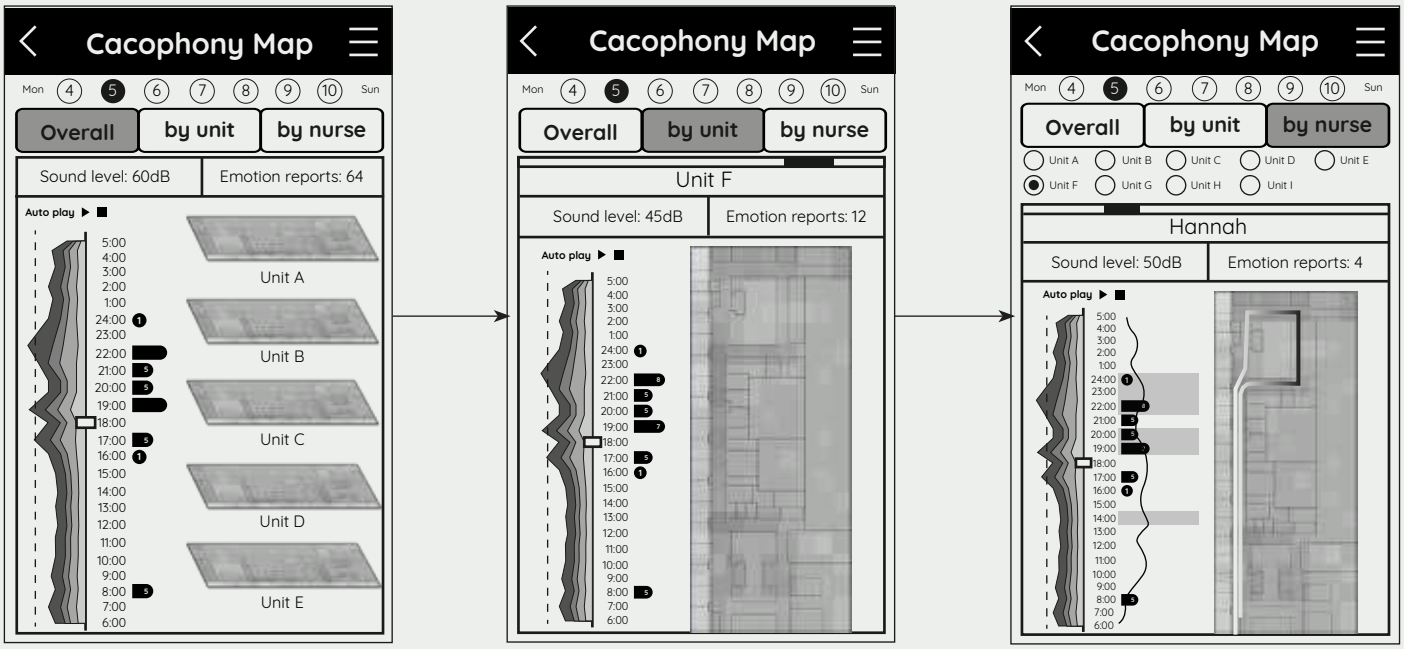


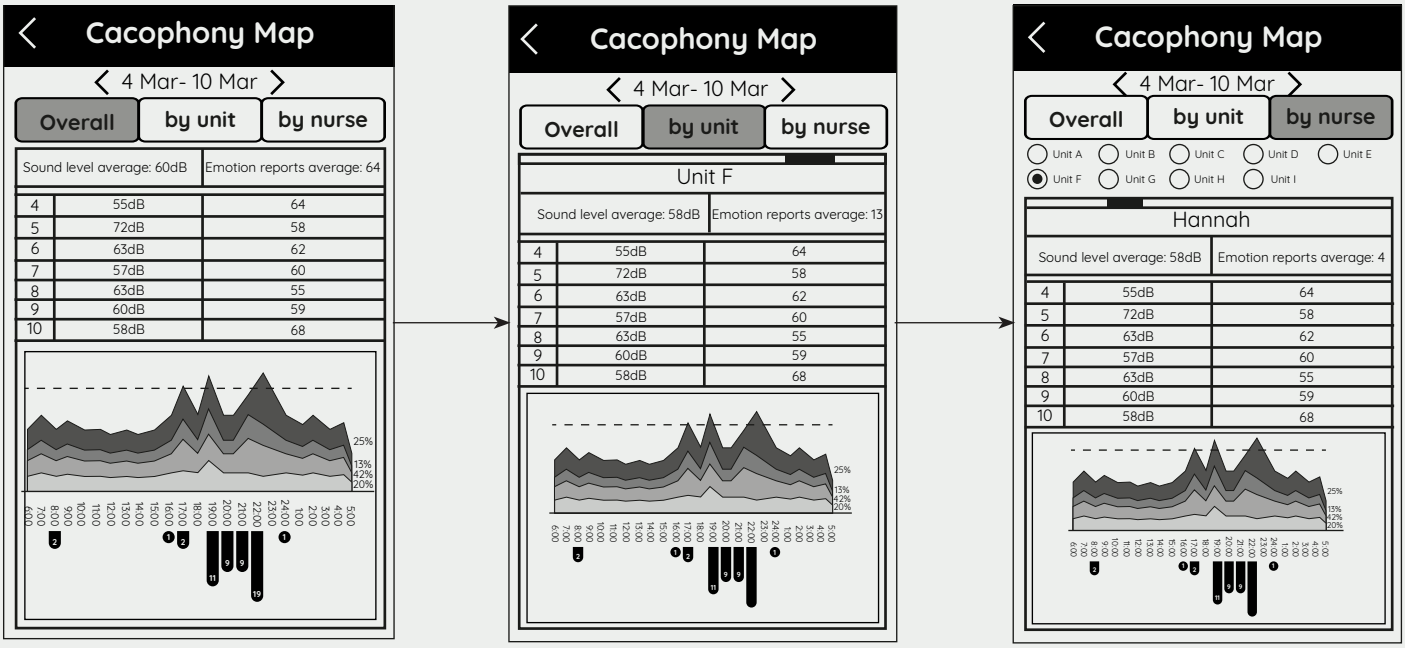


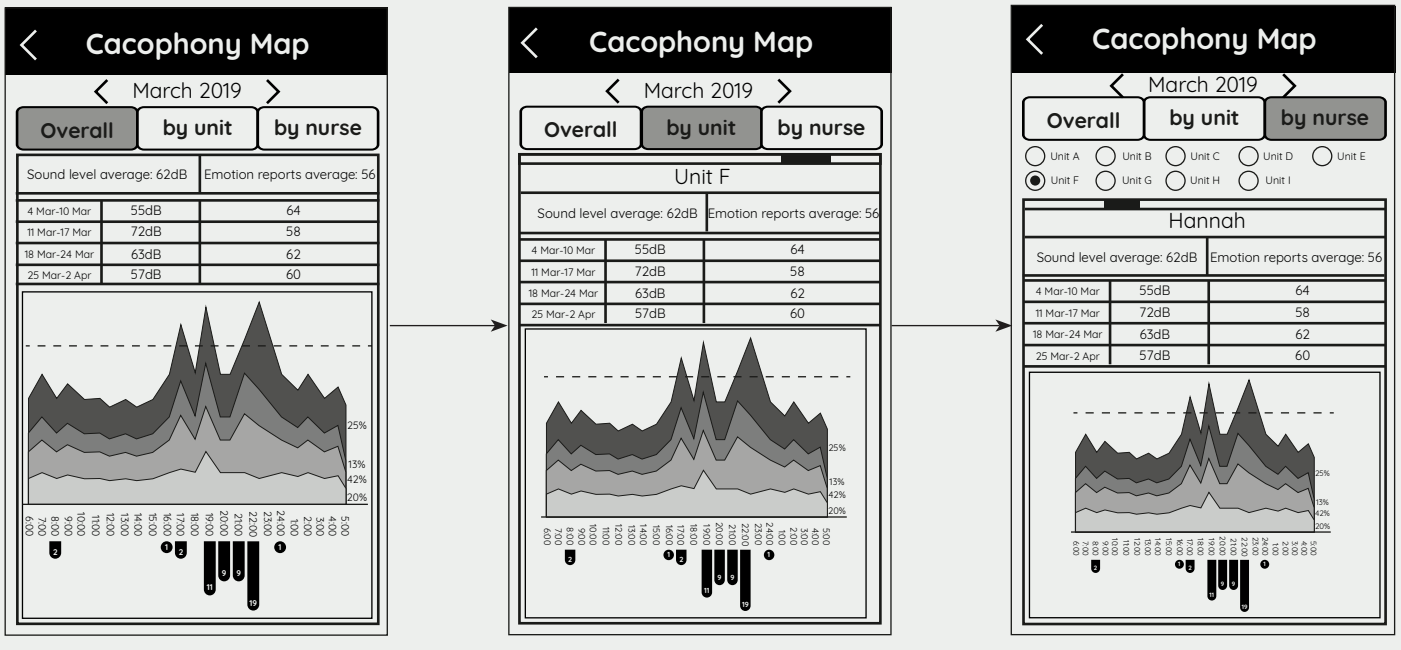


Application structure: researcher mode



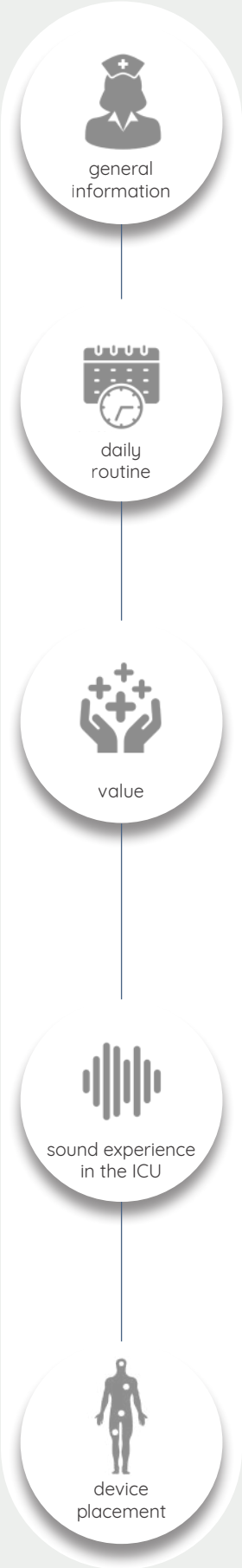

Cacophony Map
Mon 4 5 6 7 8 9 10 Sun
Overall
by unit
by nurse
Sound level: 60dB
Emotion reports: 64
Auto play
Unit A
Unit B
Unit C
Unit D
Unit E
Unit F
Sound level: 45dB
Emotion reports: 12
Unit A Unit B Unit C Unit D Unit E
Unit F Unit G Unit H Unit I
Hannah
Sound level: 50dB
Emotion reports: 4


Cacophony Map
4 Mar- 10 Mar
Overall
by unit
by nurse
Sound level average: 60dB
Emotion reports average: 64
4 55dB 64
5 72dB 58
6 63dB 62
7 57dB 60
8 63dB 55
9 60dB 59
10 58dB 68
Unit F
Sound level average: 58dB
Emotion reports average: 13
Unit A Unit B Unit C Unit D Unit E
Unit F Unit G Unit H Unit I
Hannah
Sound level average: 58dB
Emotion reports average: 4


Cacophony Map
March 2019
Overall
by unit
by nurse
Sound level average: 62dB
Emotion reports average: 56
4 Mar-10 Mar 55dB 64
11 Mar-17 Mar 72dB 58
18 Mar-24 Mar 63dB 62
25 Mar-2 Apr 57dB 60
Unit F
Sound level average: 62dB
Emotion reports average: 56
Unit A Unit B Unit C Unit D Unit E
Unit F Unit G Unit H Unit I
Hannah
Sound level average: 62dB
Emotion reports average: 56

Appendix 4

Questionaire for an interview with a nurse



General Information

1. name?
2. age?
3. work place?
4. working experience?

Daily Routine

1. What time do you start and finish at work? How long do you work a day? How many days do you work a week?
2. What kind of work do you do to take care of your patients?
3. Are you usually busy while you perform your job?
4. Is it stressful to perform your job? What is the main source of your stress?
5. Do you take some break while you are working?

Value

1. How do you feel about working as a nurse in the ICU? How would you define your passion as a nurse?
2. How do you feel about your medical team?
3. How do you feel about your patients?
4. How do you feel about your patient's family?
5. Are you interested in improving a hospital system? Is there any im provements going on?

Sound experience in the ICU

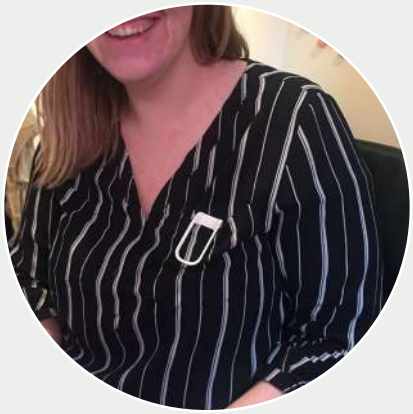
1. How do you feel about the noise level of operating sound of machines in general?
2. How do you feel about the noise level of alarms from machines?
3. How do you feel about the noise level of general conversation in the ICU? (Clinicians, visitors...)
4. How do you feel about the noise level of incidental sounds in the ICU? (footsteps, door slam, objects clashing, trolley...)
5. Are you aware of the term "Sound fatigue" or " Noise fatigue"? After listening to the definition and the symptom of the sound, can you come up with similar experiences of your own?

Device placement

1. Are you willing to try new gadgets to improve the sound environment in the ICU?
2. Is there any area that you cannot use your digital gadgets specifically?

Personal Information

Maeijke van dee Tol (23)
Aleijne ziekenhuis Leidendorp
Working experience of 3 years



Hospital Routine

day shift: 7:00-15:30
evening shift: 14:45-23:15
night shift: 22:45-7:15

Day shift starts from 7:00 to 15:30, evening shift starts from 14:45 to 23:15, and night shift starts from 22:45 to 7:15. There are overlapping hours between slots, and nurses usually hand over the patient 's medical records and important notes.

Day shift involves a lot of physical labor than other shifts since nurses need to wash patients and tide them up. Time preference really depends on people since one only goes for the night shifts while someone prefers day shift.

Value

Becoming a nurse used to be my childhood dream. I like to have challenges in my work feel achivements by them.

I love good interactions my patiens and visitors. Some can be annoying but generally, they are nice good people.

Society in the hospital can be highly hierarchical because there are different classes of nurses and doctors.

Sound experience in the ICU

Becoming a nurse used to be my childhood dream. I like to have challenges in my work feel achivements by them. I would like to change the hospital culture positively if there is a chance

Important notes for Cacophony Mapper

"shift changes by 15 minues in day/evening/night hours, so keep that in mind when you design a function with time."

"Nurses are not allowed to wear something on their arms because of possible infection. Keeping something in chest pocket is totally fine."

"Changes can be slow in the hospital because no one wants to put an additional burden on their shoulders. However, if they are used to the new system, then they will follow through the new rules and what you need to is to find the way to make nurses get used to the system by making it simple and nice."

"Some people might prefer to wear the sound collection part on inside the pocket because they want to look tidy. I think you should as people's preference and apply it to your final design."

Programming: Java for Android

Complex 1D

```
package nl.dut.ide.software.soundfilterrealgit;
/**
 * Construct a 1-D complex data sequence.
*/
public class Complex1D
{
/**
 * <em>x</em>[<em>i</em>] is the real part of <em>i</em>-th complex data.
*/
 public double x[];
/**
 * <em>y</em>[<em>i</em>] is the imaginary part of <em>i</em>-th complex data.
*/
   public double y[];
}
```

Complex Double FFT

```
package nl.dut.ide.software.soundfilterrealgit;
/**
 * FFT transform of a complex periodic sequence.
 * @author Baoshe Zhang
 * @author Astronomical Instrument Group of University of Lethbridge.
*/
public class ComplexDoubleFFT extends ComplexDoubleFFT_Mixed
{
/**
 * <em>norm_factor</em> can be used to normalize this FFT transform. This is because
 * a call of forward transform (<em>ft</em>) followed by a call of backward transform
 * (<em>bt</em>) will multiply the input sequence by <em>norm_factor</em>.
*/
    public double norm_factor;
    private double wavetable[];
    private int ndim;

/**
 * Construct a wavenumber table with size <em>n</em> for Complex FFT.
 * The sequences with the same size can share a wavenumber table. The prime
 * factorization of <em>n</em> together with a tabulation of the trigonometric functions
 * are computed and stored.
 *
 * @param  n  the size of a complex data sequence. When <em>n</em> is a multiplication of small
 * numbers (4, 2, 3, 5), this FFT transform is very efficient.
*/
    public ComplexDoubleFFT(int n)
    {
        ndim = n;
        norm_factor = n;
        if(wavetable == null || wavetable.length !=(4*ndim+15))
        {
          wavetable = new double[4*ndim + 15];
        }
        cffti(ndim, wavetable);
    }

/**
 * Forward complex FFT transform.
 *
 * @param x  2*<em>n</em> real double data representing <em>n</em> complex double data.
 * As an input parameter, <em>x</em> is an array of 2*<em>n</em> real
 * data representing <em>n</em> complex data. As an output parameter, <em>x</em> represents <em>n</em>
 * FFT'd complex data. Their relation as follows:
 * <br>
 *  x[2*i] is the real part of <em>i</em>-th complex data;
 * <br>
 *  x[2*i+1] is the imaginary part of <em>i</em>-the complex data.
 *
*/
    public void ft(double x[])
    {
       if(x.length != 2*ndim)
           throw new IllegalArgumentException("The length of data can not match that of the wavetable");
       cfftf(ndim, x, wavetable);
    }

/**
 * Forward complex FFT transform.
 *
 * @param x  an array of <em>n</em> Complex data
*/
    public void ft(Complex1D x)
    {
       if(x.x.length != ndim)
           throw new IllegalArgumentException("The length of data can not match that of the wavetable");
       double[] y = new double[2*ndim];
       for(int i=0; i<ndim; i++)
       {
           y[2*i] = x.x[i];
           y[2*i+1] = x.y[i];
       }
       cfftf(ndim, y, wavetable);
       for(int i=0; i<ndim; i++)
       {
           x.x[i]=y[2*i];
           x.y[i]=y[2*i+1];
       }
    }

/**
 * Backward complex FFT transform. It is the unnormalized inverse transform of <em>ft</em>(double[]).
 *
 * @param x  2*<em>n</em> real double data representing <em>n</em> complex double data.
 *
 * As an input parameter, <em>x</em> is an array of 2*<em>n</em>
 * real data representing <em>n</em> complex data. As an output parameter, <em>x</em> represents
 * <em>n</em> FFT'd complex data. Their relation as follows:
 * <br>
 *  x[2*<em>i</em>] is the real part of <em>i</em>-th complex data;
 * <br>
 *  x[2*<em>i</em>+1] is the imaginary part of <em>i</em>-the complex data.
 *
*/
    public void bt(double x[])
    {
       if(x.length != 2*ndim)
           throw new IllegalArgumentException("The length of data can not match that of the wavetable");
```

```
        cfftb(ndim, x, wavetable);
    }
/**
 * Backward complex FFT transform. It is the unnormalized inverse transform of <em>ft</em>(Complex1D[]).
 *
 *
 * @param x  an array of <em>n</em> Complex data
*/
    public void bt(Complex1D x)
    {
        if(x.x.length != ndim)
            throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        double[] y = new double[2*ndim];
        for(int i=0; i<ndim; i++)
        {
            y[2*i] = x.x[i];
            y[2*i+1] = x.y[i];
        }
        cfftb(ndim, y, wavetable);
        for(int i=0; i<ndim; i++)
        {
            x.x[i]=y[2*i];
            x.y[i]=y[2*i+1];
        }
    }
}
```

```
package nl.dut.ide.software.soundfilterrealgit;
/**
 * @author Baoshe Zhang
 * @author Astronomical Instrument Group of University of Lethbridge.
*/
class ComplexDoubleFFT_Mixed
{
/*--------------------------------------------------------------------
  passf2: Complex FFT's forward/backward processing of factor 2;
  isign is +1 for backward and -1 for forward transforms
 --------------------------------------------------------------------*/
    void passf2(int ido, int l1, final double cc[], double ch[], final double wtable[], int offset, int isign)
            /*isign==+1 for backward transform*/
    {
        int     i, k, ah, ac;
        double  ti2, tr2;
        int iw1;

        iw1 = offset;
        if(ido<=2)
        {
                for(k=0; k<l1; k++)
                {
                    ah=k*ido;
                    ac=2*k*ido;
                    ch[ah]=cc[ac]+cc[ac+ido];
                    ch[ah+ido*l1]=cc[ac]-cc[ac+ido];
                    ch[ah+1]=cc[ac+1]+cc[ac+ido+1];
                    ch[ah+ido*l1+1]=cc[ac+1]-cc[ac+ido+1];
                }
        }
        else
        {
                for(k=0; k<l1; k++)
                {
                    for(i=0; i<ido-1; i+=2)
                    {
                            ah=i+k*ido;
                            ac=i+2*k*ido;
                            ch[ah]=cc[ac]+cc[ac+ido];
                            tr2=cc[ac]-cc[ac+ido];
                            ch[ah+1]=cc[ac+1]+cc[ac+1+ido];
                            ti2=cc[ac+1]-cc[ac+1+ido];
                            ch[ah+l1*ido+1]=wtable[i+iw1]*ti2+isign*wtable[i+1+iw1]*tr2;
                            ch[ah+l1*ido]=wtable[i+iw1]*tr2-isign*wtable[i+1+iw1]*ti2;
                    }
                }
        }
    }
/*--------------------------------------------------------------------
  passf3: Complex FFT's forward/backward processing of factor 3;
  isign is +1 for backward and -1 for forward transforms
 --------------------------------------------------------------------*/
    void passf3(int ido, int l1, final double cc[], double ch[], final double wtable[], int offset, int isign)
    {
        final double taur=-0.5;
        final double taui=0.866025403784439;
        int     i, k, ac, ah;
        double  ci2, ci3, di2, di3, cr2, cr3, dr2, dr3, ti2, tr2;
        int iw1, iw2;

        iw1 = offset;
        iw2 = iw1 + ido;

        if(ido==2)
        {
                for(k=1; k<=l1; k++)
                {
                    ac=(3*k-2)*ido;
                    tr2=cc[ac]+cc[ac+ido];
                    cr2=cc[ac-ido]+taur*tr2;
                    ah=(k-1)*ido;
                    ch[ah]=cc[ac-ido]+tr2;

                    ti2=cc[ac+1]+cc[ac+ido+1];
                    ci2=cc[ac-ido+1]+taur*ti2;
                    ch[ah+1]=cc[ac-ido+1]+ti2;

                    cr3=isign*taui*(cc[ac]-cc[ac+ido]);
                    ci3=isign*taui*(cc[ac+1]-cc[ac+ido+1]);
                    ch[ah+l1*ido]=cr2-ci3;
                    ch[ah+2*l1*ido]=cr2+ci3;
                    ch[ah+l1*ido+1]=ci2+cr3;
                    ch[ah+2*l1*ido+1]=ci2-cr3;
                }
        }
        else
        {
                for(k=1; k<=l1; k++)
                {
                    for(i=0; i<ido-1; i+=2)
                    {
```

Complex Double FFT _Mixed

```
                                ac=i+(3*k-2)*ido;
                                tr2=cc[ac]+cc[ac+ido];
                                cr2=cc[ac-ido]+taur*tr2;
                                ah=i+(k-1)*ido;
                                ch[ah]=cc[ac-ido]+tr2;
                                ti2=cc[ac+1]+cc[ac+ido+1];
                                ci2=cc[ac-ido+1]+taur*ti2;
                                ch[ah+1]=cc[ac-ido+1]+ti2;
                                cr3=isign*taui*(cc[ac]-cc[ac+ido]);
                                ci3=isign*taui*(cc[ac+1]-cc[ac+ido+1]);
                                dr2=cr2-ci3;
                                dr3=cr2+ci3;
                                di2=ci2+cr3;
                                di3=ci2-cr3;
                                ch[ah+l1*ido+1]=wtable[i+iw1]*di2+isign*wtable[i+1+iw1]*dr2;
                                ch[ah+l1*ido]=wtable[i+iw1]*dr2-isign*wtable[i+1+iw1]*di2;
                                ch[ah+2*l1*ido+1]=wtable[i+iw2]*di3+isign*wtable[i+1+iw2]*dr3;
                                ch[ah+2*l1*ido]=wtable[i+iw2]*dr3-isign*wtable[i+1+iw2]*di3;
                        }
                }
        }
    }
/*---------------------------------------------------------------------
  passf4: Complex FFT's forward/backward processing of factor 4;
  isign is +1 for backward and -1 for forward transforms
 ---------------------------------------------------------------------*/
    void passf4(int ido, int l1, final double cc[], double ch[], final double wtable[], int offset, int isign)
    {
        int i, k, ac, ah;
        double  ci2, ci3, ci4, cr2, cr3, cr4, ti1, ti2, ti3, ti4, tr1, tr2, tr3, tr4;
        int iw1, iw2, iw3;
        iw1 = offset;
        iw2 = iw1 + ido;
        iw3 = iw2 + ido;

        if(ido==2)
        {
                for(k=0; k<l1; k++)
                {
                    ac=4*k*ido+1;
                    ti1=cc[ac]-cc[ac+2*ido];
                    ti2=cc[ac]+cc[ac+2*ido];
                            tr4=cc[ac+3*ido]-cc[ac+ido];
                            ti3=cc[ac+ido]+cc[ac+3*ido];
                            tr1=cc[ac-1]-cc[ac+2*ido-1];
                    tr2=cc[ac-1]+cc[ac+2*ido-1];
                            ti4=cc[ac+ido-1]-cc[ac+3*ido-1];
                    tr3=cc[ac+ido-1]+cc[ac+3*ido-1];
                            ah=k*ido;
                            ch[ah]=tr2+tr3;
                            ch[ah+2*l1*ido]=tr2-tr3;
                            ch[ah+1]=ti2+ti3;
                            ch[ah+2*l1*ido+1]=ti2-ti3;
                            ch[ah+l1*ido]=tr1+isign*tr4;
                            ch[ah+3*l1*ido]=tr1-isign*tr4;
                            ch[ah+l1*ido+1]=ti1+isign*ti4;
                            ch[ah+3*l1*ido+1]=ti1-isign*ti4;
                }
        }
        else
        {
                for(k=0; k<l1; k++)
                    {
                        for(i=0; i<ido-1; i+=2)
                        {
                                ac=i+1+4*k*ido;
                                ti1=cc[ac]-cc[ac+2*ido];
                                ti2=cc[ac]+cc[ac+2*ido];
                                ti3=cc[ac+ido]+cc[ac+3*ido];
                                tr4=cc[ac+3*ido]-cc[ac+ido];
                                tr1=cc[ac-1]-cc[ac+2*ido-1];
                                tr2=cc[ac-1]+cc[ac+2*ido-1];
                                ti4=cc[ac+ido-1]-cc[ac+3*ido-1];
                                tr3=cc[ac+ido-1]+cc[ac+3*ido-1];
                                ah=i+k*ido;
                                ch[ah]=tr2+tr3;
                                cr3=tr2-tr3;
                                ch[ah+1]=ti2+ti3;
                                ci3=ti2-ti3;
                                cr2=tr1+isign*tr4;
                                cr4=tr1-isign*tr4;
                                ci2=ti1+isign*ti4;
                                ci4=ti1-isign*ti4;
                                ch[ah+l1*ido]=wtable[i+iw1]*cr2-isign*wtable[i+1+iw1]*ci2;
                                ch[ah+l1*ido+1]=wtable[i+iw1]*ci2+isign*wtable[i+1+iw1]*cr2;
                                ch[ah+2*l1*ido]=wtable[i+iw2]*cr3-isign*wtable[i+1+iw2]*ci3;
                                ch[ah+2*l1*ido+1]=wtable[i+iw2]*ci3+isign*wtable[i+1+iw2]*cr3;
                                ch[ah+3*l1*ido]=wtable[i+iw3]*cr4-isign*wtable[i+1+iw3]*ci4;
                                ch[ah+3*l1*ido+1]=wtable[i+iw3]*ci4+isign*wtable[i+1+iw3]*cr4;
                        }
                    }
            }
    }
/*---------------------------------------------------------------------
  passf5: Complex FFT's forward/backward processing of factor 5;
  isign is +1 for backward and -1 for forward transforms
 ---------------------------------------------------------------------*/
    void passf5(int ido, int l1, final double cc[], double ch[], final double wtable[], int offset, int isign)
            /*isign==-1 for forward transform and+1 for backward transform*/
    {
            final double tr11=0.309016994374947;
            final double ti11=0.951056516295154;
            final double tr12=-0.809016994374947;
            final double ti12=0.587785252292473;
            int     i, k, ac, ah;
            double  ci2, ci3, ci4, ci5, di3, di4, di5, di2, cr2, cr3, cr5, cr4,
                    ti2, ti3, ti4, ti5, dr3, dr4, dr5, dr2, tr2, tr3, tr4, tr5;
        int iw1, iw2, iw3, iw4;

        iw1 = offset;
        iw2 = iw1 + ido;
        iw3 = iw2 + ido;
        iw4 = iw3 + ido;

            if(ido==2)
            {
                for(k=1; k<=l1;++k)
                {
                        ac=(5*k-4)*ido+1;
                        ti5=cc[ac]-cc[ac+3*ido];
                        ti2=cc[ac]+cc[ac+3*ido];
                        ti4=cc[ac+ido]-cc[ac+2*ido];
                        ti3=cc[ac+ido]+cc[ac+2*ido];
                        tr5=cc[ac-1]-cc[ac+3*ido-1];
                        tr2=cc[ac-1]+cc[ac+3*ido-1];
```

```
                tr4=cc[ac+ido-1]-cc[ac+2*ido-1];
                tr3=cc[ac+ido-1]+cc[ac+2*ido-1];
                ah=(k-1)*ido;
                ch[ah]=cc[ac-ido-1]+tr2+tr3;
                ch[ah+1]=cc[ac-ido]+ti2+ti3;
                cr2=cc[ac-ido-1]+tr11*tr2+tr12*tr3;
                ci2=cc[ac-ido]+tr11*ti2+tr12*ti3;
                cr3=cc[ac-ido-1]+tr12*tr2+tr11*tr3;
                ci3=cc[ac-ido]+tr12*ti2+tr11*ti3;
                cr5=isign*(ti11*tr5+ti12*tr4);
                ci5=isign*(ti11*ti5+ti12*ti4);
                cr4=isign*(ti12*tr5-ti11*tr4);
                ci4=isign*(ti12*ti5-ti11*ti4);
                ch[ah+l1*ido]=cr2-ci5;
                ch[ah+4*l1*ido]=cr2+ci5;
                ch[ah+l1*ido+1]=ci2+cr5;
                ch[ah+2*l1*ido+1]=ci3+cr4;
                ch[ah+2*l1*ido]=cr3-ci4;
                ch[ah+3*l1*ido]=cr3+ci4;
                ch[ah+3*l1*ido+1]=ci3-cr4;
                ch[ah+4*l1*ido+1]=ci2-cr5;
            }
        }
        else
        {
            for(k=1; k<=l1; k++)
            {
                for(i=0; i<ido-1; i+=2)
                {
                    ac=i+1+(k*5-4)*ido;
                    ti5=cc[ac]-cc[ac+3*ido];
                    ti2=cc[ac]+cc[ac+3*ido];
                    ti4=cc[ac+ido]-cc[ac+2*ido];
                    ti3=cc[ac+ido]+cc[ac+2*ido];
                    tr5=cc[ac-1]-cc[ac+3*ido-1];
                    tr2=cc[ac-1]+cc[ac+3*ido-1];
                    tr4=cc[ac+ido-1]-cc[ac+2*ido-1];
                    tr3=cc[ac+ido-1]+cc[ac+2*ido-1];
                    ah=i+(k-1)*ido;
                    ch[ah]=cc[ac-ido-1]+tr2+tr3;
                    ch[ah+1]=cc[ac-ido]+ti2+ti3;
                    cr2=cc[ac-ido-1]+tr11*tr2+tr12*tr3;

                    ci2=cc[ac-ido]+tr11*ti2+tr12*ti3;
                    cr3=cc[ac-ido-1]+tr12*tr2+tr11*tr3;

                    ci3=cc[ac-ido]+tr12*ti2+tr11*ti3;
                    cr5=isign*(ti11*tr5+ti12*tr4);
                    ci5=isign*(ti11*ti5+ti12*ti4);
                    cr4=isign*(ti12*tr5-ti11*tr4);
                    ci4=isign*(ti12*ti5-ti11*ti4);
                    dr3=cr3-ci4;
                    dr4=cr3+ci4;
                    di3=ci3+cr4;
                    di4=ci3-cr4;
                    dr5=cr2+ci5;
                    dr2=cr2-ci5;
                    di5=ci2-cr5;
                    di2=ci2+cr5;
                    ch[ah+l1*ido]=wtable[i+iw1]*dr2-isign*wtable[i+1+iw1]*di2;
                    ch[ah+l1*ido+1]=wtable[i+iw1]*di2+isign*wtable[i+1+iw1]*dr2;
                    ch[ah+2*l1*ido]=wtable[i+iw2]*dr3-isign*wtable[i+1+iw2]*di3;
                    ch[ah+2*l1*ido+1]=wtable[i+iw2]*di3+isign*wtable[i+1+iw2]*dr3;
                    ch[ah+3*l1*ido]=wtable[i+iw3]*dr4-isign*wtable[i+1+iw3]*di4;
                    ch[ah+3*l1*ido+1]=wtable[i+iw3]*di4+isign*wtable[i+1+iw3]*dr4;
                    ch[ah+4*l1*ido]=wtable[i+iw4]*dr5-isign*wtable[i+1+iw4]*di5;
                    ch[ah+4*l1*ido+1]=wtable[i+iw4]*di5+isign*wtable[i+1+iw4]*dr5;
                }
            }
        }
    }

/*----------------------------------------------------------------------
  passfg: Complex FFT's forward/backward processing of general factor;
  isign is +1 for backward and -1 for forward transforms
 ----------------------------------------------------------------------*/
    void passfg(int nac[], int ido, int ip, int l1, int idl1,
                final double cc[], double c1[], double c2[], double ch[], double ch2[],
                final double wtable[], int offset, int isign)
    {
        int idij, idlj, idot, ipph, i, j, k, l, jc, lc, ik, nt, idj, idl, inc, idp;
        double  wai, war;
        int iw1;

        iw1 = offset;
            idot=ido / 2;
        nt=ip*idl1;
        ipph=(ip+1)/ 2;
        idp=ip*ido;
        if(ido>=l1)
        {
            for(j=1; j<ipph; j++)
            {
                jc=ip-j;
                for(k=0; k<l1; k++)
                {
                    for(i=0; i<ido; i++)
                    {
                        ch[i+(k+j*l1)*ido]=cc[i+(j+k*ip)*ido]+cc[i+(jc+k*ip)*ido];
                        ch[i+(k+jc*l1)*ido]=cc[i+(j+k*ip)*ido]-cc[i+(jc+k*ip)*ido];
                    }
                }
            }
            for(k=0; k<l1; k++)
                for(i=0; i<ido; i++)
                    ch[i+k*ido]=cc[i+k*ip*ido];
        }
        else
        {
            for(j=1; j<ipph; j++)
            {
                jc=ip-j;
                for(i=0; i<ido; i++)
                {
                    for(k=0; k<l1; k++)
                    {
                        ch[i+(k+j*l1)*ido]=cc[i+(j+k*ip)*ido]+cc[i+(jc+k*ip)*ido];
                        ch[i+(k+jc*l1)*ido]=cc[i+(j+k*ip)*ido]-cc[i+(jc+k*ip)*ido];
                    }
                }
            }
            for(i=0; i<ido; i++)
                for(k=0; k<l1; k++)
                    ch[i+k*ido]=cc[i+k*ip*ido];
        }

        idl=2-ido;
```

```
        inc=0;
        for(l=1; l<ipph; l++)
        {
                lc=ip-l;
                idl+=ido;
                for(ik=0; ik<idl1; ik++)
                {
                    c2[ik+l*idl1]=ch2[ik]+wtable[idl-2+iw1]*ch2[ik+idl1];
                    c2[ik+lc*idl1]=isign*wtable[idl-1+iw1]*ch2[ik+(ip-1)*idl1];
                }
                idlj=idl;
                inc+=ido;
                for(j=2; j<ipph; j++)
                {
                    jc=ip-j;
                    idlj+=inc;
                    if(idlj>idp) idlj-=idp;
                    war=wtable[idlj-2+iw1];
                    wai=wtable[idlj-1+iw1];
                    for(ik=0; ik<idl1; ik++)
                    {
                            c2[ik+l*idl1]+=war*ch2[ik+j*idl1];
                            c2[ik+lc*idl1]+=isign*wai*ch2[ik+jc*idl1];
                    }
                }
        }
        for(j=1; j<ipph; j++)
                for(ik=0; ik<idl1; ik++)
                    ch2[ik]+=ch2[ik+j*idl1];
        for(j=1; j<ipph; j++)
        {
                jc=ip-j;
                for(ik=1; ik<idl1; ik+=2)
                {
                    ch2[ik-1+j*idl1]=c2[ik-1+j*idl1]-c2[ik+jc*idl1];
                    ch2[ik-1+jc*idl1]=c2[ik-1+j*idl1]+c2[ik+jc*idl1];
                    ch2[ik+j*idl1]=c2[ik+j*idl1]+c2[ik-1+jc*idl1];
                    ch2[ik+jc*idl1]=c2[ik+j*idl1]-c2[ik-1+jc*idl1];
                }
        }
        nac[0]=1;
        if(ido==2) return;
        nac[0]=0;
        for(ik=0; ik<idl1; ik++) c2[ik]=ch2[ik];
        for(j=1; j<ip; j++)
        {
                for(k=0; k<l1; k++)
                {
                    c1[(k+j*l1)*ido+0]=ch[(k+j*l1)*ido+0];
                    c1[(k+j*l1)*ido+1]=ch[(k+j*l1)*ido+1];
                }
        }
        if(idot<=l1)
        {
                idij=0;
                for(j=1; j<ip; j++)
                {
                    idij+=2;
                    for(i=3; i<ido; i+=2)
                    {
                            idij+=2;
                            for(k=0; k<l1; k++)
                            {
                                c1[i-1+(k+j*l1)*ido]=
                                        wtable[idij-2+iw1]*ch[i-1+(k+j*l1)*ido]-
                                        isign*wtable[idij-1+iw1]*ch[i+(k+j*l1)*ido];
                                c1[i+(k+j*l1)*ido]=
                                        wtable[idij-2+iw1]*ch[i+(k+j*l1)*ido]+
                                        isign*wtable[idij-1+iw1]*ch[i-1+(k+j*l1)*ido];
                            }
                    }
                }
        }
        else
        {
                idj=2-ido;
                for(j=1; j<ip; j++)
                {
                    idj+=ido;
                    for(k=0; k<l1; k++)
                    {
                            idij=idj;
                            for(i=3; i<ido; i+=2)
                            {
                                idij+=2;
                                c1[i-1+(k+j*l1)*ido]=
                                        wtable[idij-2+iw1]*ch[i-1+(k+j*l1)*ido]-
                                        isign*wtable[idij-1+iw1]*ch[i+(k+j*l1)*ido];
                                c1[i+(k+j*l1)*ido]=
                                        wtable[idij-2+iw1]*ch[i+(k+j*l1)*ido]+
                                        isign*wtable[idij-1+iw1]*ch[i-1+(k+j*l1)*ido];
                            }
                    }
                }
        }
    }

/*-----------------------------------------------------------
  cfftf1: further processing of Complex forward FFT
 -----------------------------------------------------------*/
    void cfftf1(int n, double c[], final double wtable[], int isign)
    {
        int     idot, i;
        int     k1, l1, l2;
        int     na, nf, ip, iw, ido, idl1;
        int[]  nac = new int[1];

        int     iw1, iw2;
        double[] ch = new double[2*n];

        iw1=2*n;
        iw2=4*n;
        System.arraycopy(wtable, 0, ch, 0, 2*n);

        nac[0] = 0;

        nf=(int)wtable[1+iw2];
        na=0;
        l1=1;
        iw=iw1;
        for(k1=2; k1<=nf+1; k1++)
        {
                ip=(int)wtable[k1+iw2];
                l2=ip*l1;
                ido=n / l2;
                idot=ido+ido;
                idl1=idot*l1;
```

```
                if(ip==4)
                {
                    if(na==0)
            {
                passf4(idot, l1, c, ch, wtable, iw, isign);
            }
                    else
            {
                passf4(idot, l1, ch, c, wtable, iw, isign);
            }
                    na=1-na;
                }
                else if(ip==2)
                {
                    if(na==0)
            {
                passf2(idot, l1, c, ch, wtable, iw, isign);
            }
                    else
            {
                passf2(idot, l1, ch, c, wtable, iw, isign);
            }
                    na=1-na;
                }
                else if(ip==3)
                {
                    if(na==0)
            {
                passf3(idot, l1, c, ch, wtable, iw, isign);
            }
                    else
            {
                passf3(idot, l1, ch, c, wtable, iw, isign);
            }
                    na=1-na;
                }
                else if(ip==5)
                {
                    if(na==0)
            {
                passf5(idot, l1, c, ch, wtable, iw, isign);
            }
                    else
            {
                passf5(idot, l1, ch, c, wtable, iw, isign);
            }
                    na=1-na;
                }
                else
                {
                    if(na==0)
            {
                passfg(nac, idot, ip, l1, idl1, c, c, c, ch, ch, wtable, iw, isign);
            }
                    else
            {
                passfg(nac, idot, ip, l1, idl1, ch, ch, ch, c, c, wtable, iw, isign);
            }
                    if(nac[0] !=0) na=1-na;
                }
                l1=l2;
                iw+=(ip-1)*idot;
        }
        if(na==0) return;
        for(i=0; i<2*n; i++) c[i]=ch[i];
    }

/*-----------------------------------------------------
  cfftf: Complex forward FFT
 -----------------------------------------------------*/
    void cfftf(int n, double c[], double wtable[])
    {
        cfftf1(n, c, wtable, -1);
    }

/*-----------------------------------------------------
  cfftb: Complex borward FFT
 -----------------------------------------------------*/
    void cfftb(int n, double c[], double wtable[])
    {
        cfftf1(n, c, wtable, +1);
    }

/*-----------------------------------------------------
  cffti1: further initialization of Complex FFT
 -----------------------------------------------------*/
    void cffti1(int n, double wtable[])
    {

        final int[] ntryh = {3, 4, 2, 5};
        final double twopi=2.0D*Math.PI;
        double  argh;
        int     idot, ntry=0, i, j;
        double  argld;
        int     i1, k1, l1, l2, ib;
        double  fi;
        int     ld, ii, nf, ip, nl, nq, nr;
        double  arg;
        int     ido, ipm;

         nl=n;
         nf=0;
         j=0;

    factorize_loop:
        while(true)
        {
            j++;
            if(j<=4)
                ntry=ntryh[j-1];
            else
                ntry+=2;
            do
            {
                nq=nl / ntry;
                nr=nl-ntry*nq;
                if(nr !=0) continue factorize_loop;
                nf++;
                wtable[nf+1+4*n]=ntry;
                nl=nq;
                if(ntry==2 && nf !=1)
                {
                    for(i=2; i<=nf; i++)
                    {
                        ib=nf-i+2;
                        wtable[ib+1+4*n]=wtable[ib+4*n];
                    }
```

```
                        wtable[2+4*n]=2;
                    }
                } while(nl !=1);
                break factorize_loop;
            }
            wtable[0+4*n]=n;
            wtable[1+4*n]=nf;
            argh=twopi /(double)n;
            i=1;
            l1=1;
            for(k1=1; k1<=nf; k1++)
            {
                    ip=(int)wtable[k1+1+4*n];
                    ld=0;
                    l2=l1*ip;
                    ido=n / l2;
                    idot=ido+ido+2;
                    ipm=ip-1;
                    for(j=1; j<=ipm; j++)
                    {
                        i1=i;
                        wtable[i-1+2*n]=1;
                        wtable[i+2*n]=0;
                        ld+=l1;
                        fi=0;
                        argld=ld*argh;
                        for(ii=4; ii<=idot; ii+=2)
                        {
                                i+=2;
                                fi+=1;
                                arg=fi*argld;
                                wtable[i-1+2*n]=Math.cos(arg);
                                wtable[i+2*n]=Math.sin(arg);
                        }
                        if(ip>5)
                        {
                                wtable[i1-1+2*n]=wtable[i-1+2*n];
                                wtable[i1+2*n]=wtable[i+2*n];
                        }
                    }
                    l1=l2;
            }
        }
/*---------------------------------------------------------
  cffti:  Initialization of Real forward FFT
 ---------------------------------------------------------*/
    void cffti(int n, double wtable[])
    {
        if(n==1) return;
        cffti1(n, wtable);
    }       /*cffti*/
}
```

```
package nl.dut.ide.software.soundfilterrealgit;

import android.annotation.SuppressLint;
import android.bluetooth.BluetoothAdapter;
import android.bluetooth.BluetoothDevice;
import android.bluetooth.BluetoothGatt;
import android.bluetooth.BluetoothGattCallback;
import android.bluetooth.BluetoothGattCharacteristic;
import android.bluetooth.BluetoothGattDescriptor;
import android.bluetooth.BluetoothGattService;
import android.bluetooth.BluetoothManager;
import android.bluetooth.le.BluetoothLeScanner;
import android.bluetooth.le.ScanCallback;
import android.bluetooth.le.ScanResult;
import android.content.Context;
import android.content.DialogInterface;
import android.content.Intent;
import android.content.pm.PackageManager;
import android.os.AsyncTask;
import android.os.Bundle;
import android.os.Handler;
import android.support.v7.app.AlertDialog;
import android.support.v7.app.AppCompatActivity;
import android.text.method.ScrollingMovementMethod;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.TextView;

import com.google.firebase.database.DatabaseReference;

import java.util.ArrayList;
import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.UUID;

public class ConnectMio extends AppCompatActivity {

    private static final String TAG = "ConnectMio";

    private int heartRateValue;

    DatabaseReference databasereference;
    // bluetooth
    BluetoothManager btManager;
    BluetoothAdapter btAdapter;
    BluetoothLeScanner btScanner;
    Button startScanningButton;
    Button stopScanningButton;
    TextView peripheralTextView;
    private final static int REQUEST_ENABLE_BT = 1;
    private static final int PERMISSION_REQUEST_COARSE_LOCATION = 1;

    Boolean btScanning = false;
    int deviceIndex = 0;
    ArrayList<BluetoothDevice> devicesDiscovered = new ArrayList<BluetoothDevice>();
    EditText deviceIndexInput;
    Button connectToDevice;
    Button disconnectDevice;
    BluetoothGatt bluetoothGatt;

    UUID HEART_RATE_SERVICE_UUID = convertFromInteger(0x180D);
    UUID HEART_RATE_MEASUREMENT_CHAR_UUID = convertFromInteger(0x2A37);
    UUID HEART_RATE_CONTROL_POINT_CHAR_UUID = convertFromInteger(0x2A39);
```

Connect_Mio

```
    UUID CLIENT_CHARACTERISTIC_CONFIG_UUID = convertFromInteger(0x2902);

    public final static String ACTION_GATT_CONNECTED =
            "com.example.bluetooth.le.ACTION_GATT_CONNECTED";
    public final static String ACTION_GATT_DISCONNECTED =
            "com.example.bluetooth.le.ACTION_GATT_DISCONNECTED";
    public final static String ACTION_GATT_SERVICES_DISCOVERED =
            "com.example.bluetooth.le.ACTION_GATT_SERVICES_DISCOVERED";
    public final static String ACTION_DATA_AVAILABLE =
            "com.example.bluetooth.le.ACTION_DATA_AVAILABLE";
    public final static String EXTRA_DATA =
            "com.example.bluetooth.le.EXTRA_DATA";

    public Map<String, String> uuids = new HashMap<String, String>();

    // Stops scanning after 5 seconds.
    private Handler mHandler = new Handler();
    private static final long SCAN_PERIOD = 150000;

    @SuppressLint("WrongViewCast")

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_connect_mio);

        //bluetooth
        peripheralTextView = (TextView) findViewById(R.id.PeripheralTextView);
        peripheralTextView.setMovementMethod(new ScrollingMovementMethod());
        deviceIndexInput = (EditText) findViewById(R.id.InputIndex);
        deviceIndexInput.setText("0");
        connectToDevice = (Button) findViewById(R.id.ConnectButton);
        connectToDevice.setOnClickListener(new View.OnClickListener() {
            public void onClick(View v) {
                connectToDeviceSelected();
            }
        });

        disconnectDevice = (Button) findViewById(R.id.DisconnectButton);
        disconnectDevice.setVisibility(View.INVISIBLE);
        disconnectDevice.setOnClickListener(new View.OnClickListener() {
            public void onClick(View v) {
                disconnectDeviceSelected();
            }
        });

        startScanningButton = (Button) findViewById(R.id.StartScanningButton);
        startScanningButton.setOnClickListener(new View.OnClickListener() {
            public void onClick(View v) {
                startScanning();
            }
        });

        stopScanningButton = (Button) findViewById(R.id.StopScanningButton);
        stopScanningButton.setOnClickListener(new View.OnClickListener() {
            public void onClick(View v) {
                stopScanning();
            }
        });
        stopScanningButton.setVisibility(View.INVISIBLE);

        btManager = (BluetoothManager) getSystemService(Context.BLUETOOTH_SERVICE);
        btAdapter = btManager.getAdapter();
        btScanner = btAdapter.getBluetoothLeScanner();

        if (btAdapter != null && !btAdapter.isEnabled()) {
            Intent enableIntent = new Intent(BluetoothAdapter.ACTION_REQUEST_ENABLE);
            startActivityForResult(enableIntent, REQUEST_ENABLE_BT);
        }

    }

    // Device scan callback.
    private ScanCallback leScanCallback = new ScanCallback() {
        @Override
        public void onScanResult(int callbackType, ScanResult result) {
            if (result.getDevice().getName() != null && result.getDevice().getName().startsWith("MIO")) {
                peripheralTextView.append("Index: " + deviceIndex + ", Device Name: " + result.getDevice().getName() + " rssi: " + result.getRssi() + ",
MAC: " + result.getDevice().getAddress() + "\n");
                // filtering only MIO devices
                devicesDiscovered.add(result.getDevice());
                deviceIndex++;

                // auto scroll for text view
                final int scrollAmount = peripheralTextView.getLayout().getLineTop(peripheralTextView.getLineCount()) - peripheralTextView.getH-
eight();
                // if there is no need to scroll, scrollAmount will be <=0
                if (scrollAmount > 0) {
                    peripheralTextView.scrollTo(0, scrollAmount);
                }
            }
        }
    };


    // Device connect call back
    private final BluetoothGattCallback btleGattCallback = new BluetoothGattCallback() {

        @Override
        public void onCharacteristicChanged(BluetoothGatt gatt, final BluetoothGattCharacteristic characteristic) {
            // this will get called anytime you perform a read or write characteristic operation

            final byte[] teste = characteristic.getValue();

            final String batida = teste.toString();

            final String result = "result";

            int format = BluetoothGattCharacteristic.FORMAT_UINT8;

            setHeartRateValue(characteristic.getIntValue(format, 1));

            String TAG = "d";

            Log.d(TAG, String.format("Received heart rate: %d", getHeartRateValue()));

            Log.v(result, batida);

            ConnectMio.this.runOnUiThread(new Runnable() {
                public void run() {
                    peripheralTextView.append("value of sensor (BPM) " + getHeartRateValue() + "\n");
                }
            });

        }
```

```
        @Override
        public void onConnectionStateChange(final BluetoothGatt gatt, final int status, final int newState) {
            // this will get called when a device connects or disconnects
            System.out.println(newState);
            switch (newState) {
                case 0:
                    ConnectMio.this.runOnUiThread(new Runnable() {
                        public void run() {
                            peripheralTextView.append("device disconnected\n");
                            connectToDevice.setVisibility(View.VISIBLE);
                            disconnectDevice.setVisibility(View.INVISIBLE);
                        }
                    });
                    break;
                case 2:
                    ConnectMio.this.runOnUiThread(new Runnable() {
                        public void run() {
                            peripheralTextView.append("device connected\n");
                            connectToDevice.setVisibility(View.INVISIBLE);
                            disconnectDevice.setVisibility(View.VISIBLE);
                        }
                    });

                    // discover services and characteristics for this device
                    bluetoothGatt.discoverServices();

                    break;
                default:
                    ConnectMio.this.runOnUiThread(new Runnable() {
                        public void run() {
                            peripheralTextView.append("we encounterned an unknown state, uh oh\n");
                        }
                    });
                    break;
            }
        }

        @Override
        public void onServicesDiscovered(final BluetoothGatt gatt, final int status) {
            // this will get called after the client initiates a            BluetoothGatt.discoverServices() call
            ConnectMio.this.runOnUiThread(new Runnable() {
                public void run() {
                    peripheralTextView.append("device services have been discovered\n");
                }
            });
            displayGattServices(bluetoothGatt.getServices());

            BluetoothGattCharacteristic characteristic = gatt.getService(HEART_RATE_SERVICE_UUID).getCharacteristic(HEART_RATE_MEAS-
UREMENT_CHAR_UUID);

            //BluetoothGattCharacteristic battery = gatt.getService(BATTERY_SERVICE).getCharacteristic(BATTERY_LEVEL);

            //gatt.readCharacteristic(battery);

            gatt.setCharacteristicNotification(characteristic, true);

            BluetoothGattDescriptor descriptor = characteristic.getDescriptor(CLIENT_CHARACTERISTIC_CONFIG_UUID);

            descriptor.setValue(BluetoothGattDescriptor.ENABLE_NOTIFICATION_VALUE);

            gatt.writeDescriptor(descriptor);
        }

        @Override
        public void onDescriptorWrite(BluetoothGatt gatt, BluetoothGattDescriptor descriptor, int status) {
            BluetoothGattCharacteristic characteristic = gatt.getService(HEART_RATE_SERVICE_UUID).getCharacteristic(HEART_RATE_CON-
TROL_POINT_CHAR_UUID);

            characteristic.setValue(new byte[]{1, 1});
            gatt.writeCharacteristic(characteristic);
        }

        @Override
        // Result of a characteristic read operation
        public void onCharacteristicRead(BluetoothGatt gatt,
                                         BluetoothGattCharacteristic characteristic,
                                         int status) {
            if (status == BluetoothGatt.GATT_SUCCESS) {
                broadcastUpdate(ACTION_DATA_AVAILABLE, characteristic);
            }
        }
    };

    private void broadcastUpdate(final String action,
                                 final BluetoothGattCharacteristic characteristic) {

        System.out.println(characteristic.getUuid());
    }

    @Override
    public void onRequestPermissionsResult(int requestCode, String permissions[], int[] grantResults) {
        switch (requestCode) {
            case PERMISSION_REQUEST_COARSE_LOCATION: {
                if (grantResults[0] == PackageManager.PERMISSION_GRANTED) {
                    System.out.println("coarse location permission granted");
                } else {
                    final AlertDialog.Builder builder = new AlertDialog.Builder(this);
                    builder.setTitle("Functionality limited");
                    builder.setMessage("Since location access has not been granted, this app will not be able to discover beacons when in the back-
ground.");
                    builder.setPositiveButton(android.R.string.ok, null);
                    builder.setOnDismissListener(new DialogInterface.OnDismissListener() {

                        @Override
                        public void onDismiss(DialogInterface dialog) {
                        }

                    });
                    builder.show();
                }
                return;
            }
        }
    }

    public void startScanning() {
        System.out.println("start scanning");
        btScanning = true;
        deviceIndex = 0;
        devicesDiscovered.clear();
        peripheralTextView.setText("");
        peripheralTextView.append("Started Scanning\n");
        startScanningButton.setVisibility(View.INVISIBLE);
        stopScanningButton.setVisibility(View.VISIBLE);
        AsyncTask.execute(new Runnable() {
            @Override
            public void run() {
```

```
            btScanner.startScan(leScanCallback);
        }
    });

    mHandler.postDelayed(new Runnable() {
        @Override
        public void run() {
            stopScanning();
        }
    }, SCAN_PERIOD);
}

public void stopScanning() {
    System.out.println("stopping scanning");
    peripheralTextView.append("Stopped Scanning\n");
    btScanning = false;
    startScanningButton.setVisibility(View.VISIBLE);
    stopScanningButton.setVisibility(View.INVISIBLE);
    AsyncTask.execute(new Runnable() {
        @Override
        public void run() {
            btScanner.stopScan(leScanCallback);
        }
    });
}

public void connectToDeviceSelected() {
    peripheralTextView.append("Trying to connect to device at index: " + deviceIndexInput.getText() + "\n");
    int deviceSelected = Integer.parseInt(deviceIndexInput.getText().toString());
    bluetoothGatt = devicesDiscovered.get(deviceSelected).connectGatt(this, false, btleGattCallback);
}

public void disconnectDeviceSelected() {
    peripheralTextView.append("Disconnecting from device\n");
    bluetoothGatt.disconnect();
}

private void displayGattServices(List<BluetoothGattService> gattServices) {
    if (gattServices == null) return;

    // Loops through available GATT Services.
    for (BluetoothGattService gattService : gattServices) {

        final String uuid = gattService.getUuid().toString();
        System.out.println("Service discovered: " + uuid);
        ConnectMio.this.runOnUiThread(new Runnable() {
            public void run() {
                peripheralTextView.append("Service disovered: " + uuid + "\n");
            }
        });
        new ArrayList<HashMap<String, String>>();
        List<BluetoothGattCharacteristic> gattCharacteristics =
                gattService.getCharacteristics();

        // Loops through available Characteristics.
        for (BluetoothGattCharacteristic gattCharacteristic :
                gattCharacteristics) {

            final String charUuid = gattCharacteristic.getUuid().toString();
            System.out.println("Characteristic discovered for service: " + charUuid);
            ConnectMio.this.runOnUiThread(new Runnable() {
                public void run() {
                    peripheralTextView.append("Characteristic discovered for service: " + charUuid + "\n");
                }
            });

        }
    }
}

@Override
public void onStart() {
    super.onStart();
}

@Override
public void onStop() {
    super.onStop();

}

public UUID convertFromInteger(int i) {
    final long MSB = 0x0000000000001000L;
    final long LSB = 0x800000805f9b34fbL;
    long value = i & 0xFFFFFFFF;
    return new UUID(MSB | (value << 32), LSB);
}

@Override
protected void onPause() {
    super.onPause();
}

public int getHeartRateValue() {
    return heartRateValue;
}

public void setHeartRateValue(int heartRateValue) {
    this.heartRateValue = heartRateValue;
}
}
```

```
package nl.dut.ide.software.soundfilterrealgit;

import android.content.Intent;
import android.support.annotation.NonNull;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.util.Log;
import android.util.Patterns;
import android.view.View;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ProgressBar;
import android.widget.Toast;

import com.google.android.gms.tasks.OnCompleteListener;
import com.google.android.gms.tasks.OnFailureListener;
import com.google.android.gms.tasks.OnSuccessListener;
import com.google.android.gms.tasks.Task;
import com.google.firebase.FirebaseApp;
import com.google.firebase.auth.AuthResult;
import com.google.firebase.auth.FirebaseAuth;
```

Create account

```
import com.google.firebase.auth.FirebaseUser;
import com.google.firebase.database.FirebaseDatabase;

import com.google.firebase.firestore.DocumentReference;
import com.google.firebase.firestore.FirebaseFirestore;
import com.google.firebase.firestore.QueryDocumentSnapshot;
import com.google.firebase.firestore.QuerySnapshot;
import com.google.firebase.firestore.auth.User;

import java.util.HashMap;
import java.util.Map;


public class CreateAccount extends AppCompatActivity {
    //the onclick listener is already set in xml
    //this button is used to request focus
    private Button createNewAccount;

    EditText editTextUserEmail,editTextUserPassword,editTextUserUnit,editTextUserName,editTextUserPasswordCheck;
    private FirebaseAuth mAuth;
    private ProgressBar progressBarSignUp;
    private FirebaseFirestore db;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_create_account);

        //buttons
        createNewAccount = findViewById(R.id.create_new_account);

        //user input
        editTextUserEmail= (EditText) findViewById(R.id.user_email);
        editTextUserPassword= (EditText) findViewById(R.id.user_password);
        editTextUserPasswordCheck=(EditText) findViewById(R.id.user_password_repeated);
        editTextUserName = (EditText) findViewById(R.id.user_name);
        editTextUserUnit = (EditText) findViewById(R.id.user_unit_number);

        //firebase
        FirebaseApp.initializeApp(this);
        mAuth = FirebaseAuth.getInstance();
        db = FirebaseFirestore.getInstance();
        progressBarSignUp= (ProgressBar) findViewById(R.id.progress_bar_create_account);

    }

    @Override
    public void onStart() {
        super.onStart();
        //if there is already a user logged in we got to the home screen
        if(mAuth.getCurrentUser()!= null){
            alreadyLogInToHome();
        }
    }

    public void checkUserInput(View view){
        //we will check whether the user filled in all the field and if they did that correctly
        final String email =editTextUserEmail.getText().toString().trim().replaceAll(" ","");
        final String password=editTextUserPassword.getText().toString().trim().replaceAll(" ","");
        final String passwordCheck=editTextUserPasswordCheck.getText().toString().trim().replaceAll(" ","");
        final String unit=editTextUserUnit.getText().toString().trim().replaceAll(" ","");
        final String name=editTextUserName.getText().toString();

        if (email.isEmpty()){
            editTextUserEmail.setError("Email is required");
            editTextUserEmail.requestFocus();
            return;
        }

        if (!Patterns.EMAIL_ADDRESS.matcher(email).matches()){
            editTextUserEmail.setError("Please enter a valid email");
            editTextUserEmail.requestFocus();
            return;
        }

        if (unit.isEmpty()){
            editTextUserUnit.setError("Unit number is required");
            editTextUserUnit.requestFocus();
            return;
        }

        if (name.isEmpty()){
            editTextUserName.setError("Name is required");
            editTextUserName.requestFocus();
            return;
        }

        if (password.isEmpty()){
            editTextUserPassword.setError("Password is required");
            editTextUserPassword.requestFocus();
            return;
        }

        if (password.length()<=8){
            editTextUserPassword.setError("Password should be at least 8 characters long");
            editTextUserPassword.requestFocus();
            return;
        }

        String upperCaseChars = "(.*[A-Z].*)";
        if (!password.matches(upperCaseChars )){
            editTextUserPassword.setError("Password should contain at least one capital");
            editTextUserPassword.requestFocus();
            return;
        }

        String lowerCaseChars = "(.*[a-z].*)";
        if (!password.matches(lowerCaseChars )){
            editTextUserPassword.setError("Password should contain at least one lower case letter");
            editTextUserPassword.requestFocus();
            return;
        }

        String numbers = "(.*[0-9].*)";
        if (!password.matches(numbers )){
            editTextUserPassword.setError("Password should contain at least one number");
            editTextUserPassword.requestFocus();
            return;
        }

        String specialChars = "(.*[,~,!,@,#,$,%,^,&,*,(,),-,_,=,+,[,{,],},|,;,:,<,>,/,?].*$)";
        if (!password.matches(specialChars )){
            editTextUserPassword.setError("Password should contain at least one special character");
            editTextUserPassword.requestFocus();
            return;
        }
```

```
        if(!password.equals(passwordCheck) ){
            editTextUserPasswordCheck.setError("Passwords do not match");
            editTextUserPasswordCheck.requestFocus();
            return;

        }
        //we conclude that the user input is correct
        //thus we will show the progress bar and really start to create the account
        progressBarSignUp.setVisibility(View.VISIBLE);
        createAccount(email,password,unit,name);

    }

    private void createAccount(final String email, final String password, final String unit, final String name) {
        //first we create the account in firebase auth

        mAuth.createUserWithEmailAndPassword(email, password)
                .addOnCompleteListener(this, new OnCompleteListener<AuthResult>() {
                    @Override
                    public void onComplete(@NonNull Task<AuthResult> task) {
                        if (task.isSuccessful()) {
                            storeUser(email, unit, name);

                        } else {
                            progressBarSignUp.setVisibility(View.INVISIBLE);
                            Toast.makeText(CreateAccount.this, "Registration failed, please try again",
                                    Toast.LENGTH_LONG).show();
                        }
                    }
                });

    }

    private void storeUser(String email, String unit, String name) {
        //now that the user is created we can get their personal key
        // that is created in firebase to identify them
        final String key =FirebaseAuth.getInstance().getCurrentUser().getUid();
        if (key==null){
            editTextUserEmail.requestFocus();
            Toast.makeText(CreateAccount.this, "Registration failed no user id found",
                    Toast.LENGTH_LONG).show();
        }
        else {
            //user key is found and thus we can save the data correctly now

            //file the content so that it can be send away
            Map<String, Object> userInformation = new HashMap<>();
            userInformation.put("unit", unit);
            userInformation.put("name", name);
            userInformation.put("email", email);

            db.collection("users").document(key).set(userInformation).addOnCompleteListener(new OnCompleteListener<Void>() {
                @Override
                public void onComplete(@NonNull Task<Void> task) {
                    if (task.isSuccessful()) {
                        Toast.makeText(CreateAccount.this, "Successfully registered",
                                Toast.LENGTH_LONG).show();
                        goToTestMic();

                    } else {
                        Toast.makeText(CreateAccount.this, "Registration failed, please try again",
                                Toast.LENGTH_LONG).show();
                        createNewAccount.requestFocus();
                    }
                }
            });
        }

    }

    private void goToTestMic() {
        Intent intentMic= new Intent(this, TestMic.class);
        intentMic.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
        startActivity(intentMic);
    }

    public void onClickGoToLogin(View view){
        Intent intent = new Intent(this , LoginActivity.class);
        startActivity(intent);
    }

    public void alreadyLogInToHome(){
        Intent intentHome= new Intent(this, Record.class);
        startActivity(intentHome);
    }
}
```

Emotion List Adapter

```
package nl.dut.ide.software.soundfilterrealgit;

import android.view.LayoutInflater;
import android.view.View;
import android.view.ViewGroup;
import android.widget.BaseAdapter;
import android.widget.Button;
import android.widget.TextView;

import java.util.ArrayList;
import java.util.Map;

public class EmotionListAdapter extends BaseAdapter {
    private final ArrayList mData;

    public EmotionListAdapter(Map<Integer,String>map){
        mData = new ArrayList();
        mData.addAll(map.entrySet());
        //EmotionListAdapter receives data from the SelectEmotion class
        //and saves the values of the treemap in een new array list
    }

    @Override
    public int getCount() {
        return mData.size();
    }

    @Override
    public Map.Entry<String, String> getItem(int position) {
        return (Map.Entry) mData.get(position);
    }

    @Override
    public long getItemId(int position) {
```

```
        return 0;
        //Method not needed for what we want to do
        //but has to be here, because the base adapter wants it
    }

    @Override
    public View getView(int position, View convertView, ViewGroup parent) {
        final View result;

        if (convertView == null) {
            //tell the inflater to use the custom listview .
            result = LayoutInflater.from(parent.getContext()).inflate(R.layout.custom_listview_select_emotion, parent, false);
        } else {
            result = convertView;
        }

        //get one key/value pair of the map at a certain position
        Map.Entry<String, String> item = getItem(position);

        //set the text of the listview to the value of the mapping to show the user
        //set the tag of the button to the key of the mapping to help tracking the button in SelectEmotion.java
        ((Button) result.findViewById(R.id.delete_emotion_button)).setTag(item.getKey());
        ((TextView) result.findViewById(R.id.emotion_time_text)).setText(item.getValue());

        return result;
    }
}
```

Heart rate

```
package nl.dut.ide.software.soundfilterrealgit;

public class HeartRate {
    private int heartRateValue;
    private Long timevalue;

   //constructors

    public HeartRate(int heartRateValue, Long timevalue) {
        this.heartRateValue = heartRateValue;
        this.timevalue = timevalue;
    }

    //getters

    public int getHeartRateValue() {
        return heartRateValue;
    }

    public Long getTimevalue() {
        return timevalue;
    }
}
```

Login Activity

```
package nl.dut.ide.software.soundfilterrealgit;

import android.animation.Animator;
import android.animation.AnimatorListenerAdapter;
import android.annotation.TargetApi;
import android.content.Context;
import android.content.Intent;
import android.content.pm.PackageManager;
import android.net.sip.SipSession;
import android.support.annotation.NonNull;
import android.support.design.widget.Snackbar;
import android.support.v7.app.AppCompatActivity;
import android.app.LoaderManager.LoaderCallbacks;

import android.content.CursorLoader;
import android.content.Loader;
import android.database.Cursor;
import android.net.Uri;
import android.os.AsyncTask;
import android.os.AsyncTask;

import android.os.Build;
import android.os.Bundle;
import android.provider.ContactsContract;
import android.text.TextUtils;
import android.util.Log;
import android.view.KeyEvent;
import android.view.View;
import android.view.View.OnClickListener;
import android.view.inputmethod.EditorInfo;
import android.widget.ArrayAdapter;
import android.widget.AutoCompleteTextView;
import android.widget.Button;
import android.widget.EditText;
import android.widget.ProgressBar;
import android.widget.TextView;
import android.widget.Toast;

import com.google.android.gms.tasks.OnCompleteListener;
import com.google.android.gms.tasks.Task;
import com.google.firebase.FirebaseApp;
import com.google.firebase.auth.AuthResult;
import com.google.firebase.auth.FirebaseAuth;
import com.google.firebase.auth.FirebaseUser;

import java.util.ArrayList;
import java.util.List;

import static android.Manifest.permission.READ_CONTACTS;

public class LoginActivity extends AppCompatActivity{

    AutoCompleteTextView mEmailView;
    EditText mPasswordView;
    private ProgressBar progressBarSignIn;
    private FirebaseAuth mAuth;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_login);
        progressBarSignIn= (ProgressBar) findViewById(R.id.progress_bar_login_account);
```

```
        //Textviews
        mEmailView= (AutoCompleteTextView) findViewById(R.id.email);
        mPasswordView= (EditText) findViewById(R.id.password);

        //Firebase
        FirebaseApp.initializeApp(this);
        mAuth = FirebaseAuth.getInstance();
    }

    @Override
    public void onStart() {
        super.onStart();
        //if there is already a user logged in we got to the home screen
        if(mAuth.getCurrentUser()!= null&&TestMic.isPermission()==true){
            Intent intentHome= new Intent(this, Record.class);
            startActivity(intentHome);
        }
    }

    public void onClickSignIn(View view) {
        // Store values at the time of the login attempt.
        final String password = mPasswordView.getText().toString();
        final String email = mEmailView.getText().toString();


        //check the user input
        if (email.isEmpty()){
            mEmailView.setError("Email is required");
            mEmailView.requestFocus();
            return;
        }
        if (password.isEmpty()){
            mPasswordView.setError("Password is required");
            mPasswordView.requestFocus();
            return;
        }

        //set the progressbar on
        progressBarSignIn.setVisibility(View.VISIBLE);


        mAuth.signInWithEmailAndPassword(email, password)
                .addOnCompleteListener(this, new OnCompleteListener<AuthResult>() {
                    @Override
                    public void onComplete(@NonNull Task<AuthResult> task) {
                        if (task.isSuccessful()) {
                            //hide the progressbar on
                            progressBarSignIn.setVisibility(View.INVISIBLE);

                            Toast.makeText(LoginActivity.this, "Login Successfully", Toast.LENGTH_SHORT).show();

                            //go to the record screen
                            Intent intent = new Intent(LoginActivity.this, Record.class);
                            //we clear all the activities before so that the user will ot go to login screen
                            //while they are still logged in. They have to sign out first
                            intent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
                            startActivity(intent);

                        } else {
                            //hide the progressbar
                            progressBarSignIn.setVisibility(View.INVISIBLE);

                            //Show the user why the login failed
                            Toast.makeText(getApplicationContext(), task.getException().getMessage(), Toast.LENGTH_LONG).show();
                        }
                    }
                });
    }

    public void onClickCreate(View v) {
        //when the user does not have an account, guide them to create account page
        Intent intent = new Intent(this , CreateAccount.class);
        startActivity(intent);
    }
}
```

```
package nl.dut.ide.software.soundfilterrealgit;
/**
 * FFT transform of a real periodic sequence.
 * @author Baoshe Zhang
 * @author Astronomical Instrument Group of University of Lethbridge.
*/
public class RealDoubleFFT extends RealDoubleFFT_Mixed
{
/**
 * <em>norm_factor</em> can be used to normalize this FFT transform. This is because
 * a call of forward transform (<em>ft</em>) followed by a call of backward transform
 * (<em>bt</em>) will multiply the input sequence by <em>norm_factor</em>.
*/
    public double norm_factor;
    private double wavetable[];
    private int ndim;

/**
 * Construct a wavenumber table with size <em>n</em>.
 * The sequences with the same size can share a wavenumber table. The prime
 * factorization of <em>n</em> together with a tabulation of the trigonometric functions
 * are computed and stored.
 *
 * @param  n  the size of a real data sequence. When <em>n</em> is a multiplication of small
 * numbers (4, 2, 3, 5), this FFT transform is very efficient.
*/
    public RealDoubleFFT(int n)
    {
        ndim = n;
        norm_factor = n;
        if(wavetable == null || wavetable.length !=(2*ndim+15))
        {
            wavetable = new double[2*ndim + 15];
        }
        rffti(ndim, wavetable);
    }

/**
 * Forward real FFT transform. It computes the discrete transform of a real data sequence.
 *
 * @param x an array which contains the sequence to be transformed. After FFT,
 * <em>x</em> contains the transform coeffients used to construct <em>n</em> complex FFT coeffients.
 * <br>
 * The real part of the first complex FFT coeffients is <em>x</em>[0]; its imaginary part
```

Real Double FFT

```
 * is 0. If <em>n</em> is even set <em>m</em> = <em>n</em>/2, if <em>n</em> is odd set
 * <em>m</em> = <em>n</em>/2, then for
 * <br>
 * <em>k</em> = 1, ..., <em>m</em>-1 <br>
 * the real part of <em>k</em>-th complex FFT coeffients is <em>x</em>[2*<em>k</em>-1];
 * <br>
 * the imaginary part of <em>k</em>-th complex FFT coeffients is <em>x</em>[2*<em>k</em>-2].
 * <br>
 * If <em>n</em> is even,
 * the real of part of (<em>n</em>/2)-th complex FFT coeffients is <em>x</em>[<em>n</em>]; its imaginary part is 0.
 * The remaining complex FFT coeffients can be obtained by the symmetry relation:
 * the (<em>n</em>-<em>k</em>)-th complex FFT coeffient is the conjugate of <em>n</em>-th complex FFT coeffient.
 *
*/
    public void ft(double x[])
    {
        if(x.length != ndim)
            throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        rfftf(ndim, x, wavetable);
    }

/**
 * Forward real FFT transform. It computes the discrete transform of a real data sequence.
 *
 * @param x an array which contains the sequence to be transformed. After FFT,
 * <em>x</em> contains the transform coeffients used to construct <em>n</em> complex FFT coeffients.
 * <br>
 * @param y the first complex (<em>n</em>+1)/2 (when <em>n</em> is odd) or (<em>n</em>/2+1) (when
 * <em>n</em> is even) FFT coeffients.
 * The remaining complex FFT coeffients can be obtained by the symmetry relation:
 * the (<em>n</em>-<em>k</em>)-th complex FFT coeffient is the conjugate of <em>n</em>-th complex FFT coeffient.
 *
*/
    public void ft(double x[], Complex1D y)
    {
        if(x.length != ndim)
            throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        rfftf(ndim, x, wavetable);

        if(ndim%2 == 0)
        {
            y.x = new double[ndim/2 + 1];
            y.y = new double[ndim/2 + 1];
        }
        else
        {
            y.x = new double[(ndim+1)/2];
            y.y = new double[(ndim+1)/2];
        }

        y.x[0] = x[0];
        y.y[0] = 0.0D;
        for(int i=1; i<(ndim+1)/2; i++)
        {
            y.x[i] = x[2*i-1];
            y.y[i] = x[2*i];
        }
        if(ndim%2 == 0)
        {
            y.x[ndim/2] = x[ndim-1];
            y.y[ndim/2] = 0.0D;
        }

    }

/**
 * Backward real FFT transform. It is the unnormalized inverse transform of <em>ft</em>(double[]).
 *
 * @param x an array which contains the sequence to be transformed. After FFT,
 * <em>x</em> contains the transform coeffients. Also see the comments of <em>ft</em>(double[])
 * for the relation between <em>x</em> and complex FFT coeffients.
*/
    public void bt(double x[])
    {
        if(x.length != ndim)
            throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        rfftb(ndim, x, wavetable);
    }
/**
 * Backward real FFT transform. It is the unnormalized inverse transform of <em>ft</em>(Complex1D, double[]).
 *
 * @param x  an array which contains the sequence to be transformed. When <em>n</em> is odd, it contains the first
 * (<em>n</em>+1)/2 complex data; when <em>n</em> is even, it contains (<em>n</em>/2+1) complex data.
 * @param y  the real FFT coeffients.
 * <br>
 * Also see the comments of <em>ft</em>(double[]) for the relation
 * between <em>x</em> and complex FFT coeffients.
*/
    public void bt(Complex1D x, double y[])
    {
        if(ndim%2 == 0)
        {
            if(x.x.length != ndim/2+1)
                throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        }
        else
        {
            if(x.x.length != (ndim+1)/2)
                throw new IllegalArgumentException("The length of data can not match that of the wavetable");
        }

        y[0] = x.x[0];
        for(int i=1; i<(ndim+1)/2; i++)
        {
            y[2*i-1]=x.x[i];
            y[2*i]=x.y[i];
        }
        if(ndim%2 == 0)
        {
            y[ndim-1]=x.x[ndim/2];
        }
        rfftb(ndim, y, wavetable);
    }
}
```

```
package nl.dut.ide.software.soundfilterrealgit;
/**
 * @author Baoshe Zhang
 * @author Astronomical Instrument Group of University of Lethbridge.
*/
class RealDoubleFFT_Mixed
```

Real Double FFT_Mixed

```
{
/*-------------------------------------------------
  radf2: Real FFT's forward processing of factor 2
 -------------------------------------------------*/
    void radf2(int ido, int l1, final double cc[], double ch[],
               final double wtable[], int offset)
    {
        int     i, k, ic;
        double  ti2, tr2;
        int iw1;
        iw1 = offset;

              for(k=0; k<l1; k++)
        {
                ch[2*k*ido]=cc[k*ido]+cc[(k+l1)*ido];
                ch[(2*k+1)*ido+ido-1]=cc[k*ido]-cc[(k+l1)*ido];
        }
        if(ido<2) return;
        if(ido !=2)
        {
                for(k=0; k<l1; k++)
                {
                   for(i=2; i<ido; i+=2)
                   {
                           ic=ido-i;
                           tr2 = wtable[i-2+iw1]*cc[i-1+(k+l1)*ido]
                    +wtable[i-1+iw1]*cc[i+(k+l1)*ido];
                           ti2 = wtable[i-2+iw1]*cc[i+(k+l1)*ido]
                    -wtable[i-1+iw1]*cc[i-1+(k+l1)*ido];
                           ch[i+2*k*ido]=cc[i+k*ido]+ti2;
                           ch[ic+(2*k+1)*ido]=ti2-cc[i+k*ido];
                           ch[i-1+2*k*ido]=cc[i-1+k*ido]+tr2;
                           ch[ic-1+(2*k+1)*ido]=cc[i-1+k*ido]-tr2;
                   }
                }
                if(ido%2==1)return;
        }
        for(k=0; k<l1; k++)
        {
                ch[(2*k+1)*ido]=-cc[ido-1+(k+l1)*ido];
                ch[ido-1+2*k*ido]=cc[ido-1+k*ido];
        }
    }
/*-------------------------------------------------
  radb2: Real FFT's backward processing of factor 2
 -------------------------------------------------*/
    void radb2(int ido, int l1, final double cc[], double ch[],
               final double wtable[], int offset)
    {
        int     i, k, ic;
        double  ti2, tr2;
        int iw1 = offset;

        for(k=0; k<l1; k++)
        {
                ch[k*ido]=cc[2*k*ido]+cc[ido-1+(2*k+1)*ido];
                ch[(k+l1)*ido]=cc[2*k*ido]-cc[ido-1+(2*k+1)*ido];
        }
        if(ido<2) return;
        if(ido !=2)
        {
                for(k=0; k<l1;++k)
                {
                   for(i=2; i<ido; i+=2)
                   {
                           ic=ido-i;
                           ch[i-1+k*ido]=cc[i-1+2*k*ido]+cc[ic-1+(2*k+1)*ido];
                           tr2=cc[i-1+2*k*ido]-cc[ic-1+(2*k+1)*ido];
                           ch[i+k*ido]=cc[i+2*k*ido]-cc[ic+(2*k+1)*ido];
                           ti2=cc[i+(2*k)*ido]+cc[ic+(2*k+1)*ido];
                           ch[i-1+(k+l1)*ido]=wtable[i-2+iw1]*tr2-wtable[i-1+iw1]*ti2;
                           ch[i+(k+l1)*ido]=wtable[i-2+iw1]*ti2+wtable[i-1+iw1]*tr2;
                   }
                }
                if(ido%2==1) return;
        }
        for(k=0; k<l1; k++)
        {
                ch[ido-1+k*ido]=2*cc[ido-1+2*k*ido];
                ch[ido-1+(k+l1)*ido]=-2*cc[(2*k+1)*ido];
        }
    }
/*-------------------------------------------------
  radf3: Real FFT's forward processing of factor 3
 -------------------------------------------------*/
    void radf3(int ido, int l1, final double cc[], double ch[],
               final double wtable[], int offset)
    {
        final double taur=-0.5D;
        final double taui=0.866025403784439D;
        int     i, k, ic;
        double  ci2, di2, di3, cr2, dr2, dr3, ti2, ti3, tr2, tr3;
        int iw1, iw2;
        iw1 = offset;
        iw2 = iw1 + ido;

        for(k=0; k<l1; k++)
        {
                cr2=cc[(k+l1)*ido]+cc[(k+2*l1)*ido];
                ch[3*k*ido]=cc[k*ido]+cr2;
                ch[(3*k+2)*ido]=taui*(cc[(k+l1*2)*ido]-cc[(k+l1)*ido]);
                ch[ido-1+(3*k+1)*ido]=cc[k*ido]+taur*cr2;
        }
        if(ido==1) return;
        for(k=0; k<l1; k++)
        {
                for(i=2; i<ido; i+=2)
                {
                   ic=ido-i;
                   dr2 = wtable[i-2+iw1]*cc[i-1+(k+l1)*ido]
                  +wtable[i-1+iw1]*cc[i+(k+l1)*ido];
                   di2 = wtable[i-2+iw1]*cc[i+(k+l1)*ido]
                  -wtable[i-1+iw1]*cc[i-1+(k+l1)*ido];
                   dr3 = wtable[i-2+iw2]*cc[i-1+(k+l1*2)*ido]
                  +wtable[i-1+iw2]*cc[i+(k+l1*2)*ido];
                   di3 = wtable[i-2+iw2]*cc[i+(k+l1*2)*ido]
                  -wtable[i-1+iw2]*cc[i-1+(k+l1*2)*ido];
                   cr2 = dr2+dr3;
                   ci2 = di2+di3;
                   ch[i-1+3*k*ido]=cc[i-1+k*ido]+cr2;
                   ch[i+3*k*ido]=cc[i+k*ido]+ci2;
                   tr2=cc[i-1+k*ido]+taur*cr2;
                   ti2=cc[i+k*ido]+taur*ci2;
                   tr3=taui*(di2-di3);
```

```
                ti3=taui*(dr3-dr2);
                ch[i-1+(3*k+2)*ido]=tr2+tr3;
                ch[ic-1+(3*k+1)*ido]=tr2-tr3;
                ch[i+(3*k+2)*ido]=ti2+ti3;
                ch[ic+(3*k+1)*ido]=ti3-ti2;
            }
        }
    }

/*----------------------------------------------
  radb3: Real FFT's backward processing of factor 3
 ----------------------------------------------*/
    void radb3(int ido, int l1, final double cc[], double ch[],
               final double wtable[], int offset)
    {
        final double taur=-0.5D;
        final double taui=0.866025403784439D;
        int i, k, ic;
        double ci2, ci3, di2, di3, cr2, cr3, dr2, dr3, ti2, tr2;
        int iw1, iw2;
        iw1 = offset;
        iw2 = iw1 + ido;

        for(k=0; k<l1; k++)
        {
            tr2=2*cc[ido-1+(3*k+1)*ido];
            cr2=cc[3*k*ido]+taur*tr2;
            ch[k*ido]=cc[3*k*ido]+tr2;
            ci3=2*taui*cc[(3*k+2)*ido];
            ch[(k+l1)*ido]=cr2-ci3;
            ch[(k+2*l1)*ido]=cr2+ci3;
        }
        if(ido==1) return;
        for(k=0; k<l1; k++)
        {
            for(i=2; i<ido; i+=2)
            {
                ic=ido-i;
                tr2=cc[i-1+(3*k+2)*ido]+cc[ic-1+(3*k+1)*ido];
                cr2=cc[i-1+3*k*ido]+taur*tr2;
                ch[i-1+k*ido]=cc[i-1+3*k*ido]+tr2;
                ti2=cc[i+(3*k+2)*ido]-cc[ic+(3*k+1)*ido];
                ci2=cc[i+3*k*ido]+taur*ti2;
                ch[i+k*ido]=cc[i+3*k*ido]+ti2;
                cr3=taui*(cc[i-1+(3*k+2)*ido]-cc[ic-1+(3*k+1)*ido]);
                ci3=taui*(cc[i+(3*k+2)*ido]+cc[ic+(3*k+1)*ido]);
                dr2=cr2-ci3;
                dr3=cr2+ci3;
                di2=ci2+cr3;
                di3=ci2-cr3;
                ch[i-1+(k+l1)*ido] = wtable[i-2+iw1]*dr2
                                   -wtable[i-1+iw1]*di2;
                ch[i+(k+l1)*ido] = wtable[i-2+iw1]*di2
                                 +wtable[i-1+iw1]*dr2;
                ch[i-1+(k+2*l1)*ido] = wtable[i-2+iw2]*dr3
                                     -wtable[i-1+iw2]*di3;
                ch[i+(k+2*l1)*ido] = wtable[i-2+iw2]*di3
                                   +wtable[i-1+iw2]*dr3;
            }
        }
    }

/*----------------------------------------------
  radf4: Real FFT's forward processing of factor 4
 ----------------------------------------------*/
    void radf4(int ido, int l1, final double cc[], double ch[],
               final double wtable[], int offset)
    {
        final double hsqt2=0.7071067811865475D;
        int i, k, ic;
        double ci2, ci3, ci4, cr2, cr3, cr4, ti1, ti2, ti3, ti4, tr1, tr2, tr3, tr4;
        int iw1, iw2, iw3;
        iw1 = offset;
        iw2 = offset + ido;
        iw3 = iw2 + ido;
        for(k=0; k<l1; k++)
        {
            tr1=cc[(k+l1)*ido]+cc[(k+3*l1)*ido];
            tr2=cc[k*ido]+cc[(k+2*l1)*ido];
            ch[4*k*ido]=tr1+tr2;
            ch[ido-1+(4*k+3)*ido]=tr2-tr1;
            ch[ido-1+(4*k+1)*ido]=cc[k*ido]-cc[(k+2*l1)*ido];
            ch[(4*k+2)*ido]=cc[(k+3*l1)*ido]-cc[(k+l1)*ido];
        }
        if(ido<2) return;
        if(ido !=2)
        {
            for(k=0; k<l1; k++)
            {
                for(i=2; i<ido; i+=2)
                {
                    ic=ido-i;
                    cr2 = wtable[i-2+iw1]*cc[i-1+(k+l1)*ido]
                  +wtable[i-1+iw1]*cc[i+(k+l1)*ido];
                    ci2 = wtable[i-2+iw1]*cc[i+(k+l1)*ido]
                  -wtable[i-1+iw1]*cc[i-1+(k+l1)*ido];
                    cr3 = wtable[i-2+iw2]*cc[i-1+(k+2*l1)*ido]
                  +wtable[i-1+iw2]*cc[i+(k+2*l1)*ido];
                    ci3 = wtable[i-2+iw2]*cc[i+(k+2*l1)*ido]
                  -wtable[i-1+iw2]*cc[i-1+(k+2*l1)*ido];
                    cr4 = wtable[i-2+iw3]*cc[i-1+(k+3*l1)*ido]
                  +wtable[i-1+iw3]*cc[i+(k+3*l1)*ido];
                    ci4 = wtable[i-2+iw3]*cc[i+(k+3*l1)*ido]
                  -wtable[i-1+iw3]*cc[i-1+(k+3*l1)*ido];
                    tr1=cr2+cr4;
                    tr4=cr4-cr2;
                    ti1=ci2+ci4;
                    ti4=ci2-ci4;
                    ti2=cc[i+k*ido]+ci3;
                    ti3=cc[i+k*ido]-ci3;
                    tr2=cc[i-1+k*ido]+cr3;
                    tr3=cc[i-1+k*ido]-cr3;
                    ch[i-1+4*k*ido]=tr1+tr2;
                    ch[ic-1+(4*k+3)*ido]=tr2-tr1;
                    ch[i+4*k*ido]=ti1+ti2;
                    ch[ic+(4*k+3)*ido]=ti1-ti2;
                    ch[i-1+(4*k+2)*ido]=ti4+tr3;
                    ch[ic-1+(4*k+1)*ido]=tr3-ti4;
                    ch[i+(4*k+2)*ido]=tr4+ti3;
                    ch[ic+(4*k+1)*ido]=tr4-ti3;
                }
            }
            if(ido%2==1) return;
        }
        for(k=0; k<l1; k++)
        {
            ti1=-hsqt2*(cc[ido-1+(k+l1)*ido]+cc[ido-1+(k+3*l1)*ido]);
```

```
            tr1=hsqt2*(cc[ido-1+(k+l1)*ido]-cc[ido-1+(k+3*l1)*ido]);
            ch[ido-1+4*k*ido]=tr1+cc[ido-1+k*ido];
                    ch[ido-1+(4*k+2)*ido]=cc[ido-1+k*ido]-tr1;
                    ch[(4*k+1)*ido]=ti1-cc[ido-1+(k+2*l1)*ido];
                    ch[(4*k+3)*ido]=ti1+cc[ido-1+(k+2*l1)*ido];
        }
    }
/*---------------------------------------------
  radb4: Real FFT's backward processing of factor 4
 ---------------------------------------------*/
    void radb4(int ido, int l1, final double cc[], double ch[],
                    final double wtable[], int offset)
    {
        final double sqrt2=1.414213562373095D;
        int i, k, ic;
        double  ci2, ci3, ci4, cr2, cr3, cr4;
        double  ti1, ti2, ti3, ti4, tr1, tr2, tr3, tr4;
        int iw1, iw2, iw3;
        iw1 = offset;
        iw2 = iw1 + ido;
        iw3 = iw2 + ido;

        for(k=0; k<l1; k++)
        {
                tr1=cc[4*k*ido]-cc[ido-1+(4*k+3)*ido];
                tr2=cc[4*k*ido]+cc[ido-1+(4*k+3)*ido];
                tr3=cc[ido-1+(4*k+1)*ido]+cc[ido-1+(4*k+1)*ido];
                tr4=cc[(4*k+2)*ido]+cc[(4*k+2)*ido];
                ch[k*ido]=tr2+tr3;
                ch[(k+l1)*ido]=tr1-tr4;
                ch[(k+2*l1)*ido]=tr2-tr3;
                ch[(k+3*l1)*ido]=tr1+tr4;
        }
        if(ido<2) return;
        if(ido !=2)
        {
                for(k=0; k<l1;++k)
                {
                    for(i=2; i<ido; i+=2)
                    {
                                ic=ido-i;
                                ti1=cc[i+4*k*ido]+cc[ic+(4*k+3)*ido];
                                ti2=cc[i+4*k*ido]-cc[ic+(4*k+3)*ido];
                                ti3=cc[i+(4*k+2)*ido]-cc[ic+(4*k+1)*ido];
                                tr4=cc[i+(4*k+2)*ido]+cc[ic+(4*k+1)*ido];
                                tr1=cc[i-1+4*k*ido]-cc[ic-1+(4*k+3)*ido];
                                tr2=cc[i-1+4*k*ido]+cc[ic-1+(4*k+3)*ido];
                                ti4=cc[i-1+(4*k+2)*ido]-cc[ic-1+(4*k+1)*ido];
                                tr3=cc[i-1+(4*k+2)*ido]+cc[ic-1+(4*k+1)*ido];
                                ch[i-1+k*ido]=tr2+tr3;
                                cr3=tr2-tr3;
                                ch[i+k*ido]=ti2+ti3;
                                ci3=ti2-ti3;
                                cr2=tr1-tr4;
                                cr4=tr1+tr4;
                                ci2=ti1+ti4;
                                ci4=ti1-ti4;
                                ch[i-1+(k+l1)*ido] = wtable[i-2+iw1]*cr2
                            -wtable[i-1+iw1]*ci2;
                                ch[i+(k+l1)*ido] = wtable[i-2+iw1]*ci2
                            +wtable[i-1+iw1]*cr2;
                                ch[i-1+(k+2*l1)*ido] = wtable[i-2+iw2]*cr3
                             -wtable[i-1+iw2]*ci3;
                                ch[i+(k+2*l1)*ido] = wtable[i-2+iw2]*ci3
                             +wtable[i-1+iw2]*cr3;
                                ch[i-1+(k+3*l1)*ido] = wtable[i-2+iw3]*cr4
                              -wtable[i-1+iw3]*ci4;
                                ch[i+(k+3*l1)*ido] = wtable[i-2+iw3]*ci4
                            +wtable[i-1+iw3]*cr4;
                    }
                }
                if(ido%2==1) return;
        }
        for(k=0; k<l1; k++)
        {
                ti1=cc[(4*k+1)*ido]+cc[(4*k+3)*ido];
                ti2=cc[(4*k+3)*ido]-cc[(4*k+1)*ido];
                tr1=cc[ido-1+4*k*ido]-cc[ido-1+(4*k+2)*ido];
                tr2=cc[ido-1+4*k*ido]+cc[ido-1+(4*k+2)*ido];
                ch[ido-1+k*ido]=tr2+tr2;
                ch[ido-1+(k+l1)*ido]=sqrt2*(tr1-ti1);
                ch[ido-1+(k+2*l1)*ido]=ti2+ti2;
                ch[ido-1+(k+3*l1)*ido]=-sqrt2*(tr1+ti1);
        }
    }
/*---------------------------------------------
  radf5: Real FFT's forward processing of factor 5
 ---------------------------------------------*/
    void radf5(int ido, int l1, final double cc[], double ch[],
                    final double wtable[], int offset)
    {
        final double tr11=0.309016994374947D;
        final double ti11=0.951056516295154D;
        final double tr12=-0.809016994374947D;
        final double ti12=0.587785252292473D;
        int     i, k, ic;
        double  ci2, di2, ci4, ci5, di3, di4, di5, ci3, cr2, cr3, dr2, dr3,
                dr4, dr5, cr5, cr4, ti2, ti3, ti5, ti4, tr2, tr3, tr4, tr5;
        int iw1, iw2, iw3, iw4;
        iw1 = offset;
        iw2 = iw1 + ido;
        iw3 = iw2 + ido;
        iw4 = iw3 + ido;

        for(k=0; k<l1; k++)
        {
                cr2=cc[(k+4*l1)*ido]+cc[(k+l1)*ido];
                ci5=cc[(k+4*l1)*ido]-cc[(k+l1)*ido];
                cr3=cc[(k+3*l1)*ido]+cc[(k+2*l1)*ido];
                ci4=cc[(k+3*l1)*ido]-cc[(k+2*l1)*ido];
                ch[5*k*ido]=cc[k*ido]+cr2+cr3;
                ch[ido-1+(5*k+1)*ido]=cc[k*ido]+tr11*cr2+tr12*cr3;
                ch[(5*k+2)*ido]=ti11*ci5+ti12*ci4;
                ch[ido-1+(5*k+3)*ido]=cc[k*ido]+tr12*cr2+tr11*cr3;
                ch[(5*k+4)*ido]=ti12*ci5-ti11*ci4;
        }
        if(ido==1) return;
        for(k=0; k<l1;++k)
        {
                for(i=2; i<ido; i+=2)
                {
                    ic=ido-i;
                            dr2 = wtable[i-2+iw1]*cc[i-1+(k+l1)*ido]
                        +wtable[i-1+iw1]*cc[i+(k+l1)*ido];
                            di2 = wtable[i-2+iw1]*cc[i+(k+l1)*ido]
```

```
                -wtable[i-1+iw1]*cc[i-1+(k+l1)*ido];
                        dr3 = wtable[i-2+iw2]*cc[i-1+(k+2*l1)*ido]
                +wtable[i-1+iw2]*cc[i+(k+2*l1)*ido];
                        di3 = wtable[i-2+iw2]*cc[i+(k+2*l1)*ido]
                -wtable[i-1+iw2]*cc[i-1+(k+2*l1)*ido];
                        dr4 = wtable[i-2+iw3]*cc[i-1+(k+3*l1)*ido]
                +wtable[i-1+iw3]*cc[i+(k+3*l1)*ido];
                        di4 = wtable[i-2+iw3]*cc[i+(k+3*l1)*ido]
                -wtable[i-1+iw3]*cc[i-1+(k+3*l1)*ido];
                        dr5 = wtable[i-2+iw4]*cc[i-1+(k+4*l1)*ido]
                +wtable[i-1+iw4]*cc[i+(k+4*l1)*ido];
                        di5 = wtable[i-2+iw4]*cc[i+(k+4*l1)*ido]
                -wtable[i-1+iw4]*cc[i-1+(k+4*l1)*ido];
                        cr2=dr2+dr5;
                        ci5=dr5-dr2;
                        cr5=di2-di5;
                        ci2=di2+di5;
                        cr3=dr3+dr4;
                        ci4=dr4-dr3;
                        cr4=di3-di4;
                        ci3=di3+di4;
                        ch[i-1+5*k*ido]=cc[i-1+k*ido]+cr2+cr3;
                        ch[i+5*k*ido]=cc[i+k*ido]+ci2+ci3;
                        tr2=cc[i-1+k*ido]+tr11*cr2+tr12*cr3;
                        ti2=cc[i+k*ido]+tr11*ci2+tr12*ci3;
                        tr3=cc[i-1+k*ido]+tr12*cr2+tr11*cr3;
                        ti3=cc[i+k*ido]+tr12*ci2+tr11*ci3;
                        tr5=ti11*cr5+ti12*cr4;
                        ti5=ti11*ci5+ti12*ci4;
                        tr4=ti12*cr5-ti11*cr4;
                        ti4=ti12*ci5-ti11*ci4;
                        ch[i-1+(5*k+2)*ido]=tr2+tr5;
                        ch[ic-1+(5*k+1)*ido]=tr2-tr5;
                        ch[i+(5*k+2)*ido]=ti2+ti5;
                        ch[ic+(5*k+1)*ido]=ti5-ti2;
                        ch[i-1+(5*k+4)*ido]=tr3+tr4;
                        ch[ic-1+(5*k+3)*ido]=tr3-tr4;
                        ch[i+(5*k+4)*ido]=ti3+ti4;
                        ch[ic+(5*k+3)*ido]=ti4-ti3;
                }
        }
    }

/*----------------------------------------------------
  radb5: Real FFT's backward processing of factor 5
 ----------------------------------------------------*/
    void radb5(int ido, int l1, final double cc[], double ch[],
                    final double wtable[], int offset)
    {
        final double tr11=0.309016994374947D;
        final double ti11=0.951056516295154D;
        final double tr12=-0.809016994374947D;
        final double ti12=0.587785252292473D;
        int     i, k, ic;
        double  ci2, ci3, ci4, ci5, di3, di4, di5, di2, cr2, cr3, cr5, cr4,
                ti2, ti3, ti4, ti5, dr3, dr4, dr5, dr2, tr2, tr3, tr4, tr5;
        int iw1, iw2, iw3, iw4;
        iw1 = offset;
        iw2 = iw1 + ido;
        iw3 = iw2 + ido;
        iw4 = iw3 + ido;

        for(k=0; k<l1; k++)
        {
                        ti5=2*cc[(5*k+2)*ido];
                        ti4=2*cc[(5*k+4)*ido];
                        tr2=2*cc[ido-1+(5*k+1)*ido];
                        tr3=2*cc[ido-1+(5*k+3)*ido];
                        ch[k*ido]=cc[5*k*ido]+tr2+tr3;
                        cr2=cc[5*k*ido]+tr11*tr2+tr12*tr3;
                        cr3=cc[5*k*ido]+tr12*tr2+tr11*tr3;
                        ci5=ti11*ti5+ti12*ti4;
                        ci4=ti12*ti5-ti11*ti4;
                        ch[(k+l1)*ido]=cr2-ci5;
                        ch[(k+2*l1)*ido]=cr3-ci4;
                        ch[(k+3*l1)*ido]=cr3+ci4;
                        ch[(k+4*l1)*ido]=cr2+ci5;
        }
        if(ido==1) return;
        for(k=0; k<l1;++k)
        {
                for(i=2; i<ido; i+=2)
                {
                        ic=ido-i;
                        ti5=cc[i+(5*k+2)*ido]+cc[ic+(5*k+1)*ido];
                        ti2=cc[i+(5*k+2)*ido]-cc[ic+(5*k+1)*ido];
                        ti4=cc[i+(5*k+4)*ido]+cc[ic+(5*k+3)*ido];
                        ti3=cc[i+(5*k+4)*ido]-cc[ic+(5*k+3)*ido];
                        tr5=cc[i-1+(5*k+2)*ido]-cc[ic-1+(5*k+1)*ido];
                        tr2=cc[i-1+(5*k+2)*ido]+cc[ic-1+(5*k+1)*ido];
                        tr4=cc[i-1+(5*k+4)*ido]-cc[ic-1+(5*k+3)*ido];
                        tr3=cc[i-1+(5*k+4)*ido]+cc[ic-1+(5*k+3)*ido];
                        ch[i-1+k*ido]=cc[i-1+5*k*ido]+tr2+tr3;
                        ch[i+k*ido]=cc[i+5*k*ido]+ti2+ti3;
                        cr2=cc[i-1+5*k*ido]+tr11*tr2+tr12*tr3;

                        ci2=cc[i+5*k*ido]+tr11*ti2+tr12*ti3;
                        cr3=cc[i-1+5*k*ido]+tr12*tr2+tr11*tr3;

                        ci3=cc[i+5*k*ido]+tr12*ti2+tr11*ti3;
                        cr5=ti11*tr5+ti12*tr4;
                        ci5=ti11*ti5+ti12*ti4;
                        cr4=ti12*tr5-ti11*tr4;
                        ci4=ti12*ti5-ti11*ti4;
                        dr3=cr3-ci4;
                        dr4=cr3+ci4;
                        di3=ci3+cr4;
                        di4=ci3-cr4;
                        dr5=cr2+ci5;
                        dr2=cr2-ci5;
                        di5=ci2-cr5;
                        di2=ci2+cr5;
                        ch[i-1+(k+l1)*ido] = wtable[i-2+iw1]*dr2
                           -wtable[i-1+iw1]*di2;
                        ch[i+(k+l1)*ido] = wtable[i-2+iw1]*di2
                          +wtable[i-1+iw1]*dr2;
                        ch[i-1+(k+2*l1)*ido] = wtable[i-2+iw2]*dr3
                           -wtable[i-1+iw2]*di3;
                        ch[i+(k+2*l1)*ido] = wtable[i-2+iw2]*di3
                          +wtable[i-1+iw2]*dr3;
                        ch[i-1+(k+3*l1)*ido] = wtable[i-2+iw3]*dr4
                           -wtable[i-1+iw3]*di4;
                        ch[i+(k+3*l1)*ido] = wtable[i-2+iw3]*di4
                          +wtable[i-1+iw3]*dr4;
                        ch[i-1+(k+4*l1)*ido] = wtable[i-2+iw4]*dr5
                           -wtable[i-1+iw4]*di5;
                        ch[i+(k+4*l1)*ido] = wtable[i-2+iw4]*di5
```

```
                        +wtable[i-1+iw4]*dr5;
                }
            }
        }

/*-----------------------------------------------------
  radfg: Real FFT's forward processing of general factor
  -----------------------------------------------------*/
    void radfg(int ido, int ip, int l1, int idl1, double cc[],
                double c1[], double c2[], double ch[], double ch2[],
                final double wtable[], int offset)
    {
        final double twopi=2.0D*Math.PI; //6.28318530717959;
        int     idij, ipph, i, j, k, l, j2, ic, jc, lc, ik, is, nbd;
        double  dc2, ai1, ai2, ar1, ar2, ds2, dcp, arg, dsp, ar1h, ar2h;
        int iw1 = offset;

        arg=twopi / (double)ip;
        dcp=Math.cos(arg);
        dsp=Math.sin(arg);
        ipph=(ip+1)/ 2;
        nbd=(ido-1)/ 2;
        if(ido !=1)
        {
                for(ik=0; ik<idl1; ik++) ch2[ik]=c2[ik];
                for(j=1; j<ip; j++)
                  for(k=0; k<l1; k++)
                        ch[(k+j*l1)*ido]=c1[(k+j*l1)*ido];
                if(nbd<=l1)
                {
                    is=-ido;
                    for(j=1; j<ip; j++)
                    {
                            is+=ido;
                            idij=is-1;
                            for(i=2; i<ido; i+=2)
                            {
                                idij+=2;
                                for(k=0; k<l1; k++)
                                {
                                     ch[i-1+(k+j*l1)*ido]=
                                       wtable[idij-1+iw1]*c1[i-1+(k+j*l1)*ido]
                             +wtable[idij+iw1]*c1[i+(k+j*l1)*ido];
                                     ch[i+(k+j*l1)*ido]=
                                       wtable[idij-1+iw1]*c1[i+(k+j*l1)*ido]
                             -wtable[idij+iw1]*c1[i-1+(k+j*l1)*ido];
                                }
                            }
                    }
                }
                else
                {
                    is=-ido;
                    for(j=1; j<ip; j++)
                    {
                            is+=ido;
                            for(k=0; k<l1; k++)
                            {
                                idij=is-1;
                                for(i=2; i<ido; i+=2)
                                {
                                        idij+=2;
                                        ch[i-1+(k+j*l1)*ido]=
                                          wtable[idij-1+iw1]*c1[i-1+(k+j*l1)*ido]
                                +wtable[idij+iw1]*c1[i+(k+j*l1)*ido];
                                        ch[i+(k+j*l1)*ido]=
                                          wtable[idij-1+iw1]*c1[i+(k+j*l1)*ido]
                                -wtable[idij+iw1]*c1[i-1+(k+j*l1)*ido];
                                }
                            }
                    }
                }
                if(nbd>=l1)
                {
                    for(j=1; j<ipph; j++)
                    {
                            jc=ip-j;
                            for(k=0; k<l1; k++)
                            {
                                for(i=2; i<ido; i+=2)
                                {
                                        c1[i-1+(k+j*l1)*ido]=ch[i-1+(k+j*l1)*ido]+ch[i-1+(k+jc*l1)*ido];
                                        c1[i-1+(k+jc*l1)*ido]=ch[i+(k+j*l1)*ido]-ch[i+(k+jc*l1)*ido];
                                        c1[i+(k+j*l1)*ido]=ch[i+(k+j*l1)*ido]+ch[i+(k+jc*l1)*ido];
                                        c1[i+(k+jc*l1)*ido]=ch[i-1+(k+jc*l1)*ido]-ch[i-1+(k+j*l1)*ido];
                                }
                            }
                    }
                }
                else
                {
                    for(j=1; j<ipph; j++)
                    {
                            jc=ip-j;
                            for(i=2; i<ido; i+=2)
                            {
                                for(k=0; k<l1; k++)
                                {
                                        c1[i-1+(k+j*l1)*ido]=
                                          ch[i-1+(k+j*l1)*ido]+ch[i-1+(k+jc*l1)*ido];
                                        c1[i-1+(k+jc*l1)*ido]=ch[i+(k+j*l1)*ido]-ch[i+(k+jc*l1)*ido];
                                        c1[i+(k+j*l1)*ido]=ch[i+(k+j*l1)*ido]+ch[i+(k+jc*l1)*ido];
                                        c1[i+(k+jc*l1)*ido]=ch[i-1+(k+jc*l1)*ido]-ch[i-1+(k+j*l1)*ido];
                                }
                            }
                    }
                }
        }
        else
        {
                for(ik=0; ik<idl1; ik++) c2[ik]=ch2[ik];
        }
        for(j=1; j<ipph; j++)
        {
                jc=ip-j;
                for(k=0; k<l1; k++)
                {
                    c1[(k+j*l1)*ido]=ch[(k+j*l1)*ido]+ch[(k+jc*l1)*ido];
                    c1[(k+jc*l1)*ido]=ch[(k+jc*l1)*ido]-ch[(k+j*l1)*ido];
                }
        }

        ar1=1;
        ai1=0;
        for(l=1; l<ipph; l++)
        {
                lc=ip-l;
```

```
                ar1h=dcp*ar1-dsp*ai1;
                ai1=dcp*ai1+dsp*ar1;
                ar1=ar1h;
                for(ik=0; ik<idl1; ik++)
                {
                    ch2[ik+l*idl1]=c2[ik]+ar1*c2[ik+idl1];
                    ch2[ik+lc*idl1]=ai1*c2[ik+(ip-1)*idl1];
                }
                dc2=ar1;
                ds2=ai1;
                ar2=ar1;
                ai2=ai1;
                for(j=2; j<ipph; j++)
                {
                    jc=ip-j;
                    ar2h=dc2*ar2-ds2*ai2;
                    ai2=dc2*ai2+ds2*ar2;
                    ar2=ar2h;
                    for(ik=0; ik<idl1; ik++)
                    {
                            ch2[ik+l*idl1]+=ar2*c2[ik+j*idl1];
                            ch2[ik+lc*idl1]+=ai2*c2[ik+jc*idl1];
                    }
                }
        }
        for(j=1; j<ipph; j++)
                for(ik=0; ik<idl1; ik++)
                  ch2[ik]+=c2[ik+j*idl1];

        if(ido>=l1)
        {
                for(k=0; k<l1; k++)
                {
                  for(i=0; i<ido; i++)
                  {
                          cc[i+k*ip*ido]=ch[i+k*ido];
                  }
                }
        }
        else
        {
                for(i=0; i<ido; i++)
                {
                    for(k=0; k<l1; k++)
                    {
                            cc[i+k*ip*ido]=ch[i+k*ido];
                    }
                }
        }
        for(j=1; j<ipph; j++)
        {
                jc=ip-j;
                j2=2*j;
                for(k=0; k<l1; k++)
                {
                    cc[ido-1+(j2-1+k*ip)*ido]=ch[(k+j*l1)*ido];
                    cc[(j2+k*ip)*ido]=ch[(k+jc*l1)*ido];
                }
        }
        if(ido==1) return;
        if(nbd>=l1)
        {
                for(j=1; j<ipph; j++)
                {
                    jc=ip-j;
                    j2=2*j;
                    for(k=0; k<l1; k++)
                    {
                            for(i=2; i<ido; i+=2)
                            {
                                ic=ido-i;
                                cc[i-1+(j2+k*ip)*ido]=ch[i-1+(k+j*l1)*ido]+ch[i-1+(k+jc*l1)*ido];
                                cc[ic-1+(j2-1+k*ip)*ido]=ch[i-1+(k+j*l1)*ido]-ch[i-1+(k+jc*l1)*ido];
                                cc[i+(j2+k*ip)*ido]=ch[i+(k+j*l1)*ido]+ch[i+(k+jc*l1)*ido];
                                cc[ic+(j2-1+k*ip)*ido]=ch[i+(k+jc*l1)*ido]-ch[i+(k+j*l1)*ido];
                            }
                    }
                }
        }
        else
        {
                for(j=1; j<ipph; j++)
                {
                    jc=ip-j;
                    j2=2*j;
                    for(i=2; i<ido; i+=2)
                    {
                            ic=ido-i;
                            for(k=0; k<l1; k++)
                            {
                                cc[i-1+(j2+k*ip)*ido]=ch[i-1+(k+j*l1)*ido]+ch[i-1+(k+jc*l1)*ido];
                                cc[ic-1+(j2-1+k*ip)*ido]=ch[i-1+(k+j*l1)*ido]-ch[i-1+(k+jc*l1)*ido];
                                cc[i+(j2+k*ip)*ido]=ch[i+(k+j*l1)*ido]+ch[i+(k+jc*l1)*ido];
                                cc[ic+(j2-1+k*ip)*ido]=ch[i+(k+jc*l1)*ido]-ch[i+(k+j*l1)*ido];
                            }
                    }
                }
        }
    }

/*----------------------------------------------------------
  radbg: Real FFT's backward processing of general factor
  ----------------------------------------------------------*/
    void radbg(int ido, int ip, int l1, int idl1, double cc[], double c1[],
                double c2[], double ch[], double ch2[], final double wtable[], int offset)
    {
        final double twopi=2.0D*Math.PI; //6.28318530717959;
        int     idij, ipph, i, j, k, l, j2, ic, jc, lc, ik, is;
        double  dc2, ai1, ai2, ar1, ar2, ds2;
        int     nbd;
        double  dcp, arg, dsp, ar1h, ar2h;
        int iw1 = offset;

        arg=twopi / (double)ip;
        dcp=Math.cos(arg);
        dsp=Math.sin(arg);
        nbd=(ido-1)/ 2;
        ipph=(ip+1)/ 2;
        if(ido>=l1)
        {
                for(k=0; k<l1; k++)
                {
                    for(i=0; i<ido; i++)
                    {
                            ch[i+k*ido]=cc[i+k*ip*ido];
                    }
                }
```

```
}
else
{
	for(i=0; i<ido; i++)
	{
	   for(k=0; k<l1; k++)
	   {
		ch[i+k*ido]=cc[i+k*ip*ido];
	   }
	}
}
for(j=1; j<ipph; j++)
{
	jc=ip-j;
	j2=2*j;
	for(k=0; k<l1; k++)
	{
	   ch[(k+j*l1)*ido]=cc[ido-1+(j2-1+k*ip)*ido]+cc[ido-1+(j2-1+k*ip)*ido];
	   ch[(k+jc*l1)*ido]=cc[(j2+k*ip)*ido]+cc[(j2+k*ip)*ido];
	}
}

if(ido !=1)
{
	if(nbd>=l1)
	{
	   for(j=1; j<ipph; j++)
	   {
		jc=ip-j;
		for(k=0; k<l1; k++)
		{
		   for(i=2; i<ido; i+=2)
		   {
			ic=ido-i;
			ch[i-1+(k+j*l1)*ido]=cc[i-1+(2*j+k*ip)*ido]+cc[ic-1+(2*j-1+k*ip)*ido];
			ch[i-1+(k+jc*l1)*ido]=cc[i-1+(2*j+k*ip)*ido]-cc[ic-1+(2*j-1+k*ip)*ido];
			ch[i+(k+j*l1)*ido]=cc[i+(2*j+k*ip)*ido]-cc[ic+(2*j-1+k*ip)*ido];
			ch[i+(k+jc*l1)*ido]=cc[i+(2*j+k*ip)*ido]+cc[ic+(2*j-1+k*ip)*ido];
		   }
		}
	   }
	}
	else
	{
	   for(j=1; j<ipph; j++)
	   {
		jc=ip-j;
		for(i=2; i<ido; i+=2)
		{
		   ic=ido-i;
		   for(k=0; k<l1; k++)
		   {
			ch[i-1+(k+j*l1)*ido]=cc[i-1+(2*j+k*ip)*ido]+cc[ic-1+(2*j-1+k*ip)*ido];
			ch[i-1+(k+jc*l1)*ido]=cc[i-1+(2*j+k*ip)*ido]-cc[ic-1+(2*j-1+k*ip)*ido];
			ch[i+(k+j*l1)*ido]=cc[i+(2*j+k*ip)*ido]-cc[ic+(2*j-1+k*ip)*ido];
			ch[i+(k+jc*l1)*ido]=cc[i+(2*j+k*ip)*ido]+cc[ic+(2*j-1+k*ip)*ido];
		   }
		}
	   }
	}
}

ar1=1;
ai1=0;
for(l=1; l<ipph; l++)
{
	lc=ip-l;
	ar1h=dcp*ar1-dsp*ai1;
	ai1=dcp*ai1+dsp*ar1;
	ar1=ar1h;
	for(ik=0; ik<idl1; ik++)
	{
	   c2[ik+l*idl1]=ch2[ik]+ar1*ch2[ik+idl1];
	   c2[ik+lc*idl1]=ai1*ch2[ik+(ip-1)*idl1];
	}
	dc2=ar1;
	ds2=ai1;
	ar2=ar1;
	ai2=ai1;
	for(j=2; j<ipph; j++)
	{
	   jc=ip-j;
	   ar2h=dc2*ar2-ds2*ai2;
	   ai2=dc2*ai2+ds2*ar2;
	   ar2=ar2h;
	   for(ik=0; ik<idl1; ik++)
	   {
		c2[ik+l*idl1]+=ar2*ch2[ik+j*idl1];
		c2[ik+lc*idl1]+=ai2*ch2[ik+jc*idl1];
	   }
	}
}
for(j=1; j<ipph; j++)
{
	for(ik=0; ik<idl1; ik++)
	{
	   ch2[ik]+=ch2[ik+j*idl1];
	}
}
for(j=1; j<ipph; j++)
{
	jc=ip-j;
	for(k=0; k<l1; k++)
	{
	   ch[(k+j*l1)*ido]=c1[(k+j*l1)*ido]-c1[(k+jc*l1)*ido];
	   ch[(k+jc*l1)*ido]=c1[(k+j*l1)*ido]+c1[(k+jc*l1)*ido];
	}
}

if(ido==1) return;
if(nbd>=l1)
{
	for(j=1; j<ipph; j++)
	{
	   jc=ip-j;
	   for(k=0; k<l1; k++)
	   {
		for(i=2; i<ido; i+=2)
		{
		   ch[i-1+(k+j*l1)*ido]=c1[i-1+(k+j*l1)*ido]-c1[i+(k+jc*l1)*ido];
		   ch[i-1+(k+jc*l1)*ido]=c1[i-1+(k+j*l1)*ido]+c1[i+(k+jc*l1)*ido];
		   ch[i+(k+j*l1)*ido]=c1[i+(k+j*l1)*ido]+c1[i-1+(k+jc*l1)*ido];
		   ch[i+(k+jc*l1)*ido]=c1[i+(k+j*l1)*ido]-c1[i-1+(k+jc*l1)*ido];
		}
	   }
	}
}
```

```
        else
        {
                for(j=1; j<ipph; j++)
                {
                    jc=ip-j;
                    for(i=2; i<ido; i+=2)
                    {
                            for(k=0; k<l1; k++)
                            {
                                ch[i-1+(k+j*l1)*ido]=c1[i-1+(k+j*l1)*ido]-c1[i+(k+jc*l1)*ido];
                                ch[i-1+(k+jc*l1)*ido]=c1[i-1+(k+j*l1)*ido]+c1[i+(k+jc*l1)*ido];
                                ch[i+(k+j*l1)*ido]=c1[i+(k+j*l1)*ido]+c1[i-1+(k+jc*l1)*ido];
                                ch[i+(k+jc*l1)*ido]=c1[i+(k+j*l1)*ido]-c1[i-1+(k+jc*l1)*ido];
                            }
                    }
                }
        }
        for(ik=0; ik<idl1; ik++) c2[ik]=ch2[ik];
        for(j=1; j<ip; j++)
                for(k=0; k<l1; k++)
                    c1[(k+j*l1)*ido]=ch[(k+j*l1)*ido];
        if(nbd<=l1)
        {
                is=-ido;
                for(j=1; j<ip; j++)
                {
                    is+=ido;
                    idij=is-1;
                    for(i=2; i<ido; i+=2)
                    {
                            idij+=2;
                            for(k=0; k<l1; k++)
                            {
                                c1[i-1+(k+j*l1)*ido] = wtable[idij-1+iw1]*ch[i-1+(k+j*l1)*ido]
                                    -wtable[idij+iw1]*ch[i+(k+j*l1)*ido];
                                c1[i+(k+j*l1)*ido] = wtable[idij-1+iw1]*ch[i+(k+j*l1)*ido]
                                   +wtable[idij+iw1]*ch[i-1+(k+j*l1)*ido];
                            }
                    }
                }
        }
        else
        {
                is=-ido;
                for(j=1; j<ip; j++)
                {
                    is+=ido;
                    for(k=0; k<l1; k++)
                    {
                            idij=is-1;
                            for(i=2; i<ido; i+=2)
                            {
                                idij+=2;
                                c1[i-1+(k+j*l1)*ido] = wtable[idij-1+iw1]*ch[i-1+(k+j*l1)*ido]
                                    -wtable[idij+iw1]*ch[i+(k+j*l1)*ido];
                                c1[i+(k+j*l1)*ido] = wtable[idij-1+iw1]*ch[i+(k+j*l1)*ido]
                                   +wtable[idij+iw1]*ch[i-1+(k+j*l1)*ido];
                            }
                    }
                }
        }
    }

/*---------------------------------------------------------
  rfftf1: further processing of Real forward FFT
 ---------------------------------------------------------*/
    void rfftf1(int n, double c[], final double wtable[], int offset)
    {
        int     i;
        int     k1, l1, l2, na, kh, nf, ip, iw, ido, idl1;

        double[] ch = new double[n];
        System.arraycopy(wtable, offset, ch, 0, n);

        nf=(int)wtable[1+2*n+offset];
        na=1;
        l2=n;
        iw=n-1+n+offset;
        for(k1=1; k1<=nf;++k1)
        {
                kh=nf-k1;
                ip=(int)wtable[kh+2+2*n+offset];
                l1=l2 / ip;
                ido=n / l2;
                idl1=ido*l1;
                iw-=(ip-1)*ido;
                na=1-na;
                if(ip==4)
                {
                    if(na==0)
            {
                radf4(ido, l1, c, ch, wtable, iw);
            }
                    else
            {
                radf4(ido, l1, ch, c, wtable, iw);
            }
                }
                else if(ip==2)
                {
                    if(na==0)
            {
                radf2(ido, l1, c, ch, wtable, iw);
            }
                    else
            {
                radf2(ido, l1, ch, c, wtable, iw);
            }
                }
                else if(ip==3)
                {
                    if(na==0)
            {
                 radf3(ido, l1, c, ch, wtable, iw);
            }
                    else
            {
                 radf3(ido, l1, ch, c, wtable, iw);
            }
                }
                else if(ip==5)
                {
                    if(na==0)
            {
                 radf5(ido, l1, c, ch, wtable, iw);
            }
                    else
```

```
                {
                    radf5(ido, l1, ch, c, wtable, iw);
                }
                    }
                    else
                    {
                if(ido==1) na=1-na;
                        if(na==0)
                        {
                    radfg(ido, ip, l1, idl1, c, c, c, ch, ch, wtable, iw);
                                na=1;
                        }
                        else
                        {
                    radfg(ido, ip, l1, idl1, ch, ch, ch, c, c, wtable, iw);
                                na=0;
                        }
                    }
                    l2=l1;
            }
            if(na==1) return;
            for(i=0; i<n; i++) c[i]=ch[i];
        }
    /*----------------------------------------------------------
      rfftb1: further processing of Real backward FFT
     ----------------------------------------------------------*/
        void rfftb1(int n, double c[], final double wtable[], int offset)
        {
            int     i;
            int     k1, l1, l2, na, nf, ip, iw, ido, idl1;

            double[] ch = new double[n];
            System.arraycopy(wtable, offset, ch, 0, n);

            nf=(int)wtable[1+2*n+offset];
            na=0;
            l1=1;
            iw=n+offset;
            for(k1=1; k1<=nf; k1++)
            {
                    ip=(int)wtable[k1+1+2*n+offset];
                    l2=ip*l1;
                    ido=n / l2;
                    idl1=ido*l1;
                    if(ip==4)
                    {
                        if(na==0)
                {
                        radb4(ido, l1, c, ch, wtable, iw);
                }
                        else
                {
                        radb4(ido, l1, ch, c, wtable, iw);
                }
                        na=1-na;
                    }
                    else if(ip==2)
                    {
                        if(na==0)
                {
                     radb2(ido, l1, c, ch, wtable, iw);
                }
                        else
                {
                     radb2(ido, l1, ch, c, wtable, iw);
                }
                        na=1-na;
                    }
                    else if(ip==3)
                    {
                        if(na==0)
                {
                        radb3(ido, l1, c, ch, wtable, iw);
                }
                        else
                {
                        radb3(ido, l1, ch, c, wtable, iw);
                }
                        na=1-na;
                    }
                    else if(ip==5)
                    {
                        if(na==0)
                {
                        radb5(ido, l1, c, ch, wtable, iw);
                }
                        else
                {
                        radb5(ido, l1, ch, c, wtable, iw);
                }
                        na=1-na;
                    }
                    else
                    {
                        if(na==0)
                {
                        radbg(ido, ip, l1, idl1, c, c, c, ch, ch, wtable, iw);
                }
                        else
                {
                        radbg(ido, ip, l1, idl1, ch, ch, ch, c, c, wtable, iw);
                }
                        if(ido==1) na=1-na;
                    }
                    l1=l2;
                    iw+=(ip-1)*ido;
            }
            if(na==0) return;
            for(i=0; i<n; i++) c[i]=ch[i];
        }
    /*----------------------------------------------------------
      rfftf: Real forward FFT
     ----------------------------------------------------------*/
        void rfftf(int n, double r[], double wtable[])
        {
            if(n==1) return;
            rfftf1(n, r, wtable, 0);
        }       /*rfftf*/
    /*----------------------------------------------------------
      rfftf: Real backward FFT
     ----------------------------------------------------------*/
        void rfftb(int n, double r[], double wtable[])
        {
            if(n==1) return;
```

```
        rfftb1(n, r, wtable, 0);
    } /*rfftb*/
/*-----------------------------------------------------------
  rffti1: further initialization of Real FFT
 -----------------------------------------------------------*/
    void rffti1(int n, double wtable[], int offset)
    {
        final int[] ntryh= new int[] {4, 2, 3, 5};
        final double twopi=2.0D*Math.PI;
        double argh;
        int    ntry=0, i, j;
        double argld;
        int    k1, l1, l2, ib;
        double fi;
        int    ld, ii, nf, ip, nl, is, nq, nr;
        double arg;
        int    ido, ipm;
        int    nfm1;

        nl=n;
        nf=0;
        j=0;

      factorize_loop:
        while(true)
        {
            ++j;
            if(j<=4)
                    ntry=ntryh[j-1];
            else
                    ntry+=2;
            do
            {
                    nq=nl / ntry;
                    nr=nl-ntry*nq;
                    if(nr !=0) continue factorize_loop;
                    ++nf;
               wtable[nf+1+2*n+offset]=ntry;

                    nl=nq;
                    if(ntry==2 && nf !=1)
                    {
                       for(i=2; i<=nf; i++)
                       {
                                ib=nf-i+2;
                          wtable[ib+1+2*n+offset]=wtable[ib+2*n+offset];
                       }
                  wtable[2+2*n+offset]=2;
                    }
            }while(nl !=1);
            break factorize_loop;
        }
        wtable[0+2*n+offset] = n;
        wtable[1+2*n+offset] = nf;
        argh=twopi /(double)(n);
        is=0;
        nfm1=nf-1;
        l1=1;
        if(nfm1==0) return;
        for(k1=1; k1<=nfm1; k1++)
        {
            ip=(int)wtable[k1+1+2*n+offset];
                    ld=0;
                    l2=l1*ip;
                    ido=n / l2;
                    ipm=ip-1;
                    for(j=1; j<=ipm;++j)
                    {
                       ld+=l1;
                       i=is;
                       argld=(double)ld*argh;

                       fi=0;
                       for(ii=3; ii<=ido; ii+=2)
                       {
                                i+=2;
                                fi+=1;
                                arg=fi*argld;
                    wtable[i-2+n+offset] = Math.cos(arg);
                    wtable[i-1+n+offset] = Math.sin(arg);
                       }
                       is+=ido;
                    }
                    l1=l2;
        }
    } /*rffti1*/
/*-----------------------------------------------------------
  rffti: Initialization of Real FFT
 -----------------------------------------------------------*/
    void rffti(int n, double wtable[])  /* length of wtable = 2*n + 15 */
    {
        if(n==1) return;
        rffti1(n, wtable, 0);
    } /*rffti*/

}
```

```
package nl.dut.ide.software.soundfilterrealgit;

import android.Manifest;
import android.app.NotificationChannel;
import android.app.NotificationManager;
import android.app.PendingIntent;
import android.app.TimePickerDialog;
import android.content.Context;
import android.content.Intent;
import android.content.pm.PackageManager;
import android.net.Uri;
import android.os.Build;
import android.os.Handler;
import android.support.annotation.NonNull;
import android.support.design.widget.NavigationView;
import android.support.v4.app.ActivityCompat;
import android.support.v4.app.NotificationCompat;
import android.support.v4.app.NotificationManagerCompat;
import android.support.v4.content.ContextCompat;
import android.support.v4.view.GravityCompat;
import android.support.v4.widget.DrawerLayout;
import android.support.v7.app.ActionBarDrawerToggle;
```

Record

```
import android.support.v7.app.AppCompatActivity;

import java.nio.ByteBuffer;
import java.text.DateFormat;
import java.text.ParseException;
import java.text.SimpleDateFormat;
import java.util.ArrayList;
import java.util.Calendar;
import java.util.Date;
import java.util.HashMap;
import java.util.List;
import java.util.Map;

import android.media.AudioFormat;
import android.media.AudioRecord;
import android.media.MediaRecorder;
import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.TextView;
import android.widget.TimePicker;
import android.widget.Toast;

import com.google.android.gms.tasks.OnFailureListener;
import com.google.android.gms.tasks.OnSuccessListener;
import com.google.firebase.auth.FirebaseAuth;
import com.google.firebase.firestore.DocumentSnapshot;
import com.google.firebase.storage.FirebaseStorage;
import com.google.firebase.storage.StorageReference;
import com.google.firebase.storage.UploadTask;
import com.webianks.library.scroll_choice.ScrollChoice;
import com.google.android.gms.tasks.OnCompleteListener;
import com.google.android.gms.tasks.Task;
import com.google.firebase.firestore.FirebaseFirestore;

//Zoltan, the things that are included for place and heart rate can be found by doing ctrl+F "Zoltan"

public class Record extends AppCompatActivity {
    private TextView name, nameMenu, firstLetter, firstLetterMenu;                  //Textview to show the name of the user

    //Recording
    private String TAG = "Record";                  //TAG is used for Logcat, to easily collect the text send to myself
    private static final int RECORDER_SAMPLERATE = 44100;   //Every second 44100 audio samples are taken from the analogue signal, this is
the only sample rate appropriate for all phones
    private static final int RECORDER_CHANNELS = AudioFormat
            .CHANNEL_IN_MONO;                       //Mono is used when you have one channel your audio samples have to go to (for example,
one speaker)
    private static final int RECORDER_AUDIO_ENCODING =
            AudioFormat.ENCODING_PCM_16BIT;                 //Amount of bits used for Pulse-Code-Modulation, 16 is teh most common one
    private AudioRecord recorder = null;            //Make a new, empty Audio recorder
    private Thread recordingThread = null;          //Make a new thread for the Audio recorder
    private static boolean isRecording;             //To check if certain methods have to be done
    int bufferSize = AudioRecord.getMinBufferSize(         //Buffersize for Zoltan
            RECORDER_SAMPLERATE, RECORDER_CHANNELS,
            RECORDER_AUDIO_ENCODING);                   //The number of bytes you can take at the time, getMinBufferSize calculates the mini-
mum needed with the specific phone that is used
    final int REQUEST_PERMISSION = 1000;        //To ask permission for recording again, even though this is done at the test microphone
Activity (the app did not work once because it had forgotten he had permission, so this is included)

    //Save to firebase
    private FirebaseStorage mStorageRef;
    private FirebaseFirestore db;
    private String url;
    byte[] bData;
    private String key;
    int saveFirebaseTime =10*60*1000;                   //Saving the recording to Firebase will happen every 10 minutes
    int saveOtherDataFirebaseTime=1000;                   //Saving other data to Firebase will happen every second

    //Distort recording=fast fourier transform
    double[] toTransform;
    private RealDoubleFFT transformer;                  //Make new Fast Fourier Transformer

    //EmotionSelection
    public static boolean isIsRecording() {
        return isRecording;
    }

    public static void setIsRecording(boolean isRecording) {
        Record.isRecording = isRecording;
    }

    //Calculate decibels
    private double lastPressure;                        //To calculate the decibels
    private double decibel;
    private double decibelReal;
    private static double reference = 0.00002;          //Air pressure (is reference value for microphone)

    //Calculate heart rate
    private int heartRate;                          //For Zoltan

    //Determine place
    private String place;                           //For Zoltan

    //ScrollChoice
    List<String> from = new ArrayList<>();
    ScrollChoice scrollChoiceFrom;
    private Handler recordHandler = new Handler();
    int startTime = 10 * 60 * 1000;                 //Time to wait before start recording when clicking start button, this is 10 min when the user has
not changed anything because I set the ScrollChoice on default on 10 min
    int stopTime = 0;                               //Time to wait before stop recording

    //SelectTimeBox
    TextView DisplayTime;
    private int CalendarHour, CalendarMinute;
    Calendar calendar;
    TimePickerDialog timepickerdialog;

    //While Recording
    String CHANNEL_ID = "SelectEmotionNotificationChannel"; //Channel for push notification to select emotion
    String CHANNEL_ID_2 = "IsRecordingNotificationChannel"; //Channel for push notification to see the app is recording

    //rest
    private DrawerLayout drawer;
    private TextView dateTextview;
    int showNotificationTime=3*60*1000;                 //Notification will be send every hour

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_record);

        //Firebase
        mStorageRef = FirebaseStorage.getInstance();
        db = FirebaseFirestore.getInstance();


        //when you sign out of select emotion, recording will be stopped
```

```
        //since this is in this screen, the onCreate is called
        //however there is no user logged in anymore, so getting the current user will result in null

        //we make this variable to catch the mistake of logging out
        //we tried may ways to solve this, we ended up with this
        //we know it is not the best way, but ik works
        boolean userAlreadyLoggedOut = true;


        try {
            key = FirebaseAuth.getInstance().               //Get the current user
                    getCurrentUser().getUid();
        } catch (NullPointerException e) {
            //only when you come from select emotion you call the onCreate without a user
            //since we are still in the process of logging out
            //we will redirect the user to the login page here
            Log.v("Firestore", "nullpointer after logout ");
            Intent intent = new Intent(this, LoginActivity.class);
            startActivity(intent);
            userAlreadyLoggedOut = false;
        }

        //when there is no user logged in you will not exceute this code
        //this prevents a lot of errors
        //after completing the onCreate the earlier stated intent will direct to user to the right screen
        if (userAlreadyLoggedOut) {


            //Notifications
            createNotificationChannel();                    //Create channel for notification to select emotion

            //While recording
            if (isIsRecording()) {
                intent();                           //Go to SelectEmotion page if app is recording, user does not need to do anything on Record page
                showRecording();                            //Show in notifications bar on the phone of the user that the app is recording
            }

            //Toolbar
            //get date and set it on the actionbar
            android.support.v7.widget.Toolbar toolbarDateNurse = //Import the toolbar
                    findViewById(R.id.toolbar_date);
            dateTextview = findViewById(R.id.date);
            setSupportActionBar(toolbarDateNurse);
            Calendar cal = Calendar.getInstance();
            SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
            String date = sdf.format(cal.getTime());
            getSupportActionBar().setTitle(date);
            dateTextview.setText(date);                     //Set the date in the toolbar

            //include drawermenu
            drawer = findViewById(R.id.menu_drawer_layout);
            ActionBarDrawerToggle toggle = new ActionBarDrawerToggle(this, drawer,
                    R.string.navigation_drawer_open, R.string.navigation_drawer_close);
            drawer.addDrawerListener(toggle);
            toggle.syncState();

            //Name
            name = findViewById(R.id.nameTextView);
            firstLetter = findViewById(R.id.first_letter_name_user_record);

            NavigationView navigationView = (NavigationView) findViewById(R.id.menu_view);
            nameMenu = navigationView.findViewById(R.id.name_user_menu_header);
            firstLetterMenu = navigationView.findViewById(R.id.first_letter_name_user_menu_header);
            readName();                                 //Read the name from Firebase and show it on the screen

            //Recording
            (findViewById(R.id.startRecButton)).                //Set the onClickListener btnClick on the start button
                    setOnClickListener(btnClick);
            if (!checkPermissionMic()) {                    //Check if there is still permission to record
                requestPermission();                        //If not, request permission
            }

            //ScrollChoice
            scrollChoiceFrom = findViewById(R.id.fromScroll);
            loadChoices();
            scrollChoiceFrom.addItems(from, 1);     //At default, the second item is selected (0 is the first item)
            scrollChoiceFrom.setOnItemSelectedListener(         //Set a listener on the scroll choice > when the users selects something else, teh
recording should start after another time
                    new ScrollChoice.OnItemSelectedListener() {
                        @Override
                        public void onItemSelected(ScrollChoice scrollChoice, int position, String name) {
                            startTime(position);                //The position in the list decides how long the app has to wait before starting to record (0=0 sec,
1=10 min etc.)
                        }
                    });

            //SelectTimeBox
            DisplayTime = findViewById(R.id.untilTime);
            Calendar calOnCreate = Calendar.getInstance();      //Make the current time the default
            Date timeOnCreate = calOnCreate.getTime();
            SimpleDateFormat onCreate = new SimpleDateFormat("HH:mm");
            String currentTime = onCreate.format(timeOnCreate).toString();
            DisplayTime.setText(currentTime);
            (findViewById(R.id.untilTime)).
                    setOnClickListener(selectTime);             //When the user ticks on the time, (s)he has to be able to select another time
            stopTime(currentTime);                          //The default is the current time, so when the user does not change the time, this is when the
recording has to end


            //Give notification when whole app stops, this service will be running in the background and will the last thing that is done when the
app is swiped away
            Intent intent = new Intent(this, StopService.class);
            startService(intent);
        }
    }

    //Name-----------------------------------------------------------------------------------------------------------------------------------------
    private void readName() {
        //look at firebase to see who is logged in
        Log.v("Firestore", "readName method start");
        FirebaseFirestore db = FirebaseFirestore.getInstance();

        if (key == null) {                                  //It is not possible, but when the user one way or another comes here without a key, this
code is included
            Intent intent = new Intent(this, LoginActivity.class);
            startActivity(intent);
        }

        db.collection("users").document(key).get().addOnCompleteListener(new OnCompleteListener<DocumentSnapshot>() {
            @Override
            public void onComplete(@NonNull Task<DocumentSnapshot> task) {
                if (task.isSuccessful()) {
                    DocumentSnapshot documentSnapshot = task.getResult();
                    String value = documentSnapshot.getString("name");
                    name.setText(value);
                    nameMenu.setText(value);
```

```
                //now we set the first letter
                String letterInPut = String.valueOf(value.charAt(0));
                firstLetter.setText(letterInPut);
                firstLetterMenu.setText(letterInPut);
            }
        }
    });
}

//Recording-----------------------------------------------------------------------------------------------------------------------------------
private void startRecording() {
    recorder = new AudioRecord(MediaRecorder.AudioSource.MIC,   //Make a new recorder
            RECORDER_SAMPLERATE, RECORDER_CHANNELS,
            RECORDER_AUDIO_ENCODING, bufferSize * 2);
    Log.v(TAG, "Recording started");
    recorder.startRecording();                          //Start recording
    setIsRecording(true);
    showRecording();                                    //Show in the notifications bar the app is recording

    recordingThread = new Thread(new Runnable() {
        public void run() {
            writeAudioDataToFile();                     //Read data from recorder and save it into a variable
        }
    }, "AudioRecorder Thread");
    recordingThread.start();
}

public void writeAudioDataToFile() {
    short sData[] = new short[bufferSize];//Short array to put data from buffer (audio) in

    while (isIsRecording()) {
        recorder.read(sData, 0, bufferSize);        //Save to audio data in the variable sData
        Log.v(TAG, "Short writing to file" + sData.toString());

        //Calculate decibels
        lastPressure = sData[sData.length - 1];
        double pressure = lastPressure / 9805.5336;             //This value is determined by calibrating the code with a decibel meter
        decibel = 20.0 * Math.log10(pressure / reference);
        boolean isNAN = Double.isNaN(decibel);                  //Check if decibel is a number (NaN=Not a Number=calculation went wrong)
        if (isNAN) {
            //do not update value when calculation went wrong
        } else {
            if (decibel <= 30.0) {
                //do not update value, because this are rare mistakes that happen by using the AudioRecorder to get the decibels
            } else {
                decibelReal = decibel;
                Log.v(TAG, "decibel=" + decibel);
            }
        }

        //FFT
        int length = sData.length;
        toTransform = new double[length];
        transformer = new RealDoubleFFT(length);
        for (int i = 0; i < length; i++) {
            toTransform[i] = (double) sData[i] / Short.MAX_VALUE;
        }
        transformer.ft(toTransform);
        Log.v(TAG, "Transforming done");

        //Save to firebase
        bData = new byte[toTransform.length * Double.BYTES];
        for (int i = 0; i < toTransform.length; i++)            //Only bytes can be saved in Firebase, so we have to convert the doubles
            System.arraycopy(convertDoubleToByteArray(toTransform[i]), 0, bData, i * Double.BYTES, Double.BYTES);

        //Place and heartRate
        determinePlace();                                   //For Zoltan
        heartRate();                                        //For Zoltan
    }
    if (!isIsRecording()) stopRecording();

}


public void stopRecording() {//The interface is in here, because directly using a reference to the SelectEmotion Activity caused a circular class referencing problem
    if (null != recorder) {
        setIsRecording(false);
        recorder.stop();
        recorder.release();
        recorder = null;                                    //Empty the recorder
        recordingThread = null;
        Log.v(TAG, "Recording stopped");
        NotificationManager mNotificationManager = (NotificationManager) getSystemService(Context.NOTIFICATION_SERVICE);
        mNotificationManager.cancel(0);                     //Delete the reminder to log your emotion
        mNotificationManager.cancel(1);                     //Delete the notification that shows the app is recording (because it is not anymore)
        Log.v(TAG, "notifications deleted");
    }
}

private Runnable record = new Runnable() {
    @Override
    public void run() {
        startRecording();
    }
};
private Runnable stopRecord = new Runnable() {
    @Override
    public void run() {
        stopRecording();
        intentRecord();
    }
};

private View.OnClickListener btnClick = new View.OnClickListener() {
    public void onClick(View v) {
        recordHandler.postDelayed(record, startTime);           //When the button is clicked, the recording has to begin at the time selected by the user
        recordHandler.postDelayed(stopRecord, stopTime);        //", the recording has to stop at the time selected by the user
        recordHandler.postDelayed(showNotification, showNotificationTime);    //", the user has to get a reminder to log his/her emotion every hour
        recordHandler.postDelayed(saveRecordingToFirebase, saveFirebaseTime);      //", the recording has to be saved to Firebase every 10 minutes
        recordHandler.postDelayed(saveOtherDataToFirebase, saveOtherDataFirebaseTime);          //", the decibels have to be saved to Firebase every second
        intent();                                       //", the user has to go to the SelectEmotion page, there is nothing more to be found on the Record page for the user
    }
};

public void intent() {
    Intent intent = new Intent(this, SelectEmotion.class);
    startActivity(intent);
}

public void intentRecord() {
    Intent intentRecord = new Intent(this, Record.class);
```

```
        startActivity(intentRecord);
    }

    //Place-----------------------------------------------------------------------------------------------------------------------------------------------
    public void determinePlace() {                          //For Zoltan
        place = "place";
    }

    //Heart rate------------------------------------------------------------------------------------------------------------------------------------------
    public void heartRate() {                               //For Zoltan
        heartRate = ConnectMio.getHeartRateValue();
    }

    //Save to Firebase------------------------------------------------------------------------------------------------------------------------------------
    private Runnable saveRecordingToFirebase = new Runnable() {
        @Override
        public void run() {
            if (isIsRecording()) {
                saveToFirebaseStorage();
            }
        }
    };

    private byte[] convertDoubleToByteArray(double number) {        //Only bytes can be saved in Firebase, so we have to convert the double array to a byte array
        ByteBuffer byteBuffer = ByteBuffer.allocate(Double.BYTES);
        byteBuffer.putDouble(number);
        return byteBuffer.array();
    }

    private void saveToFirebaseStorage() {
        //since audio files are more than 1mb we need to store them first before putting them
        //in a database. The database is not made for storing these bigger files

        //what is the current time?
        Calendar cal1 = Calendar.getInstance();
        Date time = cal1.getTime();
        SimpleDateFormat researcher = new SimpleDateFormat("dd MM yyyy HH:mm:ss");
        String soundtime = researcher.format(time).toString();

        //where the data has to go and what type of file is it
        //we make folders for each user and no more additional folders
        //this is not necessary since firestore provides the structure
        String path = "sound/" + key + "/" + soundtime + ".pcm";

        //what is the storage reference
        final StorageReference refFirestorage = mStorageRef.getReference(path);

        //Uploading to FireStorage (the bdata) and retrieving the download URL
        refFirestorage.putBytes(bData).addOnSuccessListener(new OnSuccessListener<UploadTask.TaskSnapshot>() {
            @Override
            public void onSuccess(UploadTask.TaskSnapshot taskSnapshot) {
                refFirestorage.getDownloadUrl().addOnSuccessListener(new OnSuccessListener<Uri>() {
                    @Override
                    public void onSuccess(Uri uri) {
                        url = uri.toString();
                        Log.v(TAG, "upload to storage succesfull, link created");
                        saveToFirebaseFirestore();
                    }
                });
            }
        });
    }

    private void saveToFirebaseFirestore() {
        //now that we received the link with the place of the data we can store it in the database

        //document name is the date
        Calendar cal2 = Calendar.getInstance();
        SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
        String date = sdf.format(cal2.getTime());

        //field name is the time
        Calendar cal3 = Calendar.getInstance();
        Date TimeNow = cal3.getTime();
        DateFormat dateFormat = new SimpleDateFormat("HH:mm:ss");
        String formattedTimeNow1 = dateFormat.format(TimeNow);

        //what is the current time? //put as value in field time
        Calendar cal1 = Calendar.getInstance();
        Date time = cal1.getTime();
        SimpleDateFormat researcher = new SimpleDateFormat("dd MM yyyy HH:mm:ss");
        String soundtime = researcher.format(time).toString();

        //making map with the fields with the corresponding values
        Map<String, Object> timeValuesSaveToFirestorage = new HashMap<>();
        timeValuesSaveToFirestorage.put("current user", key);
        timeValuesSaveToFirestorage.put("current time", soundtime);
        timeValuesSaveToFirestorage.put("link to fragment", url);

        db.collection("users").document(key).collection("sound").document(date)
                .collection("fragments").document(formattedTimeNow1).set(timeValuesSaveToFirestorage).addOnCompleteListener(new OnCompleteListener<Void>() {
            @Override
            public void onComplete(@NonNull Task<Void> task) {
                if (task.isSuccessful()) {
                    Log.v(TAG, " link and data uploaded to firestore");
                } else {
                    Log.v(TAG, "upload to Firestore failed");
                }
            }
        });
        recordHandler.postDelayed(saveRecordingToFirebase, saveFirebaseTime);
        //Do this again after 10 minutes
        //we don't want to do this too often because then the structuring will be be unorganised
        //we don't want to do this too little because then we will miss data when the user
        // stops the recording
    }

    //Save decibels, place and heart rate to firebase
    private Runnable saveOtherDataToFirebase = new Runnable() {
        @Override
        public void run() {
            if (isIsRecording()) {
                saveOtherDataToFireBase(decibelReal);
                recordHandler.postDelayed(this, saveOtherDataFirebaseTime);
            }
        }
    };

    private void saveOtherDataToFireBase(final double decibel) {
        //we seperatly save the decibels for the researcher and to use them later in select emotion
        if (isIsRecording()) {
            //only when we are recording we want to save the data
            //document name is the date
            Calendar cal2 = Calendar.getInstance();
            SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
```

```
        String date = sdf.format(cal2.getTime());

        //field name is the time
        Calendar cal3 = Calendar.getInstance();
        Date TimeNow = cal3.getTime();
        DateFormat dateFormat = new SimpleDateFormat("HH:mm:ss");
        String formattedTimeNow1 = dateFormat.format(TimeNow);

        //what is the current time? //put as value in field time
        Calendar cal1 = Calendar.getInstance();
        Date time = cal1.getTime();
        SimpleDateFormat researcher = new SimpleDateFormat("dd MM yyyy HH:mm:ss");
        String dbtime = researcher.format(time);

        //making the field with the corresponding values
        Map<String, Object> timeValuesSaveToFirestorage = new HashMap<>();
        timeValuesSaveToFirestorage.put("current user", key);
        timeValuesSaveToFirestorage.put("current time", dbtime);
        timeValuesSaveToFirestorage.put("decibel", decibel);
        timeValuesSaveToFirestorage.put("place", place);                    //For Zoltan
        timeValuesSaveToFirestorage.put("heart rate", heartRate);           //For Zoltan

        db.collection("users").document(key).collection("relatedData").document(date).collection("fragments").document(formattedTimeNow1).
set(timeValuesSaveToFirestorage).addOnCompleteListener(new OnCompleteListener<Void>() {
            @Override
            public void onComplete(@NonNull Task<Void> task) {
                Log.v(TAG, "Decibels, place and heartRate uploaded to Firestore=" + decibel);
            }
        }).addOnFailureListener(new OnFailureListener() {
            @Override
            public void onFailure(@NonNull Exception e) {
                Log.v(TAG, "Saving decibels, place and heartRate to Firestore failed");
            }
        });
    }
}

//Check permission---------------------------------------------------------------------------------------------------------------------------
private boolean checkPermissionMic() {
    int record_audio_result = ContextCompat.checkSelfPermission(this, Manifest.permission.RECORD_AUDIO);
    return record_audio_result == PackageManager.PERMISSION_GRANTED;
}

private void requestPermission() {
    ActivityCompat.requestPermissions(this, new String[]{
            Manifest.permission.RECORD_AUDIO
    }, REQUEST_PERMISSION);
}

@Override
public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
    switch (requestCode) {
        case REQUEST_PERMISSION: {                          //Show to the user if (s)he gave access or denied it
            if (grantResults.length > 0 && grantResults[0] == PackageManager.PERMISSION_GRANTED)
                Toast.makeText(this, "Permission granted", Toast.LENGTH_SHORT).show();
            else Toast.makeText(this, "Permission denied", Toast.LENGTH_SHORT).show();
        }
        break;
    }
}

//Time selection-----------------------------------------------------------------------------------------------------------------------------
//Scroll choice (from)
private void loadChoices() {
    from.add("Now");
    from.add("in 10min");
    from.add("in 15min");
    from.add("in 30min");
    from.add("in 1hour");
}

private int startTime(int pos) {
    if (pos == 0) {                                 //position 0=now, position 1=in 10min etc.
        startTime = 0;                              //Start recording directly when startButton is clicked
    } else {
        if (pos == 1) {
            startTime = 60000 * 10;                 //Time is always in milliseconds
        } else {
            if (pos == 2) {
                startTime = 60000 * 15;
            } else {
                if (pos == 3) {
                    startTime = 60000 * 30;
                } else {
                    startTime = 60000 * 60;
                }
            }
        }
    }
    Log.v(TAG, "startTime=" + startTime);
    return startTime;
}

//SelectTimeBox (until)
private View.OnClickListener selectTime = new View.OnClickListener() {
    public void onClick(View v) {                   //When the user clicks on the time, the TimeBox must be shown which automatically goes
to the current time
        calendar = Calendar.getInstance();
        CalendarHour = calendar.get(Calendar.HOUR_OF_DAY);
        CalendarMinute = calendar.get(Calendar.MINUTE);

        timepickerdialog = new TimePickerDialog(Record.this,
                3,                                  //The third theme fittest best to our app
                new TimePickerDialog.OnTimeSetListener() {
                    @Override
                    public void onTimeSet(TimePicker view, int hourOfDay, int minute) {
                        String endTime = String.format("%02d:%02d", //%02d makes sure the time on the textView is set to e.g. 07:05 instead of 7:5
when the user means five minutes past seven
                                hourOfDay, minute);
                        DisplayTime.setText(endTime);
                        stopTime(endTime);
                    }
                }, CalendarHour, CalendarMinute, true); //true means we use the 24h clock
        timepickerdialog.show();
    }
};

private int stopTime(String endTime) {              //Calculate the time the recorder has to record by using the current time and the
endTime selected by the user
    Log.v(TAG, "endTime=" + endTime);
    Calendar cal = Calendar.getInstance();
    Date TimeNow = cal.getTime();
    DateFormat dateFormat = new SimpleDateFormat("HH:mm");
    String formattedTimeNow = dateFormat.format(TimeNow);
    Log.v(TAG, "Now=" + formattedTimeNow);
    Date now = null;
    Date end = null;
```

```
        try {
            now = dateFormat.parse(formattedTimeNow);
            end = dateFormat.parse(endTime);
            long diff = end.getTime() - now.getTime();
            stopTime = (int) diff;
            Log.v(TAG, "stopTime=" + stopTime);
        } catch (ParseException e) {
            e.printStackTrace();
            Log.v(TAG, "Formatting time failed");
        }
        return stopTime;
    }

    //Push notifications----------------------------------------------------------------------------------------------------------------------------
    private Runnable showNotification = new Runnable() {
        @Override
        public void run() {
            if (isIsRecording()) {
                showNotification();
                recordHandler.postDelayed(this, showNotificationTime);
            }
        }
    };

    private void createNotificationChannel() {
        if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.O) {
            CharSequence name = "SelectEmotion";
            int importance = NotificationManager.IMPORTANCE_HIGH;      //It is important the user does not forget to log his/her emotions
            NotificationChannel channel = new NotificationChannel(CHANNEL_ID, name, importance);
            NotificationManager notificationManager = getSystemService(NotificationManager.class);
            notificationManager.createNotificationChannel(channel);
        }
    }

    private void showNotification() {
        Intent intent = new Intent(this, SelectEmotion.class);
        intent.setFlags(Intent.FLAG_ACTIVITY_NEW_TASK | Intent.FLAG_ACTIVITY_CLEAR_TASK);  //This makes sure that the phone sees the
SelectEmotion page as the beginning of the app use now, so the phone so not go back to Record when the user uses the back button
        PendingIntent pendingIntent = PendingIntent.getActivity(this, 0,  //When the user ticks on the notification, (s)he is directed to the SelectE-
motion page
                intent, 0);

        NotificationCompat.Builder builder = new NotificationCompat.Builder(this, CHANNEL_ID)
                .setSmallIcon(R.drawable.logo_cacophony)
                .setContentTitle("Share your cacophony")
                .setStyle(new NotificationCompat.BigTextStyle().                    //BigTextStyle allows the notification to be two rows of text instead
of being cut off on smaller phones
                        bigText("How was your cacophony experience in the last hour?"))
                .setPriority(NotificationCompat.PRIORITY_HIGH)                      //It is important the user does not forget to log his/her emotions
                .setContentIntent(pendingIntent)                                    //Intent to SelectEmotion page
                .setAutoCancel(true);                                               //Notification is deleted when the user ticks on it

        if (isIsRecording()) {
            NotificationManagerCompat notificationManager = NotificationManggerCompat.from(this);
            notificationManager.notify(0, builder.build());                         //Notification ID is unique for every notification and will be used to delete
the right notifications at the right time
            Log.v(TAG, "Notification send");
        }
    }

    //While Recording
    public void showRecording() {                                                   //Notification to user to show the app is recording
        if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.O) {
            CharSequence name = "isRecording";
            int importance = NotificationManager.IMPORTANCE_DEFAULT;
            NotificationChannel channel2 = new NotificationChannel(CHANNEL_ID_2, name, importance);
            NotificationManager notificationManager = getSystemService(NotificationManager.class);
            notificationManager.createNotificationChannel(channel2);
        }
        NotificationCompat.Builder builder2 = new NotificationCompat.Builder(this, CHANNEL_ID_2)
                .setSmallIcon(R.drawable.noun_recording_1614606)
                .setContentTitle("Recording")
                .setPriority(NotificationCompat.PRIORITY_DEFAULT)
                .setAutoCancel(true);

        if (isIsRecording() == true) {
            NotificationManagerCompat notificationManager2 = NotificationManagerCompat.from(this);
            notificationManager2.notify(1, builder2.build());
        }
    }

    //Rest------------------------------------------------------------------------------------------------------------------------------------------
    public void inflateMenuButtonClicked(View view) {
        //if the menu drawer is open close the drawer when the button is clicked
        //if the menu drawer is closed open the drawer when the button is clicked
        if (drawer.isDrawerOpen(GravityCompat.END)) {
            drawer.closeDrawer(GravityCompat.END);
        } else if (!drawer.isDrawerOpen(GravityCompat.END)) {
            drawer.openDrawer(GravityCompat.END);
        }
    }

    public void logOutButtonClicked(View view) {
        FirebaseAuth.getInstance().signOut();
        finish();                                   //Make sure we finish this activity and 'start over' again
        Toast.makeText(this, "Logged out",
                Toast.LENGTH_LONG).show();
        drawer.closeDrawer(GravityCompat.END);
        Intent intent = new Intent(this, LoginActivity.class);
        startActivity(intent);
    }

    //Back pressed modification---------------------------------------------------------------------------------------------------------------------
    @Override
    public void onBackPressed() {
        //If the back button is pressed while the menu drawer is open do not close the activity
        if (drawer.isDrawerOpen(GravityCompat.END)) {
            drawer.closeDrawer(GravityCompat.END);
        } else {
            super.onBackPressed();
        }
    }
```

```
package nl.dut.ide.software.soundfilterrealgit;

import android.graphics.Bitmap;
import android.graphics.Canvas;

import android.graphics.Paint;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
```

Review

```
import android.widget.ImageView;
//Graph1
import android.widget.FrameLayout;
import com.jjoe64.graphview.BarGraphView;
import com.jjoe64.graphview.GraphView;
import com.jjoe64.graphview.GraphViewSeries;
import com.jjoe64.graphview.LineGraphView;
import android.graphics.Color;

public class Review extends AppCompatActivity {
    Canvas canvas;
    ImageView imageView;
    Paint paint;
    //Graph1
//    private FrameLayout mLayout=null;
//    private GraphViewSeries mGraphSeries=null;
//    private boolean isGraph=true;5

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_review);
        imageView=(ImageView)this.findViewById(R.id.graph);
        Bitmap bitmap=Bitmap.createBitmap(256,100, Bitmap.Config.ARGB_8888);
        canvas=new Canvas(bitmap);
        paint=new Paint();
        paint.setColor(getResources().getColor(R.color.colorPrimaryDark));
        imageView.setImageBitmap(bitmap);

        //Graph1
//        mLayout=(FrameLayout)findViewById(R.id.frameLayout);
    }

    public void publishProgress (double[]toTransform){
        for (int i = 0; i < toTransform.length; i++) {
            int x = i;
            int downy = (int) (100 - (toTransform[i] * 10));
            int upy = 100;

            canvas.drawLine(x, downy, x, upy, paint);
        }

        imageView.invalidate();
    }

        //Graph1
//    @Override
//    protected void onStart() {
//        super.onStart();
//        initGraphView();
//    }
//
//    private void initGraphView(){
//        GraphView graphView;
//        graphView = new BarGraphView(this, "Frequency Domain");
//
//        mGraphSeries = new GraphViewSeries(new GraphView.GraphViewData[]{});
//        graphView.addSeries(mGraphSeries);
//
//        if (mLayout.getChildCount() > 0) {
//            mLayout.removeAllViews();
//        }
//        mLayout.addView(graphView);
//    }
//
//    public void updateGraphView(double[] toTransform,int length,short[]sData){
//        final GraphView.GraphViewData[] data = new GraphView.GraphViewData[length];
//
//            for (int i = 0; i < length; i++) {
//                data[i] = new GraphView.GraphViewData(i, sData[i]);
//            }
//        Review.this.runOnUiThread(new Runnable() {
//            @Override
//            public void run() {
//                mGraphSeries.resetData(data);
//            }
//        });
//    }
//
//    public void resetGraph(){
//        mGraphSeries.resetData(new GraphView.GraphViewData[]{});
//    }
//    }
}
```

```
package nl.dut.ide.software.soundfilterrealgit;

import android.content.Intent;
import android.support.annotation.NonNull;
import android.support.design.widget.NavigationView;
import android.support.v4.view.GravityCompat;
import android.support.v4.widget.DrawerLayout;
import android.support.v7.app.ActionBarDrawerToggle;
import android.support.v7.app.AppCompatActivity;
import android.os.Bundle;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.ImageView;
import android.widget.LinearLayout;
import android.widget.ListView;
import android.widget.TextView;
import android.widget.Toast;

import com.google.android.gms.tasks.OnCompleteListener;
import com.google.android.gms.tasks.OnFailureListener;
import com.google.android.gms.tasks.OnSuccessListener;
import com.google.android.gms.tasks.Task;
import com.google.firebase.auth.FirebaseAuth;
import com.google.firebase.firestore.DocumentReference;
import com.google.firebase.firestore.DocumentSnapshot;
import com.google.firebase.firestore.FirebaseFirestore;
import com.google.firebase.firestore.QueryDocumentSnapshot;
import com.google.firebase.firestore.QuerySnapshot;

import java.text.DateFormat;
import java.text.ParseException;
import java.text.SimpleDateFormat;
import java.util.ArrayList;
import java.util.Calendar;
import java.util.Date;
import java.util.HashMap;
import java.util.Map;
```

```
import java.util.TreeMap;
//Zoltan, search for ctrl+F 'Zoltan'  to find the stuff about the decibels taken from 30 seconds ago instead of the highest
public class SelectEmotion extends AppCompatActivity{
    private TextView nameMenu,firstLetterMenu;
    private Button emotionButton;
    private int keyEmotion = -1;
    private DrawerLayout drawer;
    private TextView dateTextview;
    private int errorCounter;
    private Record record=new Record();
    String TAG="SelectEmotion";
    TreeMap<Integer,String>emotionsAndTimeMap=new TreeMap<>();
    TreeMap<Integer,String>getEmotionsAndTimeDatabaseMap=new TreeMap<>();


    //Firebase
    private FirebaseFirestore db;
    private String key;

    //Decibels
    Double deci;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_select_emotion);

        //Firebase
        db = FirebaseFirestore.getInstance();
        key= FirebaseAuth.getInstance().              //Get the current user
                getCurrentUser().getUid();

        //get date and set it on the actionbar
        dateTextview=findViewById(R.id.date);
        Calendar cal=Calendar.getInstance();
        SimpleDateFormat sdf=new SimpleDateFormat("dd MMM, yyyy");
        String date=sdf.format(cal.getTime());
        dateTextview.setText(date);

        //include drawermenu
        drawer = findViewById(R.id.menu_drawer_layout_emotion);
        ActionBarDrawerToggle toggle = new ActionBarDrawerToggle(this, drawer,
                R.string.navigation_drawer_open, R.string.navigation_drawer_close);


        //Finding the right textview to set the name of the user later in readname()
        NavigationView navigationViewEmotion = (NavigationView) findViewById(R.id.menu_view_emotion);
        nameMenu = navigationViewEmotion.findViewById(R.id.name_user_menu_header_emotion);
        firstLetterMenu = navigationViewEmotion.findViewById(R.id.first_letter_name_user_menu_header_emotion);
        readName();
    }
    //Name-----------------------------------------------------------------------------------------------------------------------------------------------------
    private void readName() {
        //We will check who the current logged in user is in Firebase
        Log.v("Firestore", "readName method start");

        Log.v(TAG,"key="+key);

        db.collection("users").document(key).get().addOnCompleteListener(new OnCompleteListener<DocumentSnapshot>() {
            @Override
            public void onComplete(@NonNull Task<DocumentSnapshot> task) {
                if(task.isSuccessful()){
                    DocumentSnapshot documentSnapshot=task.getResult();
                    String value= documentSnapshot.getString("name");
                    nameMenu.setText(value);

                    //now we set the first letter
                    String letterInPut = String.valueOf(value.charAt(0));
                    firstLetterMenu.setText(letterInPut);
                }
            }
        });
    }

    //Emotion clicked-------------------------------------------------------------------------------------------------------------------------------------------
    public void emotionClicked(View v) throws ParseException {
        //the clicked emotion button
        emotionButton = (Button) v;

        Calendar cal5 = Calendar.getInstance();
        Date TimeNow = cal5.getTime();
        DateFormat dateFormat = new SimpleDateFormat("HH:mm:ss");
        String formattedTimeNow2 = dateFormat.format(TimeNow);

        //get emotion of the button that is clicked
        String emotionSelected = String.valueOf(emotionButton.getText().toString());
        Log.d(TAG,emotionSelected);

        //give emotion to the show emotion method to add time and show it in the listview
        showEmotion(emotionSelected,formattedTimeNow2);

        //timeEmotionResearcher to firebase
        saveEmotionToFirebaseFirestore(emotionSelected,formattedTimeNow2);

        //save the decibels level of when the button was clicked
        getDecibel();
    }

    private void getDecibel() throws ParseException {
        //we will store the decibels every seconds for research purposes
        //we will also se this data to connect the clicked emotion to a decibel level
        //to find the right time we will have to get the data to make the right path to the decibel data

        //document name in Firebase is the date
        Calendar cal4 = Calendar.getInstance();
        SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
        String date = sdf.format(cal4.getTime());

        //field name is the time
        DateFormat dateFormat = new SimpleDateFormat("HH:mm:ss");
        String formattedTimeNow2 = dateFormat.format(new Date());
        Date date2 = dateFormat.parse(formattedTimeNow2);
        Calendar cal5 = Calendar.getInstance();
        cal5.setTime(date2);
        cal5.add(Calendar.SECOND, -30);                    //Zoltan, this is where I decide I take the decibels from 30 seconds ago
        Date datereal=cal5.getTime();
        String formattedTimeNow3 = dateFormat.format(datereal);
        Log.v(TAG,"formattedTimenow3="+formattedTimeNow3);

        DocumentReference dbref=db.collection("users").document(key).collection("relatedData")
                .document(date).collection("fragments").document(formattedTimeNow3);

        dbref.get().addOnSuccessListener(new OnSuccessListener<DocumentSnapshot>() {
            @Override
```

```
            public void onSuccess(DocumentSnapshot documentSnapshot) {
                if(documentSnapshot.exists()){
                    //when there is a document at th stated time
                    //we will store the data in a variable in java
                    deci=documentSnapshot.getDouble("decibel");     //Zoltan, here I get the decibel so I think you should get an array here
                    Log.v(TAG,"decibels="+deci);
                }else{
                    //there is no document
                    // what to do then has to be explored further
                    Log.v(TAG,"No document for decibels");
                }
            }
        }).addOnFailureListener(new OnFailureListener() {
            @Override
            public void onFailure(@NonNull Exception e) {
                Log.v(TAG,"Getting decibels failed");
            }
        });
        //connecting to firebase failed
    }

    private void showEmotion(String emotionSelected,String timeEmotionClicked){
        //get time that emotion was clicked
        SimpleDateFormat user=new SimpleDateFormat("HH:mm");
        Calendar cal = Calendar.getInstance();
        Date time=cal.getTime();
        String timeEmotionUser=user.format(time);

        //put emotion and time to the treemap
        emotionsAndTimeMap.put(keyEmotion,emotionSelected+" "+timeEmotionUser);
        getEmotionsAndTimeDatabaseMap.put(keyEmotion,timeEmotionClicked);

        //lower the key with one so that the new entries in the treemap will be automatically sorted
        //on top of the treemap, so that the order does not have to be switched when inserting it in
        //the the listview
        keyEmotion=keyEmotion-1;

        //find the listview where the emotions and times should be displayed
        //give the treemap with the emotions and times to the EmotionListAdapter
        //set the view from the adapter to the listview where it should be displayed
        ListView listView = findViewById(R.id.list_emotion);
        EmotionListAdapter adapter = new EmotionListAdapter(emotionsAndTimeMap);
        listView.setAdapter(adapter);
    }

    public void saveEmotionToFirebaseFirestore(String emotionData, String timeEmotionClicked) {
        //save the data connected to the right user

        //document name is the date
        Calendar cal4 = Calendar.getInstance();
        SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
        String date = sdf.format(cal4.getTime());

        //what is the current time? //put as value in field time
        Calendar cal1 = Calendar.getInstance();
        Date time=cal1.getTime();
        SimpleDateFormat researcher=new SimpleDateFormat("dd/MM/yyyy HH:mm:ss");
        String emotiontime = researcher.format(time);

        //making the fields and set the corresponding values
        //we put them all in one map since we can not add new fields once a document is created
        Map<String, Object> emotionValuesSaveToFirestorage = new HashMap<>();
        emotionValuesSaveToFirestorage.put("current user",key);
        emotionValuesSaveToFirestorage.put("current time",emotiontime);
        emotionValuesSaveToFirestorage.put("emotion data",emotionData);
        emotionValuesSaveToFirestorage.put("decibel",deci);

        db.collection("users").document(key).collection("emotion").document(date)
                .collection("fragments").document(timeEmotionClicked).set(emotionValuesSaveToFirestorage).addOnCompleteListener(new OnCom-
pleteListener<Void>() {
            @Override
            public void onComplete(@NonNull Task<Void> task) {
                if (task.isSuccessful()) {
                    //what to do when you uploaded the data?
                    Log.v(TAG, " link and data uploaded to firestore EMOTION");
                    //we will not inform the user about this, this will only distract them
                } else {
                    //what to do when failed to upload the data
                    Log.v(TAG, "upload to firestore failed EMOTION :(");
                    //inform the user and ask them to try again
                    Toast.makeText(SelectEmotion.this, "Logging emotion failed, please try again", Toast.LENGTH_LONG).show();
                }
            }
        });

    }

    //Delete emotion-----------------------------------------------------------------------------------------------------------------------------------------------
    public void deleteEmotionClicked(View view){
        //get the button that was clicked (the listview has many buttons that call this method)
        LinearLayout vwParentRow = (LinearLayout)view.getParent();
        Button btnChild = (Button)vwParentRow.getChildAt(1);

        //get the tag that is given to the button and remove the entry of the treemap
        //with the same key value as the tag
        Log.d("Tag", String.valueOf(btnChild.getTag()));
        emotionsAndTimeMap.remove(btnChild.getTag());
        String timeEmotionClicked=getEmotionsAndTimeDatabaseMap.get(btnChild.getTag());

        //Refresh the view of the listview, without the just deleted entry pair of the treemap
        ListView listView = findViewById(R.id.list_emotion);
        EmotionListAdapter adapter = new EmotionListAdapter(emotionsAndTimeMap);
        listView.setAdapter(adapter);

        deleteEmotion(timeEmotionClicked);
    }

    public void deleteEmotion(String timeEmotionClicked) {
        //receive the time emotion clicked since this forms the reference
        // to the right emotion that has to be deleted

        //document name is the date
        Calendar cal4 = Calendar.getInstance();
        SimpleDateFormat sdf = new SimpleDateFormat("dd MMM, yyyy");
        String date = sdf.format(cal4.getTime());

        db.collection("users").document(key).collection("emotion").document(date)
                .collection("fragments").document(timeEmotionClicked)
                .delete()
                .addOnSuccessListener(new OnSuccessListener<Void>() {
                    @Override
                    public void onSuccess(Void aVoid) {
                        Toast.makeText(SelectEmotion.this, "Emotion deleted successfully", Toast.LENGTH_LONG).show();
                        Log.v(TAG, "Emotion deleted successfully!");
                    }
                })
                .addOnFailureListener(new OnFailureListener() {
```

```
                @Override
                public void onFailure(@NonNull Exception e) {
                    Toast.makeText(SelectEmotion.this, "Could not delete emotion", Toast.LENGTH_SHORT).show();
                    Log.w(TAG, "Error deleting document", e);
                }
            });
    }

    //Finish today-----------------------------------------------------------------------------------------------------------------------------------------------
    public void finishTodayButtonClicked(View view) {
        Record.setIsRecording(false);
        //Go to the recording screen
        Intent intent = new Intent(this, Record.class);
        startActivity(intent);
    }

    //Menu right side-------------------------------------------------------------------------------------------------------------------------------------------
    public void inflateMenuButtonClicked(View view) {
        //if the menu drawer is open close the drawer when the button is clicked
        //if the menu drawer is closed open the drawer when the button is clicked
        if (drawer.isDrawerOpen(GravityCompat.END)){
            drawer.closeDrawer(GravityCompat.END);
        }else if(!drawer.isDrawerOpen(GravityCompat.END)){
            drawer.openDrawer(GravityCompat.END);
        }
    }

    //Back pressed-----------------------------------------------------------------------------------------------------------------------------------------------
    @Override
    public void onBackPressed() {
        //If the back button is pressed while the menu drawer is open do not close the activity
        if (drawer.isDrawerOpen(GravityCompat.END)) {
            drawer.closeDrawer(GravityCompat.END);
        }
        // else do no nothing, only when recording is stopped the user is allowed to go back
        //or when they press the finish today button
    }

    //Log out----------------------------------------------------------------------------------------------------------------------------------------------------
    public void logOutButtonClickedEmotion(View view) {
        FirebaseAuth.getInstance().signOut();
        Log.v("FirebaseAuth", "user logged out on firebase ");
        Record.setIsRecording(false);
        Log.v("please", "stop recording had happened ");

        // make sure we finish this activity and 'start over' again
        // it wont be possible to use the back button to come back to this screen
        finish();
        Toast.makeText(this, "Logged out", Toast.LENGTH_LONG).show();
        drawer.closeDrawer(GravityCompat.END);

//      go the the login activity again
        Intent intentEmotionSignOut = new Intent(this, LoginActivity.class);
        startActivity(intentEmotionSignOut);
    }
}
```

Stop Service

```
package nl.dut.ide.software.soundfilterrealgit;

import android.app.NotificationChannel;
import android.app.NotificationManager;
import android.app.Service;
import android.content.Context;
import android.content.Intent;
import android.os.Build;
import android.os.IBinder;
import android.support.annotation.Nullable;
import android.support.v4.app.NotificationCompat;

public class StopService extends Service {
    @Nullable
    @Override
    public IBinder onBind(Intent intent) {
        return null;
    }

    String CHANNEL_ID_3 = "RecordingStoppedNotificationChannel";

    @Override
    public void onTaskRemoved(Intent rootIntent) {              //When the app is moved away from the list by the user
        super.onTaskRemoved(rootIntent);

        NotificationManager mNotificationManager = (NotificationManager) getSystemService(Context.NOTIFICATION_SERVICE);
        mNotificationManager.cancel(0);                         //Delete the reminder to log your emotion
        mNotificationManager.cancel(1);                         //Delete the notification that shows the app is recording (because it is not anymore)

        if (Build.VERSION.SDK_INT >= Build.VERSION_CODES.O) {       //Create a notification that says the app stopped, so when the working shift of the user had not finished (s)he can start the recording again (app had stopped accidentally)
            CharSequence name = "recordingStopped";
            int importance = NotificationManager.IMPORTANCE_HIGH;
            NotificationChannel channel3 = new NotificationChannel(CHANNEL_ID_3, name, importance);
            NotificationManager notificationManager2 = getSystemService(NotificationManager.class);
            notificationManager2.createNotificationChannel(channel3);
        }
        NotificationCompat.Builder builder3 = new NotificationCompat.Builder(this, CHANNEL_ID_3)
                .setSmallIcon(R.drawable.logo_cacophony)
                .setContentTitle("Recording stopped")
                .setPriority(NotificationCompat.PRIORITY_HIGH)
                .setAutoCancel(true)
                .setStyle(new NotificationCompat.BigTextStyle().bigText("When your shift has not finished yet, please start the recording again."));

        mNotificationManager.notify(3, builder3.build());
    }
}
```

Test Mic

```
package nl.dut.ide.software.soundfilterrealgit;

import android.Manifest;
import android.content.Intent;
import android.content.pm.PackageManager;
import android.graphics.Bitmap;
import android.graphics.Canvas;
import android.graphics.Color;
import android.graphics.Paint;
import android.media.MediaRecorder;
import android.os.Bundle;
import android.os.Environment;
```

```
import android.support.annotation.NonNull;
import android.support.v4.app.ActivityCompat;
import android.support.v4.content.ContextCompat;
import android.support.v7.app.AppCompatActivity;
import android.util.Log;
import android.view.View;
import android.widget.Button;
import android.widget.ImageView;
import android.widget.TextView;
import android.widget.Toast;

import java.io.File;
import java.io.IOException;

public class TestMic extends AppCompatActivity {
    private TextView infoTextView;
    private MediaRecorder mTestRecorder = null;                    //Initialize a new media recorder
    private ImageView testMicButton,hiddenView;
    private Button continueButton;
    private int testFailedTimes=0;
    private int soundTooLowTimes=0;
    private String TAG="Mic_test";                                 //TAG is used for Logcat, to easily collect the text send to myself
    private String on_off="off";
    final int REQUEST_PERMISSION=1000;
    private String test="";
    private static boolean permission=false;

    public static boolean isPermission() {
        return permission;
    }

    public static void setPermission(boolean permission) {
        TestMic.permission = permission;
    }

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_test_mic);
        infoTextView=findViewById(R.id.textTestMicResult);
        testMicButton=findViewById(R.id.testMicButton);
        continueButton=findViewById(R.id.continueButton);
        hiddenView=findViewById(R.id.hiddenView);
        if(checkPermissionMic()){                                  //When there is permission to use the MIC, the test can start
            testMicButton.setOnClickListener(new View.OnClickListener() {
                @Override
                public void onClick(View v) {
                    if(on_off=="off"){                             //When app is not recording, start recording when button is pushed
                        if(testFailedTimes<3 && soundTooLowTimes<3) {   //When microphone test has not yet been done 3 times
                            Bitmap bitmap=recordingOnColour();         //Make the button red, like a real recorder
                            hiddenView.setImageBitmap(bitmap);
                            hiddenView.setVisibility(View.VISIBLE);
                            infoTextView.setText("Recording started");
                            on_off="on";
                            recordStart();                         //And start recording
                        }
                        else{
                            infoChange("Reinstall the app or let your microphone be checked by a mechanic");
                            testMicButton.setEnabled(false);           //You cannot test anymore
                        }
                    }
                    else{                                          //When app is recording, stop recording when button is pushed
                        infoTextView.setText("Recording ended");
                        hiddenView.setVisibility(View.INVISIBLE);      //Delete the red circle on the recording button
                        recordStop();                              //Stop recording
                        checkAmplitude();                              //Check if the sound is loud enough
                        on_off="off";
                    }
                }
            });
        }
        else{
            requestPermission();
            testMicButton.setOnClickListener(new View.OnClickListener() {
                @Override
                public void onClick(View v) {
                    if(on_off=="off"){                             //When app is not recording, start recording when button is pushed
                        if(testFailedTimes<3 && soundTooLowTimes<3) {   //When microphone test has not yet been done 3 times
                            Bitmap bitmap=recordingOnColour();         //Make the button red, like a real recorder
                            hiddenView.setImageBitmap(bitmap);
                            hiddenView.setVisibility(View.VISIBLE);
                            infoTextView.setText("Recording started");
                            on_off="on";
                            recordStart();                         //And start recording
                        }
                        else{
                            infoChange("Reinstall the app or let your microphone be checked by a mechanic");
                            testMicButton.setEnabled(false);           //You cannot test anymore
                        }
                    }
                    else{                                          //When app is recording, stop recording when button is pushed
                        infoTextView.setText("Recording ended");
                        hiddenView.setVisibility(View.INVISIBLE);      //Delete the red circle on the recording button
                        recordStop();                              //Stop recording
                        checkAmplitude();                              //Check if the sound is loud enough
                        on_off="off";
                    }
                }
            });
        }
    }

    @Override
    public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
        switch (requestCode){
            case REQUEST_PERMISSION:                                   //Show to user if (s)he gave/denied permission
            {
                if(grantResults.length>0 && grantResults[0]==PackageManager.PERMISSION_GRANTED&&grantResults[1]==PackageManager.PER-
MISSION_GRANTED)
                {Toast.makeText(this,"Permission granted",Toast.LENGTH_SHORT).show();
                Log.v("toast", "accepted");
                setPermission(true);}
                else {
                    intent();
                    Log.v("toast", "denied");
                    Toast.makeText(this,"Permission is needed to use this app",Toast.LENGTH_LONG).show();}
            }
            break;
        }
    }

    private void requestPermission() {
        ActivityCompat.requestPermissions(this,new String[]{
                Manifest.permission.RECORD_AUDIO,Manifest.permission.WRITE_EXTERNAL_STORAGE
        },REQUEST_PERMISSION);
    }
```

```
    private boolean checkPermissionMic() {
        int record_audio_result= ContextCompat.checkSelfPermission(this,Manifest.permission.RECORD_AUDIO);
        int write_external_storage_result= ContextCompat.checkSelfPermission(this,Manifest.permission.WRITE_EXTERNAL_STORAGE);
        return record_audio_result==PackageManager.PERMISSION_GRANTED && write_external_storage_result==PackageManager.PERMIS-
SION_GRANTED;
    }

    public void continueButtonClicked(View view){
        Intent micWorksIntent = new Intent(this,Record.class);
        micWorksIntent.addFlags(Intent.FLAG_ACTIVITY_CLEAR_TOP);
        startActivity(micWorksIntent);
    }

    private void intent(){
        Intent intent = new Intent(this, LoginActivity.class);
        startActivity(intent);
    }

    private void recordStart() {
        if (mTestRecorder == null) {
            Log.v(TAG,"recording");
            test = Environment.getExternalStorageDirectory().
                    getAbsolutePath()+"/mic_test_record.3gp";          //Place to save the audio file temporarily
            mTestRecorder = new MediaRecorder();                       //Make a new media recorder
            mTestRecorder.setAudioSource(MediaRecorder.AudioSource.MIC);
            mTestRecorder.setOutputFormat(MediaRecorder.OutputFormat.THREE_GPP);
            mTestRecorder.setAudioEncoder(MediaRecorder.AudioEncoder.AMR_NB);
            mTestRecorder.setOutputFile(test);

            try {                                                      //Try-catch method must be used to use prepare()
                mTestRecorder.prepare();
                mTestRecorder.start();
                mTestRecorder.getMaxAmplitude();
            } catch (IOException e) {
                Log.e(TAG,"prepare() failed");
            }
        }
    }

    private void recordStop() {
        if (mTestRecorder != null) {
            Log.v(TAG,"recording stopped");
            mTestRecorder.stop();
        }
    }

    private void checkAmplitude() {
        if (mTestRecorder != null) {
            Log.v(TAG,"calculating amplitude");
            double REFERENCE=0.00002;                                  //Air pressure (is reference value for microphone)
            double amplitude = mTestRecorder.getMaxAmplitude();
            Log.v(TAG,"amplitude="+amplitude);
            double pressure = amplitude / 90000.5336;                  //This value is determined by calibrating the code with a decibel meter
            Log.v(TAG,"pressure="+pressure);
            double db = (20 * Math.log10(pressure / REFERENCE));    //Formula used by everyone on the internet
            String decibels=Double.toString(db);
            Log.v(TAG,"decibels="+decibels);
            if (db >= 45) {                                            //Determined by experiment and internet research
                infoChange("Sound level approved");
                continueButton.setVisibility(View.VISIBLE);        //When the sound button was good, the user is allowed to continue to the real app
                File file = new File(Environment.getExternalStorageDirectory().getAbsolutePath()+"/mic_test_record.3gp");
                boolean isSuccess = file.delete();                 //Delete the audio file from the phone
                Log.v(TAG,"file deleted from phone");
            } else {
                infoChange("Sound level too low, put your phone on a different place");
                soundTooLowTimes = soundTooLowTimes + 1;
            }
        }
        else {
            infoChange("Sound test failed, try again");
            testFailedTimes=testFailedTimes+1;
            Log.e(TAG,"nothing recorded");
        }
        mTestRecorder = null;
    }

    private void infoChange (String info){                         //Method used to show different texts to the user
        infoTextView.setText(info);
    }

    private Bitmap recordingOnColour(){                            //Create red circle on recording icon to make it look real
        Bitmap bitmap=Bitmap.createBitmap(200,200, Bitmap.Config.ARGB_8888);
        Canvas canvas=new Canvas(bitmap);
        Paint paint=new Paint(Paint.ANTI_ALIAS_FLAG);
        paint.setColor(Color.RED);
        canvas.drawCircle(100,100,75,paint);
        return bitmap;
    }
}
```

User test: SUS(System Usability Scale) Survey

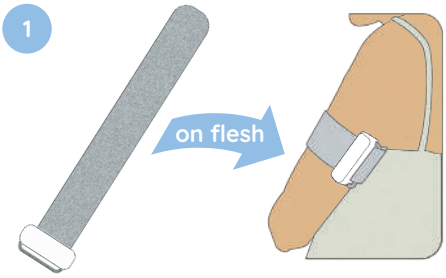
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Jiwon **Score :** 11 / 12

Gender : Female **Age :** 26

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



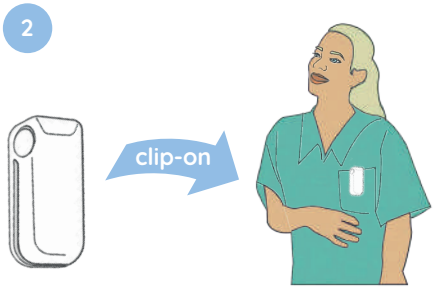
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 1 0

2



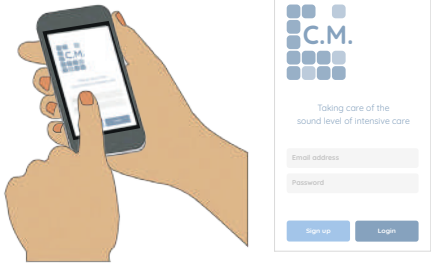
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 1 0

3



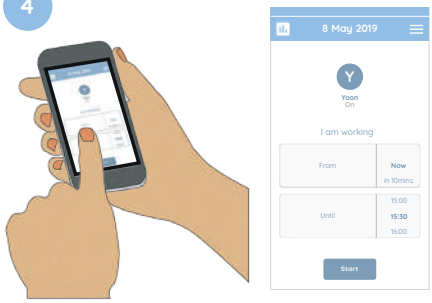
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

2 ☑ 1 0

4



Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 ☑ 1 0

5

When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Regular intervention made me difficult to concentrate on my work.

Easy — **Okay** — **Difficult**

2 1 ☑ 0

6

Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Why do you think so?

Strongly disagree 1 2 3 4 5 Strongly agree

2. Cacophony Mapper application was clearly structured.

Why do you think so?

Strongly disagree 1 2 3 4 5 Strongly agree

3. Cacophony Mapper application was complicated to use.

Why do you think so?

Strongly disagree 1 2 3 4 5 Strongly agree

4. Cacophony Mapper interface was straghtforward to use.

Why do you think so?

Strongly disagree 1 2 3 4 5 Strongly agree

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Why do you think so?

Interval for the emotion report for this testing was too short for me. I had to switch my concentration too often.

Strongly disagree 1 2 3 4 5 Strongly agree

Comments? App itself is very easy to use but I think nurses may feel to disrupted by having notification frequently.

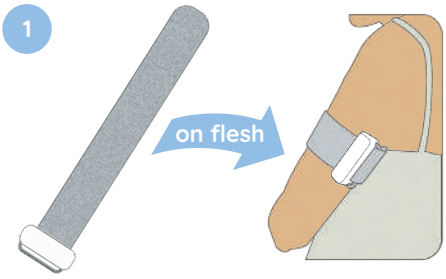
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Sanne
Gender : Female **Age :** 21

Score : 12 / 12

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



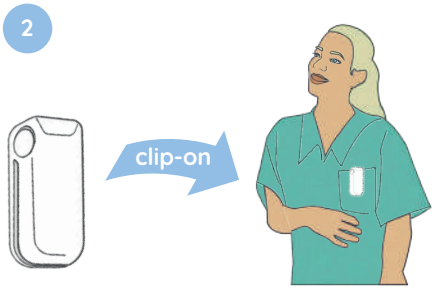
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

2



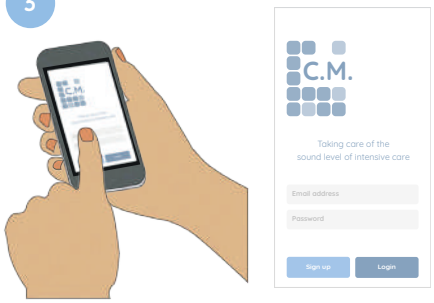
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

3



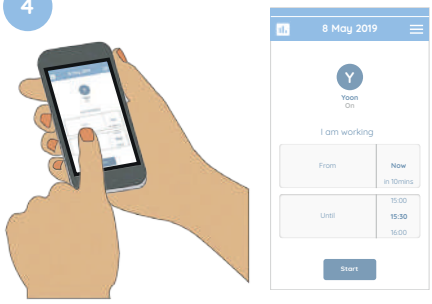
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

4



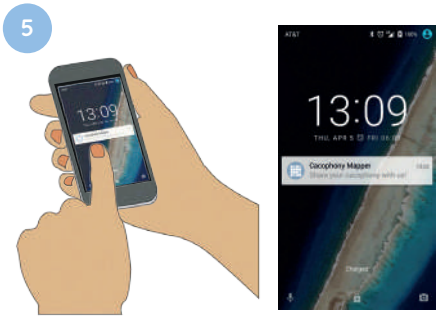
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

5



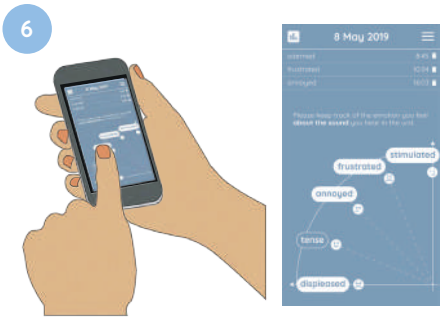
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

2. Cacophony Mapper application was clearly structured.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

the way emotion are presented is a bit fuzzy because you don't know what are on each axis.

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

I think it whould be easy because what you need to click is just emotion and the process is quick and easy.

Comments?

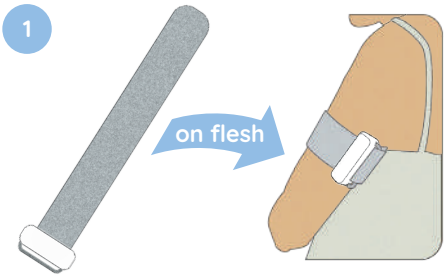
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Rob
Gender : Male
Age : 23

Score : 9 / 12

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

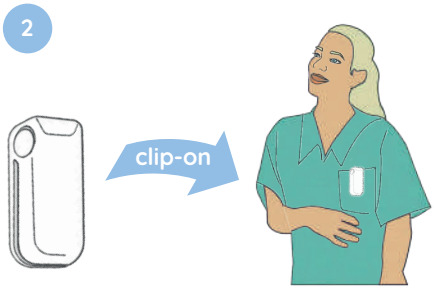
Easy — **Okay** — **Difficult**

2 ☑ 0

Why?

One hand is difficult to coordinate.

2



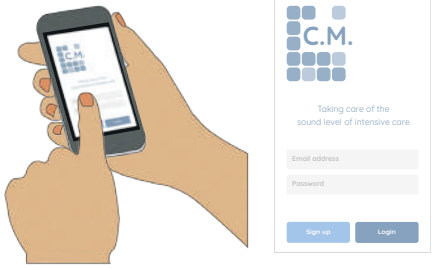
Please wear the clip the microphone device on your chest area.

Easy — **Okay** — **Difficult**

☑ 1 0

Why?

3



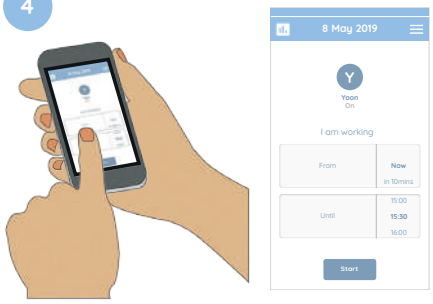
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Easy — **Okay** — **Difficult**

☑ 1 0

Why?

4



Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Easy — **Okay** — **Difficult**

2 ☑ 0

Why?

The starting time was not set in now so it was not easy to understand a first.

5

When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

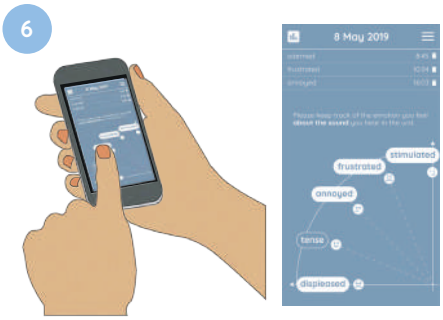
Easy — **Okay** — **Difficult**

2 1 ☑

Why?

I didn't notice them very well.

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Easy — **Okay** — **Difficult**

2 ☑ 0

Why?

It seemed uneasy to understand at first.

17/25

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree 1 2 3 ☑ 4 5 Strongly agree

Why do you think so?

It was a simple interface.

2. Cacophony Mapper application was clearly structured.

Strongly disagree 1 2 ☑ 3 4 5 Strongly agree

Why do you think so?

No strong opinion on this since this is a part of the applicaiton.

3. Cacophony Mapper application was complicated to use.

Strongly disagree 1 ☑ 2 3 4 5 Strongly agree

Why do you think so?

It was easy to use.

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree 1 2 3 ☑ 4 5 Strongly agree

Why do you think so?

It was easy to use.

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree 1 ☑ 2 3 4 5 Strongly agree

Why do you think so?

I think notifications will distract me.

Comments?

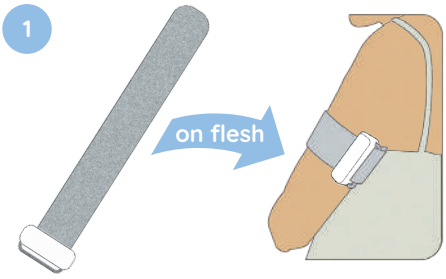
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Jooyoung
Gender : Female
Age : 27

Score : 10 / 12

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



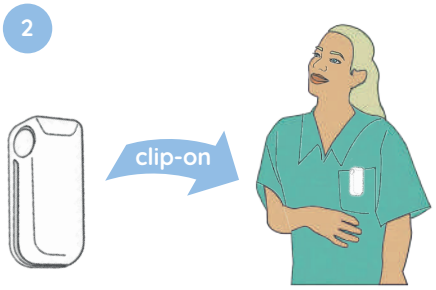
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 ✓ | 1 | 0

2



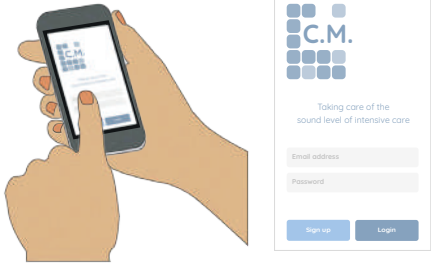
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

2 ✓ | 1 | 0

3



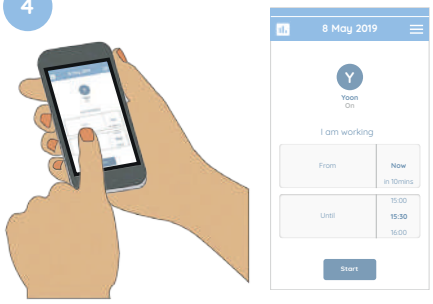
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

2 ✓ | 1 | 0

4



Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

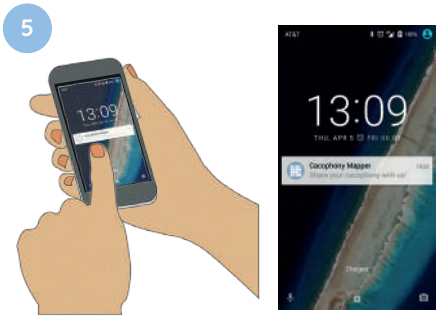
Why?

I didn't know what HB meant.

Easy — **Okay** — **Difficult**

2 | 1 ✓ | 0

5



When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

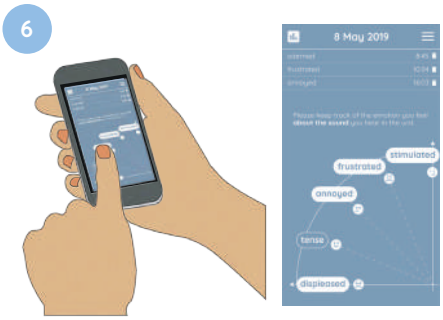
Why?

The interaction was easy but there was no vibration, so I couldn't be noticed easily.

Easy — **Okay** — **Difficult**

2 | 1 ✓ | 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

2 ✓ | 1 | 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

2. Cacophony Mapper application was clearly structured.

Strongly disagree ○ 1 ○ 2 ✓ 3 ○ 4 ○ 5 Strongly agree

Why do you think so?

Buttons were really intuitive to click but wasn't sure why those buttons are positioned in that way.

3. Cacophony Mapper application was complicated to use.

Strongly disagree ○ 1 ✓ 2 ○ 3 ○ 4 ○ 5 Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

I think it would be practical to use this applicaiton in the hospital environment, but notifications shouldn't bother clinicians too much.

Comments?

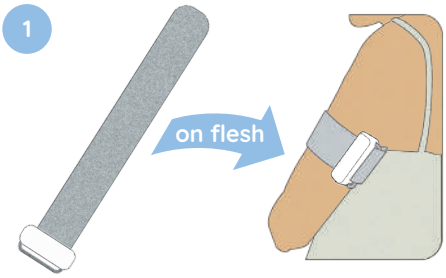
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Sebastiaan **Score :** 10 / 12

Gender : Male **Age :** 26

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



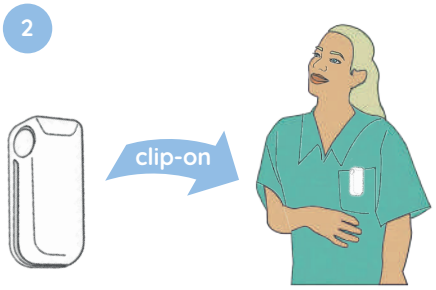
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

2



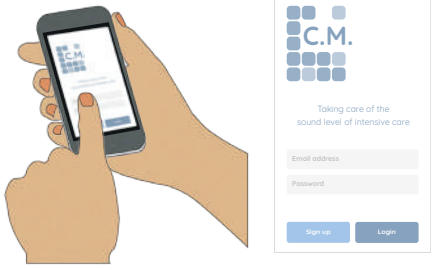
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

3



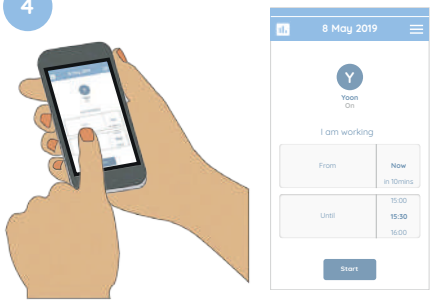
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

4



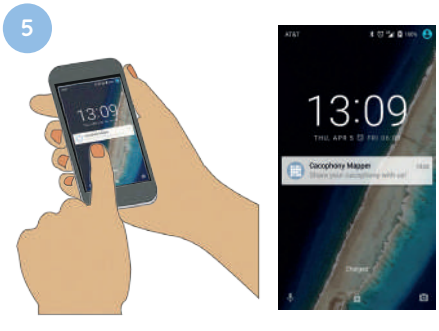
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

5



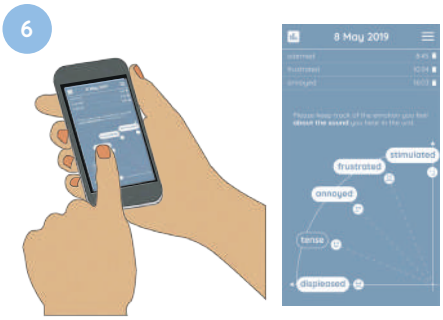
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

19 /25

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Why do you think so?

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

2. Cacophony Mapper application was clearly structured.

Why do you think so?

Strongly disagree ○ 1 ○ 2 ✓ 3 ○ 4 ○ 5 Strongly agree

3. Cacophony Mapper application was complicated to use.

Why do you think so?

Strongly disagree ○ 1 ✓ 2 ○ 3 ○ 4 ○ 5 Strongly agree

4. Cacophony Mapper interface was straghtforward to use.

Why do you think so?

I didn't see buttons at first, so I tried to press halfway the emotions. I think expressing a middle-ground options is missing (for example emotion between frustrated and neutral)

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Why do you think so?

I think it is disturbing to press buttons regularly.

Strongly disagree ○ 1 ✓ 2 ○ 3 ○ 4 ○ 5 Strongly agree

Comments?

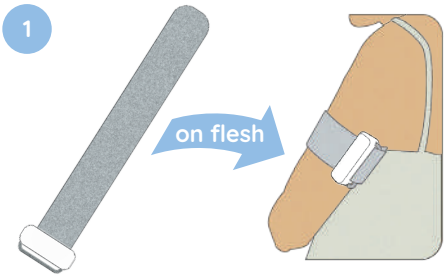
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Grace **Score :** 11 / 12

Gender : Female **Age :** 32

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



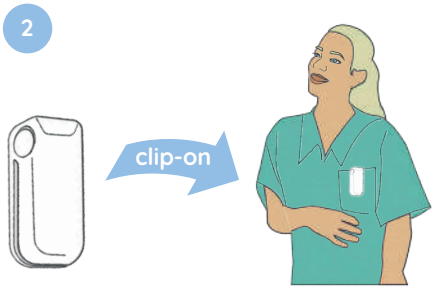
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

2



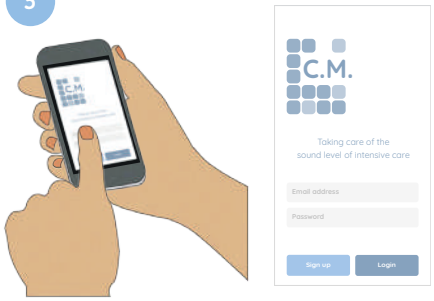
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

3



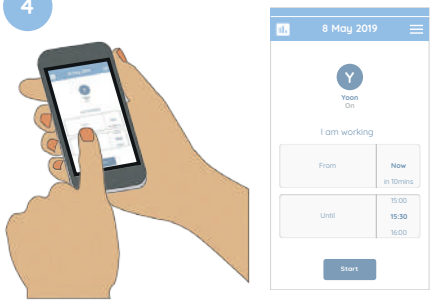
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

4



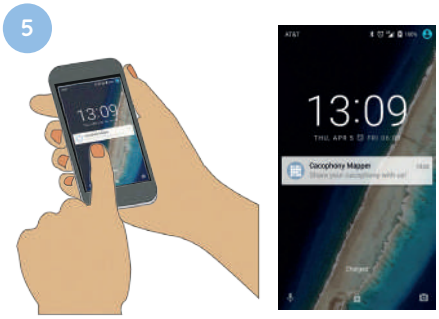
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

5



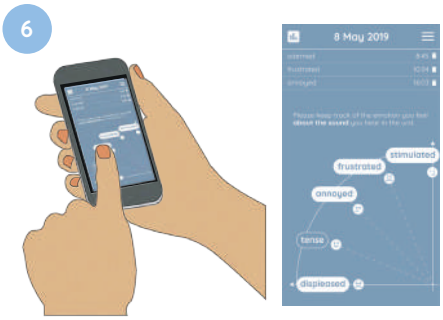
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

2 | 1 | 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

It was not complicated in the beginning but time setting was a bit tricky. In general, it was easy to learn.

2. Cacophony Mapper application was clearly structured.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree ○ 1 ✓ 2 ○ 3 ○ 4 ○ 5 Strongly agree

Why do you think so?

Only the first time was a bit complicated but was not too much to learn.

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

For me, emotion buttons are straigtforward to use.

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree ○ 1 ○ 2 ○ 3 ○ 4 ✓ 5 Strongly agree

Why do you think so?

By using device, I can check the stress level and manage the stress in the end and it will improve the work environment in the end.

Comments?

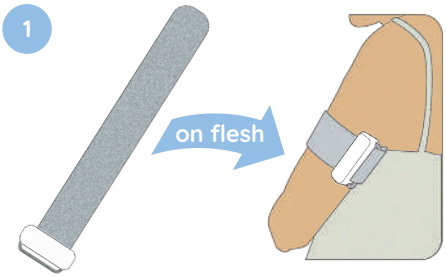
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : G.young **Gender :** Female **Age :** 29

Score : 11 **/ 12**

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



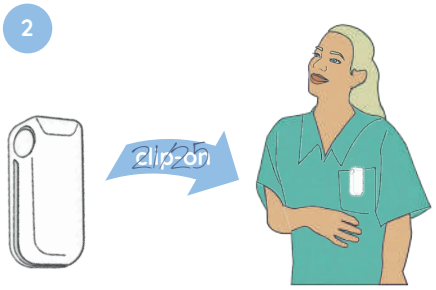
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

2



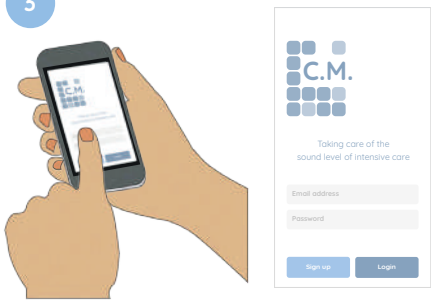
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

3



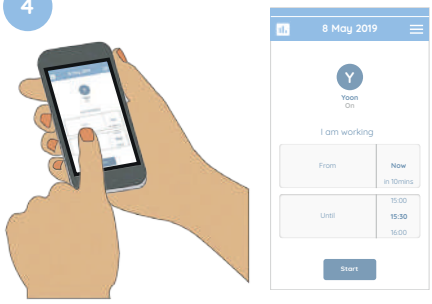
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

4



Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

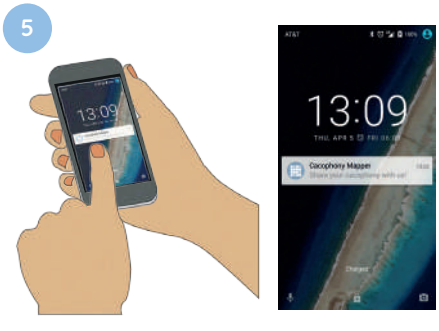
Why?

I think the time setting interface should be more intuitive. (confusing to set up time for now and after.)

Easy — **Okay** — **Difficult**

2 ✓ 0

5



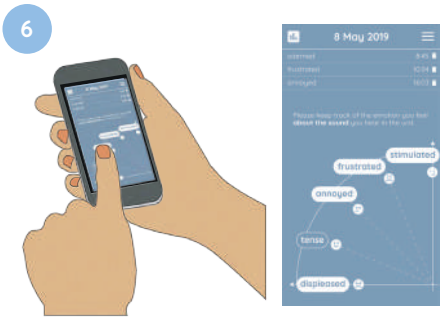
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

It was easy to follow because it was intuitive and self-explanatory interface.

2. Cacophony Mapper application was clearly structured.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

In case of real situation, it would be difficult to stop for a moment to record emotion.

Comments?

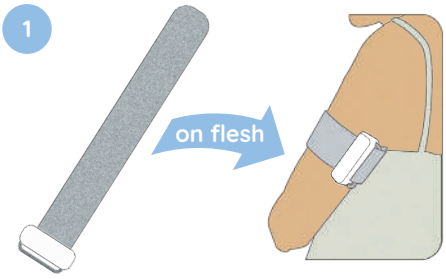
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Veronika
Gender : Female **Age :** 29

Score : 9 / 12

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



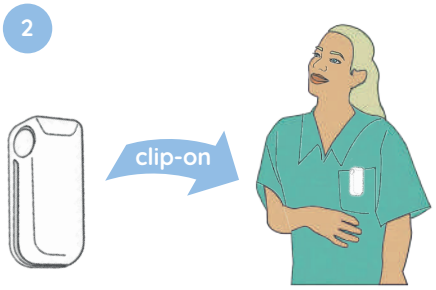
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 ✓ 1 0

2



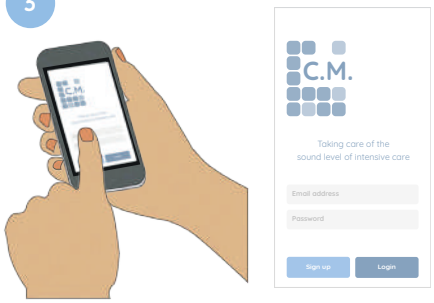
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

✓ 2 1 0

3



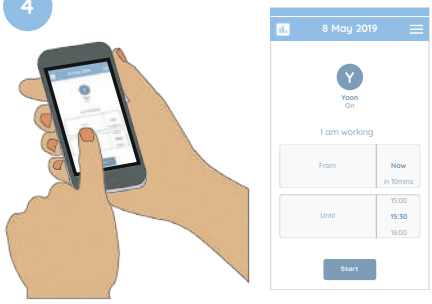
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

✓ 2 1 0

4



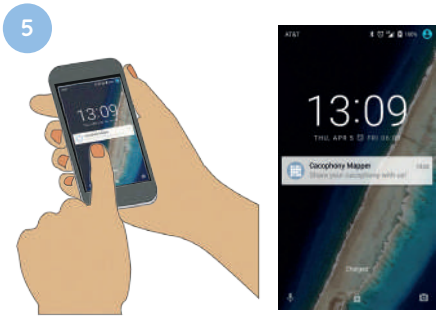
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 ✓ 0

5



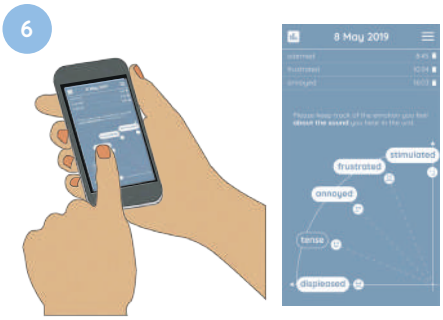
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

2 ✓ 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

✓ 1 0

18/25

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree 1 ○ 2 ○ 3 ○ 4 ✓ 5 ○ Strongly agree

Why do you think so?

At first, I didn't understand the inteface but it was easy to learn.

2. Cacophony Mapper application was clearly structured.

Strongly disagree 1 ○ 2 ○ 3 ○ 4 ✓ 5 ○ Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree 1 ○ 2 ✓ 3 ○ 4 ○ 5 ○ Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree 1 ○ 2 ○ 3 ○ 4 ○ 5 ✓ Strongly agree

Why do you think so?

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree 1 ✓ 2 ○ 3 ○ 4 ○ 5 ○ Strongly agree

Why do you think so?

It was quite difficult to keep concentration while I tried to work on something.

Comments? The notification for emotion report should be more clear since the device didn't give a buzz in the testing

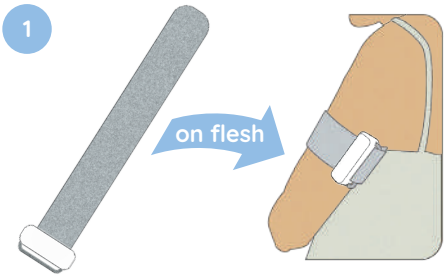
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Danielle **Score :** / 12

Gender : Female **Age :** 24

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



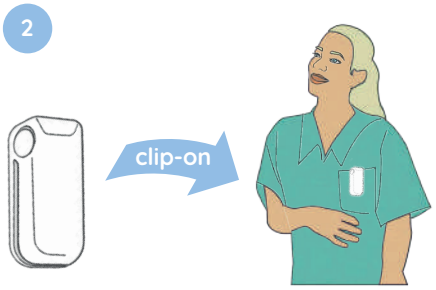
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

2



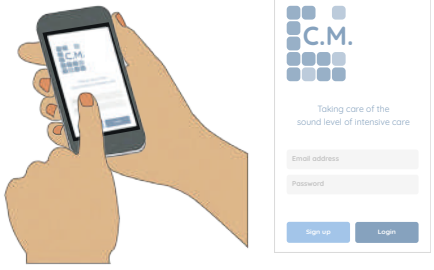
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

3



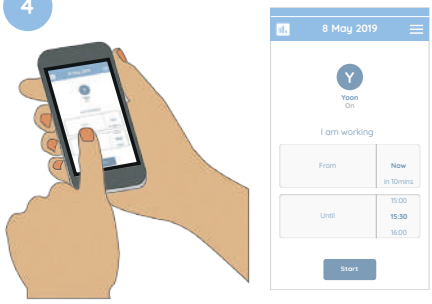
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

4



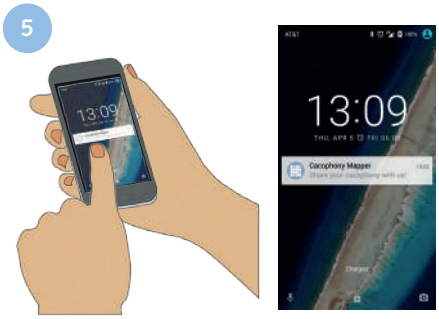
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

5



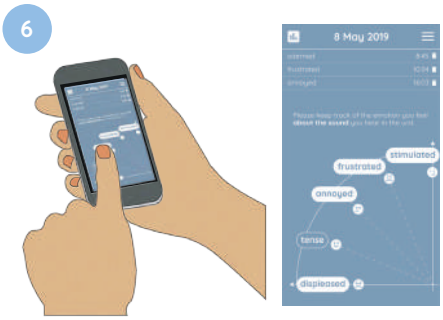
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

2. Cacophony Mapper application was clearly structured.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree ✓ 1 ○ 2 ○ 3 ○ 4 ○ 5 Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

I think giving off vibration as a notification is improtant since the mobile will be in your pocket.

Comments?

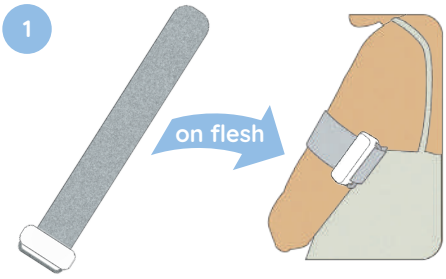
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Alex
Gender : Male
Age : 25

Score : 10 / 12

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



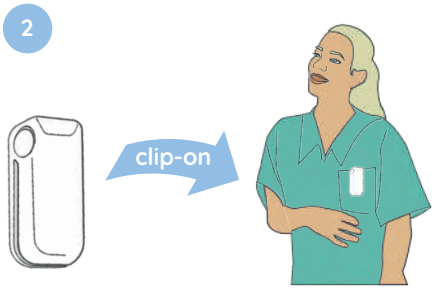
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

2



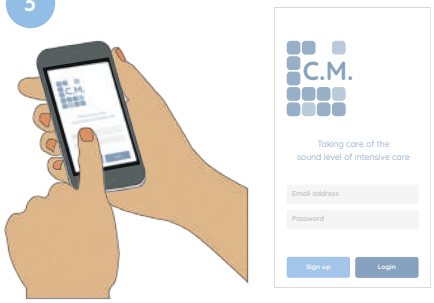
Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

3



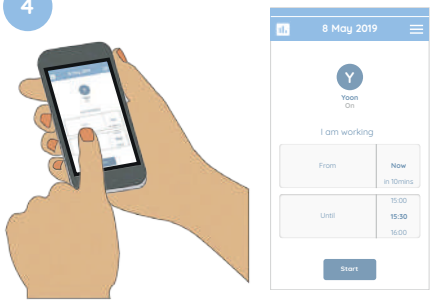
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

4



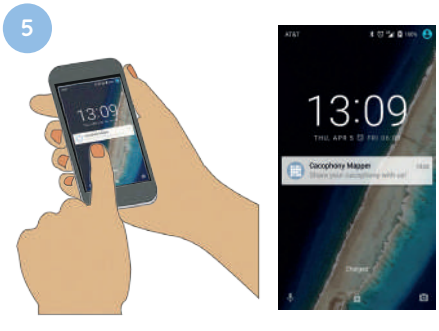
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

5



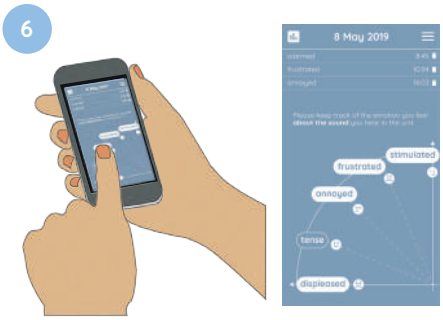
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

2 ☑ 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

☑ 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

It is simple interface with a little layers.

2. Cacophony Mapper application was clearly structured.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

I think "Start HD" button and "Start Rec" button should be combined. It is weird to have those buttons in parallel.

3. Cacophony Mapper application was complicated to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

The "neutral" button was positioned a bit differently than others, so it took some time for me to recognize there was one.

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree 1 2 3 4 5 Strongly agree

Why do you think so?

Since the only task is report their emotion, I think it can be done in the real environment too.

Comments?

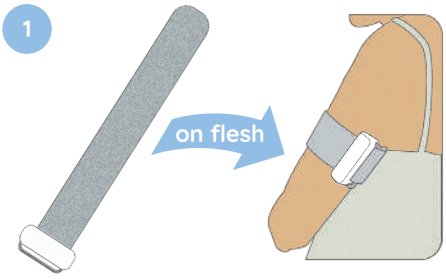
Cacophony Mapper: Defining Noise Fatigue in the ICU

Name : Yiling **Score :** 11 **/ 12**

Gender : Female **Age :** 22

The purpose of this project is to find how sound stimuli can affect nurses' stress level and emotional responses in the ICU. Thus, you are going to be asked to wear a heart rate detection device and a sound collector during the test. Sound data will be distorted using a filter while recording, so no one can listen or restore the original sound that you don't need to worry about the privacy issue. The data will be only used for academic purpose. Please follow the instruction below and rate your usability of each process. The questionnaire on the next page should be filled in after the test. The duration of the recordning will be 12 minutes and you do not need to try to remember the sound from the recording. Thank you for your participation and enjoy!

1



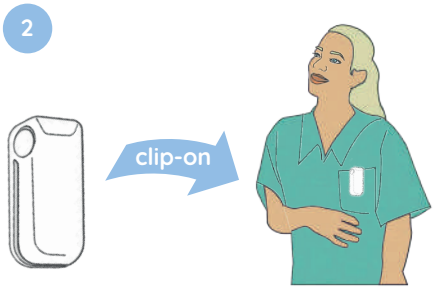
Please fasten the armband on your outer side of the bare upper arm for the heart rate collection.

Why?

Easy — **Okay** — **Difficult**

2 1 0

2



Please wear the clip the microphone device on your chest area.

Why?

Easy — **Okay** — **Difficult**

2 1 0

3

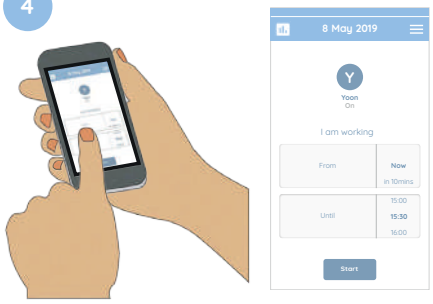
Please Sign in to Cacophony Mapper application, using Email and password written below:
Emai l: designer.yoon.lee@gmail.com
Password : dldbs

Why?

Easy — **Okay** — **Difficult**

2 1 0

4



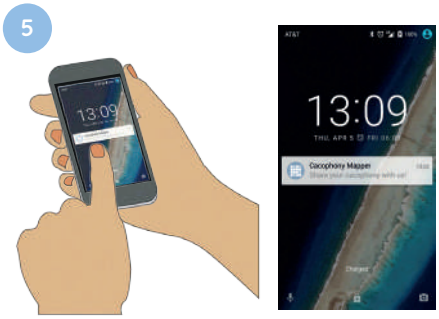
Please **start HB button** to connect the device to the Bluetooth. Assign the time slot **from now to 12 minutes** later and press **ttart rec button** and enjoy your work! :)

Why?

Easy — **Okay** — **Difficult**

2 1 0

5



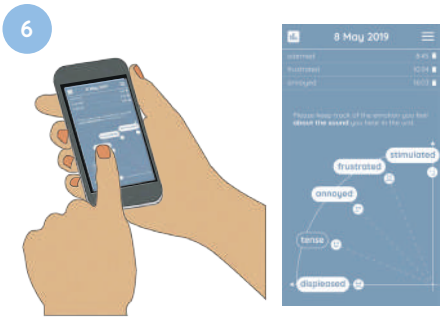
When there is a notification, please start the application by swiping the notification from the left to the rigt and report your emotion.

Why?

Easy — **Okay** — **Difficult**

2 1 0

6



Please press the emotion button which was relevant to your emotion related to your recent sound experience.

Why?

Easy — **Okay** — **Difficult**

2 1 0

The SUS(System Usability Scale) Survey for Cacophony Mapper application

1. Cacophony Mapper application was manageable to learn.

Strongly disagree ○ 1 ○ 2 ○ 3 ○ 4 ✓ 5 Strongly agree

Why do you think so?

2. Cacophony Mapper application was clearly structured.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

3. Cacophony Mapper application was complicated to use.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

It took me some time to get a Bluetooth connection for heart rate tracker.

4. Cacophony Mapper interface was straghtforward to use.

Strongly disagree ○ 1 ○ 2 ○ 3 ○ 4 ✓ 5 Strongly agree

Why do you think so?

5. I think it will be practical to used Cacophony Mapper during work in a medical environment.

Strongly disagree ○ 1 ○ 2 ○ 3 ✓ 4 ○ 5 Strongly agree

Why do you think so?

Notifications without vibration was not easy to catch.

Comments? *I think respondent's personal situation can affect to general emotion report even though that is not related to sound experience.*

User test data: Alex

15:39:59	8	39	20	0.644106388	0.529583812	0.486123085	incidental	incidental	
15:40:09	147	21	135	0.850320756	0.74557966	0.652014613	incidental	alarms	
15:40:19	117	135	122	6.582211971	5.469937325	4.860274792	incidental	alarms	
15:40:29	499	493	505	1.458024025	1.273670793	1.180526137	incidental	alarms	
15:40:39	554	533	520	1.176363468	1.047368526	0.942393959	incidental	alarms	
15:40:49	133	128	137	4.106258869	2.228001118	2.034805298	incidental	alarms	
15:40:59	129	128	535	4.591194153	2.443080664	2.379304409	incidental	alarms	
15:41:09	150	25	17	1.705943704	1.50355494	1.231989026	incidental	alarms	
15:41:19	18	21	19	3.56516242	1.723113775	1.622363448	incidental	alarms	
15:41:29	17	554	18	1.429094315	0.83224678	0.754692078	incidental	alarms	
15:41:39	12	52	22	0.785875738	0.635855138	0.611743569	incidental	alarms	
15:41:49	127	159	150	3.22524786	2.465080261	2.105055332	incidental	alarms	
15:41:59	159	147	158	1.371004581	1.291425467	0.976236224	incidental	alarms	
15:42:09	22	25	133	7.856760502	6.864361286	6.343356609	incidental	alarms	
15:42:19	156	159	18	2.803440094	1.492396116	1.418008924	incidental	alarms	
15:42:29	21	20	48	3.771864176	2.307833195	1.827970743	incidental	alarms	
15:42:39	580	524	125	3.482909679	1.499684334	1.484639406	incidental	alarms	tense
15:42:49	135	149	148	1.19209671	1.131442308	1.110735178	incidental	alarms	
15:42:59	33	152	228	1.62851119	0.860989034	0.694765806	conversation	alarms	
15:43:09	130	129	195	8.403878212	7.079025269	2.119298697	conversation	alarms	
15:43:19	19	21	38	1.467500687	0.70647794	0.523199558	conversation	alarms	
15:43:29	555	18	5	0.64147234	0.544946015	0.460469186	conversation	alarms	
15:43:39	62	233	234	5.182752132	5.126153469	4.658127308	conversation	alarms	
15:43:49	12	19	160	0.927852988	0.765834391	0.679667771	conversation	alarms	
15:43:59	21	25	382	4.410992622	4.356499672	1.724694848	conversation	alarms	
15:44:09	498	501	130	5.031188011	3.394296408	3.284371376	conversation	alarms	
15:44:19	43	50	44	1.183899522	1.072505713	0.983790219	conversation	alarms	
15:44:29	41	39	133	4.704407215	3.654771328	3.458458662	conversation	alarms	
15:44:39	44	48	47	18.07993317	17.20371056	14.6455555	conversation	alarms	
15:44:49	31	32	486	4.456507206	4.183105946	3.207586288	conversation	alarms	
15:44:59	64	162	61	1.789117455	1.464941144	1.153492808	conversation	alarms	
15:45:10	17	23	25	1.650973797	1.355594158	0.870652497	conversation	alarms	
15:45:20	6	28	19	0.616817892	0.56064719	0.461586595	conversation	incidental	
15:45:30	137	136	152	8.398532867	4.987271786	4.382613659	conversation	alarms	
15:45:40	39	20	13	2.887423515	2.511431932	2.166568995	conversation	alarms	
15:45:50	49	46	54	6.325631142	5.379469395	4.926165581	conversation	alarms	
15:46:00	19	140	15	0.624008477	0.555241644	0.545738697	machinery	alarms	neutral
15:46:10	42	43	15	1.675107121	1.314034462	1.162965298	machinery	alarms	
15:46:20	18	130	17	1.775048733	1.482331872	1.049422622	machinery	alarms	
15:46:30	18	25	476	0.604535758	0.580966711	0.508769512	machinery	alarms	
15:46:40	17	25	501	0.953009903	0.852466166	0.819085479	machinery	alarms	
15:46:50	18	131	125	2.445971966	1.784727454	1.45101738	machinery	alarms	
15:47:00	132	158	125	1.264959574	1.236393571	1.102118254	machinery	alarms	
15:47:10	9	35	11	0.528651774	0.488947213	0.399754435	machinery	incidental	
15:47:20	122	16	23	0.917823017	0.729592025	0.648360014	machinery	alarms	
15:47:30	533	514	19	1.798423052	1.781312227	1.694318771	machinery	alarms	
15:47:40	46	129	132	4.429954529	3.993202686	3.572512865	machinery	alarms	
15:47:50	21	127	133	0.952254772	0.887187839	0.784747362	machinery	alarms	neutral
15:48:00	20	21	27	1.057020307	0.658643484	0.533652604	machinery	alarms	
15:48:10	22	39	47	3.88098526	3.417440891	3.361878872	machinery	alarms	
15:48:20	17	16	20	0.97189647	0.746565938	0.50773561	machinery	alarms	
15:48:30	33	31	36	8.989224434	7.620128632	5.083240032	machinery	alarms	
15:48:40	152	126	17	3.234216452	1.745088577	1.532834291	machinery	alarms	neutral
15:48:50	14	27	23	1.509068847	0.955012321	0.881629407	machinery	alarms	
15:49:00	26	20	27	0.721761763	0.678753912	0.628189802	alarms	alarms	
15:49:10	46	43	41	5.472846031	2.885528326	1.660222054	alarms	alarms	
15:49:20	503	541	187	3.318225622	2.716632366	2.330497026	alarms	alarms	displeased
15:49:30	48	140	418	36.3119812	35.67761993	32.44536209	alarms	alarms	
15:49:40	324	325	232	9.851565361	5.417140961	4.082657337	alarms	alarms	tense

User test data: Seanne

16:07:57	5	6	2	0.710522115	0.38446638	0.21181196	incidental	incidental	
16:08:07	20	7	8	0.614666522	0.446586609	0.230622366	incidental	incidental	
16:08:17	294	279	48	2.520742178	1.796815515	1.766399622	incidental	alarms	
16:08:27	28	20	3	0.502557516	0.399103969	0.200112805	incidental	alarms	
16:08:37	483	496	479	2.770599127	1.472480297	1.317313075	incidental	alarms	
16:08:47	17	156	538	1.037716389	0.900786817	0.862035334	incidental	alarms	
16:08:57	426	506	503	12.87022114	9.396623611	8.88446331	incidental	alarms	
16:09:07	27	48	72	0.971475065	0.959652245	0.83101064	incidental	alarms	
16:09:17	120	20	22	0.872095048	0.683949709	0.682326436	incidental	alarms	
16:09:27	544	9	481	0.772643209	0.589879036	0.555261612	incidental	conversation	
16:09:38	17	481	483	1.896683812	1.046649814	0.902090669	incidental	alarms	
16:09:48	8	17	19	5.272541523	4.872628212	2.357375145	incidental	alarms	
16:09:58	132	130	133	1.713200688	1.30224371	1.295361042	incidental	alarms	
16:10:08	127	126	122	1.185773849	1.14768517	0.844431102	incidental	alarms	
16:10:18	13	11	119	0.404566944	0.383023739	0.359775096	incidental	incidental	
16:10:28	20	106	524	1.354585528	1.105025768	0.968459606	incidental	alarms	
16:10:38	8	12	19	0.509446263	0.425008386	0.318956614	incidental	incidental	
16:10:48	542	511	518	7.420064926	6.505860329	6.165812969	incidental	alarms	
16:10:58	570	569	540	10.40882301	9.861982346	9.4626894	conversation	alarms	
16:11:08	32	28	18	0.681998551	0.580636263	0.541672051	conversation	alarms	neutral
16:11:18	15	24	21	0.289766639	0.283656776	0.279452324	conversation	incidental	
16:11:28	23	21	487	1.564345717	1.18693006	1.133638263	conversation	alarms	
16:11:38	40	52	105	4.217610359	3.89155364	2.871868372	conversation	alarms	
16:11:48	489	487	40	2.055076361	1.845409274	1.835873842	conversation	alarms	
16:11:58	77	64	137	1.019643545	0.842453599	0.776765645	conversation	alarms	
16:12:08	61	38	277	4.702656746	3.706007004	3.543186665	conversation	alarms	
16:12:18	17	136	131	0.663666546	0.602090955	0.545530736	conversation	alarms	
16:12:28	541	556	549	2.203088999	2.124807835	2.085826635	conversation	alarms	
16:12:38	493	495	42	1.822015047	1.413558722	1.295358062	conversation	alarms	
16:12:48	497	48	494	2.958487034	2.785494328	2.444543123	conversation	alarms	
16:12:58	545	548	46	2.178141356	1.705423117	1.656334281	conversation	alarms	
16:13:08	159	20	140	6.431181431	4.953906059	2.434844255	conversation	alarms	
16:13:18	17	22	18	1.072820306	0.443038553	0.407504082	conversation	incidental	
16:13:28	39	36	40	1.810913801	1.525228739	1.178532958	conversation	alarms	
16:13:38	19	48	20	3.536713123	2.250235081	1.585165262	conversation	alarms	
16:13:48	17	5	8	1.168688059	1.112052441	1.072661877	conversation	incidental	
16:13:58	488	485	25	0.617590249	0.602681339	0.585592806	machinery	alarms	
16:14:08	22	23	24	0.836657047	0.734859228	0.478975773	machinery	alarms	
16:14:18	18	14	15	0.506452143	0.410884231	0.337433875	machinery	incidental	
16:14:28	20	22	9	0.840863526	0.383311301	0.283714145	machinery	incidental	
16:14:38	158	117	128	1.092973113	0.985507011	0.765605927	machinery	alarms	
16:14:48	151	15	12	0.731207788	0.27691409	0.26621449	machinery	alarms	
16:14:58	548	346	130	0.304116726	0.298543245	0.275202662	machinery	alarms	
16:15:08	120	117	1761	0.324523389	0.31837526	0.289710939	machinery	alarms	
16:15:18	18	503	512	1.063646674	0.740127385	0.722709715	machinery	alarms	
16:15:28	46	49	44	2.448371887	2.439112425	2.314001322	machinery	alarms	
16:15:38	544	542	558	13.55915833	10.4619627	9.281758308	machinery	alarms	
16:15:49	41	20	6	1.022966504	0.541732252	0.432336271	machinery	alarms	
16:15:59	37	48	121	1.122999787	0.789976895	0.727570772	machinery	alarms	
16:16:09	12	120	18	0.380976975	0.195934013	0.172100037	machinery	incidental	
16:16:19	46	47	49	8.318790436	5.412504196	3.104804516	machinery	alarms	
16:16:29	119	120	12	1.583693027	0.931433201	0.802872837	machinery	alarms	
16:16:39	20	150	159	0.818787873	0.557632267	0.545074165	machinery	alarms	
16:16:49	22	33	41	0.556367457	0.3789379	0.374347687	machinery	alarms	
16:16:59	18	16	44	2.989885092	0.889253795	0.783872426	alarms	alarms	neutral
16:17:09	22	485	17	0.555345595	0.424865514	0.366340011	alarms	alarms	
16:17:19	74	71	154	2.860734701	2.535277843	2.400329113	alarms	alarms	
16:17:29	160	18	144	1.358982205	1.010075212	0.912889004	alarms	alarms	
16:17:39	122	119	123	10.73904991	10.46014214	5.199195385	alarms	alarms	
16:17:49	189	192	571	43.70874023	13.57853222	3.447214127	alarms	alarms	
16:17:59	45	46	138	33.79218674	13.26746082	10.60404491	alarms	alarms	
16:18:09	323	322	321	30.4916172	20.15363503	18.0724144	alarms	alarms	
16:18:19	327	328	323	52.7885704	30.98361778	19.71361542	alarms	alarms	
16:18:29	92	279	464	5.219455242	4.342640877	3.122792006	alarms	alarms	
16:18:39	137	296	493	2.697107077	2.487110853	2.120351076	alarms	alarms	
16:18:49	32	52	59	0.44848451	0.340228647	0.309576213	alarms	alarms	
16:18:59	18	24	479	0.86117059	0.338442057	0.271438807	alarms	alarms	
16:19:09	17	20	130	4.65100956	3.322273254	2.697648048	alarms	alarms	
16:19:19	20	19	261	1.290632486	0.807500601	0.645923078	alarms	alarms	
16:19:29	156	19	46	0.293792069	0.28677088	0.280494869	alarms	alarms	
16:19:39	135	131	140	1.888917923	1.728644967	0.893991351	alarms	alarms	
16:19:49	17	18	28	1.058460832	0.527031839	0.412888795	alarms	alarms	
16:19:59	484	481	498	1.551034093	1.548577309	1.44999826	alarms	alarms	
16:20:09	22	17	19	6.529929161	3.020483017	1.814458489	alarms	alarms	stimulated

User test data: Rob

16:40:47	10	8	17	1.039099932	0.982508481	0.742913127	incidental	incidental
16:40:57	24	26	20	0.597828984	0.420042962	0.375925213	incidental	alarms
16:41:07	154	169	155	2.09198451	1.621603608	1.618193984	incidental	alarms
16:41:17	513	505	485	7.740833282	7.589360237	7.34264946	incidental	alarms
16:41:27	544	540	542	13.37444115	13.34817982	12.28671932	incidental	alarms
16:41:37	53	18	51	2.07562542	0.900625646	0.796648741	incidental	alarms
16:41:47	506	481	490	5.118053913	4.638739586	3.971023798	incidental	alarms
16:41:57	158	47	49	4.941292286	4.792693138	4.550886154	incidental	alarms
16:42:07	213	522	91	1.44577086	1.25209403	1.231671929	incidental	alarms
16:42:17	119	33	114	14.63299561	6.066511631	5.645432949	incidental	alarms
16:42:27	552	577	512	1.18301487	1.161760092	1.09439671	incidental	alarms
16:42:37	554	59	7	1.169650674	0.897233069	0.878208041	incidental	alarms
16:42:47	33	34	520	5.164369106	4.326026917	3.890940666	incidental	alarms
16:42:57	541	526	539	6.508298397	5.754269123	5.532942295	incidental	alarms
16:43:07	148	147	60	1.438809514	1.057294369	0.677373827	incidental	alarms
16:43:17	518	542	148	11.18504143	7.719101429	7.59879446	incidental	alarms
16:43:27	505	513	515	4.314263344	3.869976282	3.861080647	incidental	alarms
16:43:37	31	7	20	1.364399076	0.792173564	0.631704152	incidental	incidental
16:43:47	524	127	143	1.579311728	1.573803306	1.379780293	conversation	alarms
16:43:57	220	41	21	3.114866257	1.62343514	1.501739621	conversation	alarms
16:44:07	138	68	115	16.65231514	11.49840641	10.73727512	conversation	alarms
16:44:17	74	33	16	3.471644878	1.793573022	1.715986729	conversation	alarms
16:44:27	45	132	133	2.168279886	1.703951359	1.491841912	conversation	alarms
16:44:37	216	36	33	8.010576248	5.788788795	5.404756546	conversation	alarms
16:44:47	38	17	33	2.10831666	1.460656762	1.07184279	conversation	alarms
16:44:57	18	35	16	3.192421675	2.487936735	2.197903633	conversation	alarms
16:45:07	132	234	182	3.579767227	3.376803398	3.171082973	conversation	alarms
16:45:17	464	19	505	4.562903881	3.651084423	3.628459215	conversation	alarms
16:45:28	157	159	153	8.243818283	4.493390083	3.034391165	conversation	alarms
16:45:38	60	33	61	3.446494579	2.492540836	2.211471319	conversation	alarms
16:45:48	457	492	455	5.494787216	5.396153927	4.695379257	conversation	alarms
16:45:58	36	31	40	9.650292397	2.56801796	2.463037491	conversation	alarms
16:46:08	119	132	123	1.530821085	1.503254771	1.032045245	conversation	alarms
16:46:18	268	267	530	4.447056293	3.627594233	3.614217043	conversation	alarms
16:46:28	481	82	80	1.45530355	1.281589746	1.280394554	conversation	alarms
16:46:38	10	19	45	1.384601593	1.085710883	0.931094766	conversation	incidental
16:46:48	495	506	494	4.967416763	3.030070543	2.93023181	machinery	alarms
16:46:58	145	89	125	2.030191183	1.818526506	1.682952166	machinery	alarms
16:47:08	41	126	17	1.387679577	0.526874006	0.472448468	machinery	alarms
16:47:18	13	12	27	0.847348154	0.721876264	0.61306107	machinery	incidental
16:47:28	482	152	479	0.974067211	0.649145424	0.641013205	machinery	alarms
16:47:38	13	505	518	4.059233665	3.272021532	3.204139948	machinery	alarms
16:47:48	62	493	509	7.315855503	5.156857491	5.14608717	machinery	alarms
16:47:58	145	148	13	2.073961496	1.219843149	0.720811009	machinery	alarms
16:48:08	29	34	11	1.37118113	1.175948381	0.76844883	machinery	alarms
16:48:18	101	16	117	1.229141712	0.839885294	0.834397018	machinery	alarms
16:48:28	17	13	0	0.52560699	0.470985949	0.372783601	machinery	incidental
16:48:38	26	5	514	1.036781311	0.902969897	0.850231826	machinery	conversation
16:48:48	149	52	146	3.579552889	1.519678354	1.462223172	machinery	alarms
16:48:58	179	145	111	1.20058763	1.138506413	1.100787878	machinery	alarms
16:49:08	60	5	26	0.987124622	0.625522673	0.491485	machinery	conversation
16:49:18	19	59	55	1.309285045	0.81005758	0.677002668	machinery	alarms
16:49:28	18	64	236	1.117798209	0.796342432	0.780175149	machinery	alarms
16:49:38	46	51	36	2.256728888	1.87263298	1.871433496	machinery	alarms
16:49:48	63	27	144	1.074630618	0.735072374	0.709842741	alarms	alarms
16:49:58	190	187	192	14.01190758	9.375844955	6.73725462	alarms	alarms
16:50:08	28	39	49	2.557298899	2.413362741	1.667062759	alarms	alarms
16:50:18	323	322	324	51.12166977	17.29683495	16.79649162	alarms	alarms
16:50:28	323	322	321	42.66131973	12.62232685	9.018177032	alarms	alarms
16:50:38	324	232	325	26.75146294	22.65579796	17.38445854	alarms	alarms
16:50:48	94	93	96	11.16823769	4.36613512	2.763538122	alarms	alarms
16:50:58	10	14	16	0.771783412	0.471904904	0.442848235	alarms	incidental
16:51:08	45	44	47	3.361966848	2.544906378	2.436533213	alarms	alarms
16:51:18	483	59	480	0.600999832	0.565864682	0.427426606	alarms	alarms
16:51:29	12	10	19	0.858640671	0.790932059	0.752977967	alarms	incidental
16:51:39	42	43	47	3.044989109	2.926728964	2.712777376	alarms	alarms
16:51:49	47	50	36	14.47799301	10.80557251	2.591726542	alarms	alarms
16:51:59	45	48	47	17.35769272	13.05684566	10.20236397	alarms	alarms
16:52:09	29	107	34	1.334489226	0.613675833	0.543630958	alarms	alarms
16:52:19	32	477	516	7.847962379	6.610364914	6.157445431	alarms	alarms
16:52:29	16	2	3	0.541903794	0.391672611	0.384153426	alarms	incidental annoyed

User test data: Yiling

17:07:59	130	128	115	1.892530441	1.887761712	1.160543799	incidental	alarms
17:08:09	8	10	1	14.47416401	13.03718376	11.41836548	incidental	incidental
17:08:19	45	60	30	1.843403578	0.892732263	0.656602204	incidental	alarms
17:08:29	564	537	512	4.499670029	4.161001682	4.047255516	incidental	alarms
17:08:39	32	481	537	4.941087723	4.837652683	4.40790844	incidental	alarms
17:08:49	21	44	51	2.524539471	2.470428705	2.144984484	incidental	alarms
17:08:59	32	30	33	0.659386456	0.633183956	0.427133858	incidental	alarms
17:09:09	152	153	210	1.580917358	0.828518093	0.613653362	incidental	alarms
17:09:19	19	13	15	1.102884531	0.792247772	0.761434138	incidental	incidental
17:09:29	531	526	540	1.315104723	1.281718254	1.059751749	incidental	alarms
17:09:39	535	503	6	0.88737905	0.85753274	0.837998211	incidental	alarms
17:09:49	14	39	20	0.576659441	0.489192367	0.423495114	incidental	incidental
17:09:59	34	149	152	2.739526749	2.692025661	2.542077541	incidental	alarms
17:10:09	33	20	60	0.546090305	0.44175306	0.42544055	incidental	alarms
17:10:19	581	60	63	1.531219125	1.257000566	0.950802982	incidental	alarms
17:10:29	533	532	463	3.638239145	2.315394163	2.274621964	incidental	alarms
17:10:39	57	34	59	1.538600326	1.469774723	1.275994897	incidental	alarms
17:10:49	58	56	535	2.168540716	1.630045056	1.187678337	incidental	alarms
17:10:59	46	18	48	3.755710125	0.843919337	0.742275596	conversation	alarms
17:11:09	21	18	17	1.937965035	1.390839219	0.99963057	conversation	incidentalneutral
17:11:19	25	27	5	1.321648359	0.743083715	0.722719371	conversation	alarms
17:11:29	56	28	206	4.934378147	4.771194458	4.543140888	conversation	alarms
17:11:39	492	487	498	14.86143494	14.0588398	13.76727104	conversation	alarms
17:11:50	59	61	62	3.773186445	2.108029604	2.048760414	conversation	alarms
17:12:00	48	34	29	1.63340795	0.96076107	0.948511243	conversation	alarms
17:12:10	21	18	19	6.610150337	3.775693417	2.861665249	conversation	alarms
17:12:20	55	37	56	10.30368233	6.7374053	6.126133442	conversation	alarms
17:12:30	284	282	155	34.15539932	26.80799294	13.12618446	conversation	alarms
17:12:40	317	312	287	7.513030529	6.557031631	6.187628746	conversation	alarms
17:12:50	484	285	560	1.381744742	1.182373881	1.167956591	conversation	alarms
17:13:00	118	115	121	28.22658157	27.96336555	9.983579636	conversation	alarms
17:13:10	66	25	46	1.006198764	1.002270341	0.949438274	conversation	alarms
17:13:20	555	523	532	2.457521915	2.391184092	1.807694077	conversation	alarms
17:13:30	58	111	57	11.69158363	8.796308517	8.334608078	conversation	alarms
17:13:40	515	510	296	2.896110058	2.278457403	1.730339766	conversation	alarms
17:13:50	19	152	18	0.8618294	0.645956814	0.538463235	conversation	alarms
17:14:00	138	132	285	2.674177408	2.597175598	1.875570774	machinery	alarms
17:14:10	59	54	31	1.449941754	0.6231336	0.599691093	machinery	alarms
17:14:20	38	35	24	1.090775728	0.932018042	0.668730021	machinery	alarms
17:14:30	33	109	518	1.52170372	1.477239966	1.34579587	machinery	alarms
17:14:40	149	152	484	1.504201889	1.112612963	1.010590672	machinery	alarms
17:14:50	131	133	135	5.324565411	3.477408648	2.141494989	machinery	alarms
17:15:00	132	128	131	3.120678186	1.83014524	1.83001864	machinery	alarms
17:15:10	18	34	55	0.924144506	0.696073115	0.654142678	machinery	alarms
17:15:20	109	114	154	2.670768499	2.331732035	1.644517779	machinery	alarms
17:15:30	112	114	33	0.86798197	0.70795536	0.566696942	machinery	alarms
17:15:40	25	38	140	0.763505936	0.705826402	0.70350188	machinery	alarms
17:15:50	560	116	33	0.786450148	0.753486097	0.639213204	machinery	alarms
17:16:00	17	16	9	1.080584168	1.029021144	0.532033205	machinery	alarms
17:16:10	60	24	21	0.819250882	0.500545084	0.498998195	machinery	alarms
17:16:20	50	45	31	2.172754049	1.850085735	1.305486083	machinery	alarms
17:16:30	214	267	496	3.492395878	3.327813625	3.184565306	machinery	alarms
17:16:40	291	287	281	4.489722252	3.185323238	2.429413557	machinery	alarms
17:16:50	19	17	15	6.279038906	2.531110048	1.82383728	machinery	alarms
17:17:00	9	15	18	0.569962382	0.553806663	0.517280757	alarms	incidental
17:17:10	187	185	186	14.16517353	8.190429688	4.94155407	alarms	alarms
17:17:21	21	5	150	2.055325747	0.57019949	0.437132299	alarms	incidental
17:17:31	45	93	326	38.4779892	29.77163315	16.26302338	alarms	alarms annoyed
17:17:41	328	321	91	21.0336647	20.98144913	19.54422188	alarms	alarms
17:17:51	326	323	93	108.581604	60.45914459	19.34014702	alarms	alarms
17:18:01	93	89	88	13.85219574	8.014172554	4.928872108	alarms	alarms
17:18:11	34	23	25	1.139199853	0.611036658	0.471668422	alarms	alarms
17:18:21	39	36	41	4.296550751	2.712813854	1.552251101	alarms	alarms
17:18:31	212	311	113	0.682120204	0.642637312	0.605268657	alarms	alarms
17:18:41	151	154	160	1.98104322	0.992358565	0.742482007	alarms	alarms
17:18:51	20	59	17	1.02164638	0.805145741	0.787052155	alarms	alarms
17:19:01	16	33	14	1.119623542	0.395195872	0.348778397	alarms	incidental
17:19:11	35	48	46	14.59531403	13.8795929	11.33552361	alarms	alarms
17:19:21	141	130	102	2.547394037	2.275119543	1.877234936	alarms	alarms
17:19:31	135	216	155	1.034382105	1.008874178	0.958984256	alarms	alarms
17:19:41	34	29	27	0.930357873	0.841998875	0.547120035	alarms	alarms
17:19:51	18	21	17	8.081004143	7.637934685	4.078391552	alarms	alarms

User test data: Danielle

9:16:16	21	41	52	7.151490211	2.696174145	2.694789648	incidental	alarms	
9:16:26	482	479	528	11.69486809	8.466977119	8.18756485	incidental	alarms	
9:16:36	27	50	6	3.748390913	1.653293133	1.299674153	incidental	alarms	
9:16:46	27	21	9	3.690021992	1.711241484	1.43593514	incidental	alarms	
9:16:56	28	12	55	3.491794348	2.818813562	1.292420149	incidental	conversation	
9:17:06	12	9	28	4.835211754	4.16134882	3.147669315	incidental	conversation	
9:17:16	27	28	168	4.23562336	2.718127966	1.630605102	incidental	alarms	
9:17:26	9	8	5	1.879603267	1.383043528	1.272710681	incidental	incidental	
9:17:36	134	139	188	2.879995584	2.100272655	1.794801593	incidental	alarms	
9:17:46	12	13	9	2.807193279	2.272709131	2.003452778	incidental	incidental	
9:17:56	28	514	25	3.699324846	2.390648603	1.377858877	incidental	alarms	
9:18:06	27	12	39	1.851634502	1.356700778	0.839499593	incidental	incidental	
9:18:16	143	49	54	4.915223598	4.474447727	3.903252125	incidental	alarms	
9:18:26	530	536	204	14.83256435	13.02470112	8.226765633	incidental	alarms	
9:18:36	28	27	9	3.195938826	1.428242445	1.125320911	incidental	alarms	
9:18:46	519	537	512	11.30263805	9.977215767	8.189624786	incidental	alarms	annoyed
9:18:56	520	509	566	8.580681801	7.507294178	7.255396843	incidental	alarms	
9:19:06	27	9	8	1.6654284	0.870800734	0.795195639	incidental	incidental	
9:19:16	28	484	45	4.535767555	3.724573374	3.509334803	conversation	alarms	
9:19:26	239	220	238	5.089596272	2.54197526	2.098855257	conversation	alarms	
9:19:37	140	136	91	22.62044334	21.28461647	21.10818672	conversation	alarms	annoyed
9:19:47	72	27	75	3.109105349	2.962091923	2.503932476	conversation	alarms	
9:19:57	145	144	27	3.715475082	3.640892029	2.553212881	conversation	alarms	
9:20:07	251	233	245	12.419137	7.990366936	3.109497786	conversation	alarms	
9:20:17	27	44	152	4.778178215	1.546033859	1.335282922	conversation	alarms	annoyed
9:20:27	53	27	55	9.021807671	4.30816555	4.215033531	conversation	alarms	
9:20:37	143	184	161	6.345106125	5.323157787	4.861945629	conversation	alarms	
9:20:47	20	19	43	7.577735424	7.523971081	6.884532928	conversation	alarms	
9:20:57	154	151	23	12.93583393	10.03177929	10.01042271	conversation	alarms	frustrated
9:21:07	158	27	41	4.832979679	4.447251797	3.749598503	conversation	alarms	
9:21:17	28	156	154	3.806804419	3.52761054	3.487945795	conversation	alarms	
9:21:27	27	177	24	9.0704422	6.537706852	5.312616348	conversation	alarms	
9:21:37	12	131	113	2.733172178	2.338883638	2.053529263	conversation	alarms	
9:21:47	11	26	13	5.031493664	2.06901741	1.945884824	conversation	alarms	
9:21:57	28	133	162	4.315606594	3.694514036	2.994884014	conversation	alarms	
9:22:07	28	45	21	6.98544693	3.490190029	2.547591686	conversation	alarms	
9:22:17	485	495	502	8.426734924	7.754645348	7.670830727	machinery	alarms	
9:22:27	28	152	143	5.35162735	2.826239347	2.304220915	machinery	alarms	
9:22:37	9	12	1	1.730967641	1.150119901	1.021242619	machinery	incidental	
9:22:47	12	11	20	1.623417974	1.274803519	1.173481226	machinery	incidental	
9:22:57	25	23	136	2.642693996	2.514294624	2.048959017	machinery	alarms	
9:23:07	490	493	481	15.02823257	10.89540672	8.769422531	machinery	alarms	
9:23:17	54	50	45	17.39298058	16.67319298	13.28390694	machinery	alarms	
9:23:27	17	150	23	1.772077799	1.713576555	1.503858447	machinery	alarms	
9:23:37	28	27	17	4.319963455	2.006504536	1.951328754	machinery	alarms	
9:23:47	25	126	23	2.973407269	1.5728122	1.335409522	machinery	alarms	
9:23:57	27	10	14	4.628973484	2.337071657	1.705862999	machinery	conversation	
9:24:07	23	508	511	2.615906954	1.148960233	0.923203588	machinery	alarms	
9:24:17	28	130	188	4.083840847	3.069315672	2.831234932	machinery	alarms	
9:24:27	28	27	10	4.054014683	2.284908056	1.950602651	machinery	alarms	
9:24:37	12	25	15	1.059217334	1.020497918	0.910541177	machinery	incidental	displeased
9:24:47	503	24	484	1.29420197	1.234768391	1.026834369	machinery	alarms	
9:24:57	22	23	28	6.802853584	4.788938046	1.880402088	machinery	conversation	
9:25:07	52	28	39	6.390545845	5.622183323	5.287916183	machinery	alarms	
9:25:17	27	10	12	5.016571999	3.487641335	2.576686144	alarms	conversation	
9:25:27	189	25	21	2.548378706	1.74114275	1.524577379	alarms	alarms	
9:25:38	33	22	42	2.47625351	2.156744003	2.084729671	alarms	alarms	
9:25:48	93	326	232	12.6768856	11.38009548	10.77188492	alarms	alarms	
9:25:58	325	46	93	28.05281448	16.8348465	15.22848225	alarms	alarms	annoyed
9:26:08	93	92	232	15.26310158	9.712119102	6.359476089	alarms	alarms	displeased
9:26:18	94	91	96	23.6879921	14.61385059	9.964966774	alarms	alarms	
9:26:28	12	28	9	1.595017433	1.548710585	1.081302524	alarms	alarms	
9:26:38	27	46	31	5.54929781	3.00070262	2.209462166	alarms	alarms	
9:26:48	27	161	13	3.174592733	1.077640295	0.81621176	alarms	alarms	
9:26:58	28	25	18	2.535887241	1.154134035	0.87116617alarms	alarms		

User test data: Veronika

10:32:18	11	27	7	2.294693947	1.308060408	1.165325284	incidental	incidental
10:32:28	8	44	13	1.148837805	1.056872964	0.764154613	incidental	alarms
10:32:38	411	415	377	5.520960808	5.406888962	5.054074287	incidental	alarms
10:32:48	10	503	20	1.620798707	1.217840672	0.918102205	incidental	alarms
10:32:58	51	54	33	19.56132698	11.39912987	9.058878899	incidental	alarms
10:33:08	56	128	148	1.977231503	1.533670425	1.476028681	incidental	alarms
10:33:18	516	521	554	4.619310856	4.604483128	4.390069485	incidental	alarms
10:33:28	28	50	145	1.054684162	0.597533882	0.451067865	incidental	alarms
10:33:38	46	29	55	1.976608157	1.133196831	1.129597902	incidental	alarms
10:33:48	144	155	510	3.733062029	2.26845932	2.052835226	incidental	alarms
10:33:58	28	534	51	1.861937642	1.528154016	0.999179065	incidental	alarms
10:34:08	20	7	10	3.508394003	3.008552074	2.930915356	incidental	conversation
10:34:18	38	43	26	3.569845676	2.493527174	1.86967957	incidental	alarms
10:34:28	19	13	17	1.237397671	1.055128813	0.899583817	incidental	incidental
10:34:38	576	577	21	3.037503719	2.049071789	1.814663291	incidental	alarms
10:34:48	577	576	579	10.59157276	7.799260616	5.518237114	incidental	alarms
10:34:58	27	22	14	2.773247719	1.819146395	1.255747437	incidental	alarms
10:35:08	12	7	9	1.890351057	1.817890882	1.201205969	incidental	incidental
10:35:18	27	14	8	1.140398979	0.99508971	0.670914412	conversation	incidental
10:35:28	150	77	143	14.56927299	8.228412628	7.403042793	conversation	alarms
10:35:38	8	15	22	0.694181263	0.666387439	0.664834738	conversation	alarms
10:35:48	125	132	126	3.705796719	3.58012557	2.983273745	conversation	alarms
10:35:58	34	36	37	2.66730094	2.007698298	1.034283519	conversation	alarms
10:36:08	52	9	28	2.844129562	1.158126712	1.025991917	conversation	conversation
10:36:18	212	44	209	7.532952309	7.169885635	6.140591145	conversation	alarms
10:36:28	19	56	27	4.454545498	2.939962626	2.378005981	conversation	alarms
10:36:38	67	55	17	3.75669241	2.175770521	2.072430849	conversation	alarms
10:36:48	305	114	149	2.345376968	2.209614038	2.151815176	conversation	alarms
10:36:58	35	54	33	3.958182573	2.233396053	1.661250234	conversation	alarms
10:37:08	112	123	69	4.761347771	4.521755219	2.933573246	conversation	alarms
10:37:18	505	407	472	2.394695044	1.36916399	1.301686406	conversation	alarms
10:37:29	28	27	12	1.191939712	0.671868503	0.506473601	conversation	incidental
10:37:39	141	372	146	6.257899761	5.942346573	5.800124168	conversation	alarms
10:37:49	54	27	12	1.435435295	1.17553103	1.16431427	conversation	alarms
10:37:59	32	137	14	0.778958619	0.690298557	0.594677866	conversation	alarms
10:38:09	129	134	135	4.224490643	3.754508257	3.384399891	conversation	alarms
10:38:19	28	9	33	0.914806545	0.905131757	0.715242624	machinery	conversation
10:38:29	484	27	28	2.883055687	2.434592247	2.254121304	machinery	alarms tense
10:38:39	27	23	24	3.595589638	2.730292082	1.885015965	machinery	alarms
10:38:49	21	26	12	2.410000563	1.412234783	1.136987209	machinery	alarms
10:38:59	131	53	129	8.022500038	4.093475819	3.588572741	machinery	alarms
10:39:09	128	56	21	2.772661924	2.552744389	1.967232585	machinery	alarms
10:39:19	28	20	22	2.064037561	1.43258667	1.313506722	machinery	alarms
10:39:29	28	10	54	1.462924361	1.452179909	1.3332026	machinery	conversation
10:39:39	516	486	485	7.150791645	6.08809185	5.812129498	machinery	alarms
10:39:49	9	17	21	1.205497742	0.981280565	0.867879152	machinery	incidental
10:39:59	27	127	29	2.167774677	1.633837461	1.284159422	machinery	alarms
10:40:09	24	26	52	1.465933561	0.947442949	0.904983342	machinery	alarms
10:40:19	43	27	14	2.248245478	2.157669306	1.138263106	machinery	incidental
10:40:29	24	27	134	1.974739313	1.908869267	1.027631998	machinery	alarms annoyed
10:40:39	497	22	134	3.770386934	2.519325733	1.829385757	machinery	alarms
10:40:49	27	28	11	2.055547476	1.777517438	1.709682584	machinery	alarms
10:40:59	21	20	135	2.056849003	1.80619967	1.781591654	machinery	alarms
10:41:09	10	8	6	1.597311258	1.551157355	1.162927866	machinery	incidental
10:41:19	191	570	571	18.62853622	9.561905861	6.333662987	alarms	alarms
10:41:29	28	24	32	3.129999876	2.237655401	1.133799434	alarms	alarms
10:41:39	488	485	27	3.898231268	3.632342577	3.030939817	alarms	alarms
10:41:49	232	92	231	22.61315727	18.33107948	12.34101868	alarms	alarms
10:41:59	323	230	94	54.44478607	32.63043976	21.67127991	alarms	alarms
10:42:09	463	91	92	11.01971054	8.352343559	3.330014706	alarms	alarms
10:42:19	456	505	466	14.69853783	11.63384342	11.57468128	alarms	alarms
10:42:29	490	493	492	4.898583889	3.240541935	3.147239447	alarms	alarms
10:42:39	21	491	490	1.995904326	1.951113582	1.910012841	alarms	alarms
10:42:49	28	27	22	3.666051865	2.646187305	1.476629615	alarms	alarms
10:42:59	20	23	13	1.034578443	0.856300771	0.813100934	alarms	alarms

User test data: Sebastiaan

11:25:36	28	55	27	1.969115615	0.96558249	0.852519095	incidental	alarms
11:25:46	150	24	9	1.083293557	0.797544658	0.779554784	incidental	alarms
11:25:56	13	10	55	1.642445207	1.271178722	0.692914367	incidental	incidental
11:26:06	23	16	45	1.471314669	1.17630589	1.175912619	incidental	alarms
11:26:16	518	8	527	2.126106739	2.025937319	1.866433859	incidental	conversation
11:26:26	405	436	419	6.452401638	5.874213219	5.731959343	incidental	alarms
11:26:36	58	18	35	11.48550892	11.34888268	5.59655714	incidental	alarms
11:26:46	453	456	461	2.32869792	2.127718925	2.049471855	incidental	alarms neutral
11:26:56	57	59	56	11.52961349	10.70764542	8.709519386	incidental	alarms
11:27:06	12	28	7	4.126995087	2.08877039	1.658205867	incidental	alarms
11:27:16	28	10	27	2.42629838	1.798405766	1.202665925	incidental	conversationtense
11:27:26	25	28	57	1.60232532	1.316610694	1.270137072	incidental	alarms
11:27:36	69	47	33	2.95507884	2.58637619	2.145574808	incidental	alarms
11:27:46	12	13	27	1.514156699	0.93178153	0.871504366	incidental	incidental
11:27:56	8	28	4	1.179131389	0.995558918	0.639388502	incidental	alarms
11:28:06	581	66	28	6.356960297	2.897024155	2.589231253	incidental	alarms
11:28:16	579	64	63	11.54938316	9.506243706	6.628759861	incidental	alarms annoyed
11:28:26	27	20	14	2.3043468	1.05183959	0.895087123	incidental	incidental
11:28:36	27	28	19	2.328874588	1.650809407	1.040549159	conversation	alarms
11:28:46	28	21	56	1.378231287	0.791463077	0.623678684	conversation	alarms displeased
11:28:56	78	146	40	10.5734396	6.748380661	6.364908218	conversation	alarms
11:29:06	28	10	5	2.391965151	0.994561851	0.840453506	conversation	conversation
11:29:16	63	62	126	8.254466057	7.274656773	3.203687906	conversation	alarms
11:29:26	28	27	34	2.856121778	2.427476406	1.825103641	conversation	alarms
11:29:36	28	9	21	2.884320021	1.230260849	0.929153979	conversation	incidental
11:29:46	43	46	22	6.469465733	6.010754585	4.727680683	conversation	alarms
11:29:56	38	43	41	6.253027916	3.661488056	3.647302866	conversation	alarms
11:30:06	27	54	57	3.528403282	2.249177456	1.817506671	conversation	alarms neutral
11:30:16	11	28	27	5.370411396	2.179083586	2.030194998	conversation	conversation
11:30:26	53	12	63	15.89331055	1.966136575	1.282641292	conversation	conversation
11:30:37	28	153	151	3.195996523	2.174797773	1.970234871	conversation	alarms
11:30:47	27	152	399	3.083113909	2.606058836	2.307239771	conversation	alarms
11:30:57	13	28	17	2.015722036	2.702246904	1.986137748	conversation	alarms
11:31:07	28	112	30	3.332910776	2.305878639	2.01207757	conversation	alarms
11:31:17	27	17	26	3.077638388	1.084090948	1.050943375	conversation	alarms
11:31:27	28	20	16	3.309455156	1.112711668	0.801709235	conversation	alarms neutral
11:31:37	27	71	74	4.305193424	3.982532501	3.721191168	machinery	alarms
11:31:47	21	54	24	1.141684055	0.816473663	0.727447629	machinery	alarms
11:31:57	27	151	152	3.296149254	2.892079353	2.689720154	machinery	alarms
11:32:07	27	480	485	2.384147167	1.47986269	1.294992089	machinery	alarms
11:32:17	136	132	20	2.529531717	2.182869673	1.419336438	machinery	alarms
11:32:27	138	129	115	9.554092407	4.907641411	4.631075859	machinery	alarms
11:32:37	73	11	72	2.276298761	2.185675859	1.921110988	machinery	conversation
11:32:47	27	26	10	2.718696594	1.457232952	1.149860859	machinery	alarms
11:32:57	129	54	22	2.023449421	1.746567488	1.443922639	machinery	alarms
11:33:07	154	14	16	2.058388948	1.799431205	1.677916884	machinery	conversation
11:33:17	27	10	151	3.752159119	1.928512931	1.87612009	machinery	conversation
11:33:27	28	41	126	4.618263721	4.542482853	4.404816151	machinery	alarms neutral
11:33:37	28	9	130	3.381670237	0.790322185	0.726473331	machinery	conversation
11:33:47	12	17	40	4.70091486	3.033494473	2.020224094	machinery	conversation
11:33:57	58	115	61	3.9207623	1.72622931	1.629024029	machinery	alarms
11:34:07	27	55	58	2.656564474	2.546852827	1.564499021	machinery	alarms
11:34:17	122	154	16	1.566611767	1.519802809	1.206100464	machinery	alarms
11:34:27	28	125	27	2.851987123	2.626901627	2.219040632	machinery	alarms
11:34:37	28	25	8	2.491541386	1.343864918	1.239791512	alarms	alarms neutral
11:34:47	189	192	570	63.17152023	18.07365799	4.755170345	alarms	alarms
11:34:57	25	15	22	1.228029132	0.759709477	0.747937441	alarms	alarms stimulated
11:35:07	27	151	130	3.59883213	2.339906454	2.218961	alarms	alarms
11:35:17	231	325	92	13.85807323	13.01589966	9.820515633	alarms	alarms annoyed
11:35:27	328	321	330	11.19163704	9.75357151	6.940268517	alarms	alarms
11:35:37	93	464	28	4.722037792	2.948964834	2.645795107	alarms	alarms tense
11:35:47	518	529	490	10.32171535	9.806639671	6.019711018	alarms	alarms
11:35:57	135	129	495	2.496124268	2.153523445	1.873429179	alarms	alarms
11:36:07	489	487	488	2.231730223	2.174782038	2.016093493	alarms	alarms
11:36:17	27	11	18	3.075688362	1.105739713	0.886654019	alarms	incidental
11:36:27	20	22	1	1.023683429	0.995732427	0.729698062	alarms	alarms
11:36:38	28	17	22	2.703814268	1.627921939	1.418863297	alarms	alarms annoyed
11:36:48	46	50	41	58.60517883	30.10993385	22.87420082	alarms	alarms
11:36:58	22	16	26	0.861316621	0.852836967	0.815629721	alarms	alarms
11:37:08	28	17	63	4.332481861	2.10238719	1.671923995	alarms	alarms
11:37:18	28	13	21	1.889196634	1.651843548	1.268960834	alarms	incidental neutral
11:37:28	26	24	25	1.001429677	0.823279381	0.728381813	alarms	alarms

User test data: Grace

11:59:39	28	27	9	4.623202801	2.426186562	1.078794718	incidental	alarms	
11:59:50	27	24	17	7.094645023	3.410418987	1.574731112	incidental	alarms	
12:00:00	52	136	153	6.153242588	1.650621057	1.537567973	incidental	alarms	
12:00:10	26	24	147	1.720538497	1.568169475	0.865384281	incidental	alarms	
12:00:20	56	51	26	3.003758907	2.502877474	1.643029213	incidental	alarms	
12:00:30	28	19	25	4.17519331	3.298220873	2.283214569	incidental	conversation	
12:00:40	22	25	20	3.1704247	1.586277127	1.251597881	incidental	alarms	
12:00:50	27	22	28	4.608717918	3.244668484	2.961169958	incidental	conversation	
12:01:00	23	28	25	2.182429314	2.154643774	1.992760062	incidental	alarms	
12:01:10	21	25	22	1.919779301	1.330961347	1.186939716	incidental	alarms	
12:01:20	27	10	45	7.359247684	2.281397581	2.134804964	incidental	conversation	
12:01:30	27	28	24	5.957940102	4.857526302	1.836008549	incidental	alarms	
12:01:40	53	54	61	13.33977127	11.89666843	7.421809673	incidental	alarms	
12:01:50	27	28	138	3.677411079	2.854299068	1.196129084	incidental	alarms	
12:02:00	21	28	20	2.441614866	1.58179009	1.084333539	incidental	alarms	
12:02:10	28	21	19	6.474571228	2.861078024	2.834282637	incidental	alarms	
12:02:20	28	203	45	7.768414021	3.959387541	3.095061064	incidental	alarms	
12:02:30	14	23	21	2.429658651	1.61804986	1.437155366	incidental	alarms	
12:02:40	27	24	26	5.499542236	2.563435316	2.514909029	conversation	conversation	
12:02:50	28	44	48	4.839356899	2.237853527	1.319298625	conversation	alarms	
12:03:00	49	128	50	11.87108421	10.7442131	8.419054031	conversation	alarms	
12:03:10	23	22	20	3.433101177	2.112426996	2.04229331	conversation	alarms	
12:03:20	28	54	30	4.907268047	3.335788012	2.74038291	conversation	alarms	
12:03:30	232	53	194	4.528813362	4.229128838	3.905090809	conversation	alarms	
12:03:40	58	57	40	8.287996292	7.892627716	3.754794359	conversation	alarms	
12:03:50	27	22	59	4.607179165	1.908158422	0.603257179	conversation	alarms	
12:04:00	58	137	55	4.16057682	3.644209862	3.15717721	conversation	alarms	
12:04:10	41	40	24	6.083827972	3.689831257	3.67198801	conversation	alarms	
12:04:20	44	40	45	9.784633636	4.929528236	4.852638721	conversation	alarms	
12:04:30	111	38	73	2.058978558	2.005007029	1.64692235	conversation	alarms	
12:04:40	28	19	30	5.395042419	1.810998917	1.302332163	conversation	conversation	
12:04:50	541	529	552	17.2049408	13.07628059	12.96273422	conversation	alarms	
12:05:01	27	21	20	2.784080744	1.395780683	1.323904514	conversation	alarms	
12:05:11	146	145	25	3.148075104	2.793838024	1.542563319	conversation	alarms	
12:05:21	28	53	56	5.673161507	5.567042351	3.4982059	conversation	alarms	
12:05:31	28	127	168	5.609119892	1.591896653	1.403025985	conversation	alarms	
12:05:41	28	21	19	3.03504014	2.029938936	0.95227164	machinery	alarms	neutral
12:05:51	135	27	128	8.071238518	7.314929008	3.466858149	machinery	alarms	
12:06:01	28	137	27	5.373339653	1.982198954	1.782373071	machinery	alarms	
12:06:11	21	19	28	2.181253672	1.113038778	0.738007307	machinery	alarms	
12:06:21	27	135	128	4.173387527	2.944423199	1.755921245	machinery	alarms	
12:06:31	27	16	51	5.847138882	1.135391474	0.780976355	machinery	alarms	
12:06:41	13	149	21	1.972770452	0.98650521	0.928998828	machinery	alarms	
12:06:51	136	27	130	5.366831779	4.095824718	3.854221106	machinery	alarms	
12:07:01	27	28	13	5.370240211	0.933895469	0.823529541	machinery	alarms	
12:07:11	27	19	29	5.371603489	1.497075796	1.439094186	machinery	conversation	
12:07:21	27	29	14	5.507139206	1.78002429	1.589178205	machinery	alarms	
12:07:31	27	22	33	4.221342087	1.783385873	1.399047375	machinery	conversation	
12:07:41	27	129	53	3.729072571	3.649280071	3.058070183	machinery	alarms	
12:07:51	27	129	132	4.369183064	2.629248142	2.236401558	machinery	alarms	
12:08:01	27	20	21	5.912745953	2.582180977	1.833705664	machinery	alarms	
12:08:11	133	53	21	3.094628096	2.745390177	2.60572052	machinery	alarms	
12:08:21	27	497	28	5.293276787	3.235704899	3.10655117	machinery	alarms	
12:08:31	9	27	14	7.266902924	4.628377438	2.63356328	machinery	alarms	
12:08:41	21	22	20	3.30622077	2.706644297	1.049539447	alarms	alarms	neutral
12:08:51	28	30	56	4.57575655	1.155439138	1.133819699	alarms	alarms	
12:09:01	9	19	21	2.832947493	1.86837554	1.745624661	alarms	alarms	
12:09:11	232	231	234	37.37086868	13.0040369	4.840088367	alarms	alarms	
12:09:21	46	45	231	28.89851761	20.03741074	12.21646881	alarms	alarms	
12:09:31	231	328	47	17.29243279	12.07922649	11.34845066	alarms	alarms	
12:09:41	91	87	89	16.13611031	7.662304401	7.047790527	alarms	alarms	
12:09:51	27	28	9	4.057697773	3.879599333	1.087979198	alarms	alarms	
12:10:01	27	56	28	4.371813774	3.534749746	3.121341228	alarms	alarms	
12:10:11	23	5	7	1.37717855	1.14567852	1.029925346	alarms	incidental	
12:10:21	27	125	503	4.893764496	1.307442546	1.264758229	alarms	alarms	
12:10:31	28	27	24	5.428726196	4.070519447	1.40096736	alarms	conversation	
12:10:41	19	48	15	1.417472363	1.332935929	1.122065544	alarms	alarms	
12:10:51	48	47	45	46.22812653	33.09703064	32.45941544	alarms	alarms	
12:11:01	507	53	27	14.86945724	8.799114227	6.372742176	alarms	alarms	
12:11:11	134	136	302	3.781892538	2.86131072	2.816670656	alarms	alarms	
12:11:21	28	22	508	7.127122402	2.285135269	1.682128429	alarms	alarms	
12:11:31	28	25	11	5.143651962	1.54765594	1.225855112	alarms	alarms	annoyed

User test data: G.Young

14:20:06	67	27	19	7.540002346	6.797169685	4.774970055	incidental	alarms
14:20:16	28	9	27	3.746375561	1.423963189	1.030683041	incidental	conversation
14:20:26	11	18	27	2.572280407	2.555030346	1.985975385	incidental	alarms
14:20:36	27	12	149	3.094005346	1.33594954	1.163872957	incidental	conversation
14:20:46	27	28	1	6.982021809	1.277415037	1.232492089	incidental	alarms
14:20:56	145	25	23	1.474550605	1.313052893	1.151423693	incidental	alarms
14:21:06	14	43	11	0.910595953	0.760030389	0.698426902	incidental	alarms
14:21:16	27	26	24	5.603274345	2.860610723	1.747789741	incidental	conversation
14:21:26	28	53	50	5.087116718	3.275455952	2.189687729	incidental	alarms
14:21:36	44	46	41	7.94879961	4.669539928	4.141410351	incidental	alarms
14:21:46	14	16	501	1.648228049	1.117802024	0.948689699	incidental	alarms
14:21:56	143	21	20	2.46069932	2.130955458	1.570138693	incidental	alarms
14:22:07	28	21	9	4.282043934	2.245159864	2.123203278	incidental	alarms
14:22:17	27	29	26	2.802129269	1.345947981	1.243124127	incidental	alarms
14:22:27	27	29	28	3.77788353	1.30975461	0.80465734	incidental	alarms
14:22:37	515	575	540	10.93678284	4.823992252	4.630722523	incidental	alarms
14:22:47	151	150	53	28.11200523	11.50099087	11.04461765	incidental	alarms
14:22:57	28	27	30	3.810489178	1.321841955	1.225100756	incidental	conversation
14:23:07	28	21	25	3.588833332	3.297245979	1.623665452	conversation	alarms
14:23:17	28	5	31	4.337031364	1.542915463	1.365833402	conversation	conversation
14:23:27	28	10	25	3.826195002	1.292457223	1.056930423	conversation	conversation
14:23:37	27	139	39	6.210716724	4.731399536	3.01632905	conversation	alarms
14:23:47	54	163	161	15.39936161	12.98440456	10.37187481	conversation	alarms
14:23:57	27	39	56	4.574797153	1.054690123	0.826096416	conversation	alarms
14:24:07	28	30	7	1.046790719	1.044104934	1.027809262	conversation	alarms
14:24:17	29	26	27	3.560585737	2.895953417	2.722746849	conversation	alarms
14:24:27	42	145	34	7.475886822	6.122803211	5.115092278	conversation	alarms
14:24:37	27	49	48	5.124500275	4.331405163	4.283764362	conversation	alarms
14:24:47	551	554	527	5.142971992	4.753363132	4.356653214	conversation	alarms
14:24:57	52	51	24	7.251577377	6.546813011	2.458556652	conversation	alarms
14:25:07	55	27	14	3.130869627	2.569172144	1.187230706	conversation	alarms
14:25:17	141	151	28	6.358185768	5.438684464	3.437332392	conversation	alarms
14:25:27	27	145	147	6.514137268	3.42183423	3.269988537	conversation	alarms
14:25:37	12	9	131	3.33723855	3.078137398	2.723371983	conversation	conversation
14:25:47	117	115	124	14.22468281	12.14705563	9.012540817	conversation	alarms
14:25:57	156	151	73	4.37443161	4.15144825	3.061911821	conversation	alarms
14:26:07	27	12	9	2.698652506	1.761046767	0.991763651	machinery	conversation
14:26:17	143	147	149	2.456121922	2.376675844	2.282536983	machinery	alarms
14:26:27	152	151	150	5.746739388	4.245556831	2.853684425	machinery	alarms
14:26:37	28	21	34	4.751237392	0.969172716	0.962122858	machinery	conversation
14:26:47	136	133	138	5.149169922	4.903017044	4.793756485	machinery	alarms
14:26:57	28	23	119	5.076906681	2.424602509	1.735145688	machinery	alarms
14:27:07	25	51	28	1.921126485	1.898246646	1.811532497	machinery	alarms
14:27:17	28	27	21	4.865671635	3.02214098	1.460920215	machinery	alarms neutral
14:27:27	27	151	149	5.026008129	3.743047714	2.436625957	machinery	alarms
14:27:37	27	128	151	5.550057888	2.681246758	1.777306557	machinery	alarms
14:27:47	134	138	136	7.474253178	6.976080418	5.371792316	machinery	alarms
14:27:57	28	21	15	4.47353363	1.330658317	0.850514829	machinery	alarms
14:28:08	27	26	55	2.151736975	1.644249439	1.49890089	machinery	alarms
14:28:18	28	120	13	3.414346457	1.948920846	0.725260794	machinery	alarms
14:28:28	19	150	21	1.608497143	1.490173936	0.926643193	machinery	alarms
14:28:38	27	138	140	3.939167976	1.987244129	1.635384798	machinery	alarms
14:28:48	27	11	28	3.367008448	1.446322799	1.245889306	machinery	conversation
14:28:58	27	13	15	2.18998456	0.940152109	0.77273941	machinery	incidental
14:29:08	501	53	549	9.223461151	8.79083252	8.472768784	alarms	alarms
14:29:18	489	28	493	4.883031368	4.495944977	2.865291834	alarms	alarms neutral
14:29:28	189	27	185	9.122590065	3.791307449	2.567850351	alarms	alarms displeased
14:29:38	142	512	229	16.28835106	15.96070004	12.4248333	alarms	alarms
14:29:48	323	91	321	31.82233238	11.99202633	11.57143116	alarms	alarms tense
14:29:58	91	322	324	18.06955338	9.634752274	9.087903023	alarms	alarms
14:30:08	93	95	27	17.91080284	4.426354408	3.258761644	alarms	alarms tense
14:30:18	27	20	29	6.169540405	1.720032692	1.588703871	alarms	conversation frustrated
14:30:28	56	82	24	5.73029089	1.951060176	1.811835051	alarms	alarms
14:30:38	28	27	9	4.102149487	3.575804234	2.356558561	alarms	alarms
14:30:48	27	28	12	4.723105431	2.164969921	1.434097767	alarms	alarms neutral
14:30:58	17	10	54	1.297272444	1.237224579	1.066417575	alarms	incidental
14:31:08	37	8	10	3.180339813	2.068088055	1.736163735	alarms	conversation
14:31:18	43	46	47	18.67030144	15.32499886	11.50626659	alarms	alarms annoyed
14:31:28	28	148	13	3.252566814	1.61956501	1.449410439	alarms	alarms tense
14:31:38	9	19	5	2.238597631	1.305418134	1.151694894	alarms	incidental frustrated
14:31:48	27	29	31	5.278033733	1.612689018	1.419395566	alarms	conversation
14:31:58	13	22	87	1.560978413	1.514557958	1.456640124	alarms	alarms neutral

User test data: Jooyoung

14:20:06	67	27	19	7.540002346	6.797169685	4.774970055	incidental	alarms
14:20:16	28	9	27	3.746375561	1.423963189	1.030683041	incidental	conversation
14:20:26	11	18	27	2.572280407	2.555030346	1.985975385	incidental	alarms
14:20:36	27	12	149	3.094005346	1.33594954	1.163872957	incidental	conversation
14:20:46	27	28	1	6.982021809	1.277415037	1.232492089	incidental	alarms
14:20:56	145	25	23	1.474550605	1.313052893	1.151423693	incidental	alarms
14:21:06	14	43	11	0.910595953	0.760030389	0.698426902	incidental	alarms
14:21:16	27	26	24	5.603274345	2.860610723	1.747789741	incidental	conversation
14:21:26	28	53	50	5.087116718	3.275455952	2.189687729	incidental	alarms
14:21:36	44	46	41	7.94879961	4.669539928	4.141410351	incidental	alarms
14:21:46	14	16	501	1.648228049	1.117802024	0.948689699	incidental	alarms
14:21:56	143	21	20	2.46069932	2.130955458	1.570138693	incidental	alarms
14:22:07	28	21	9	4.282043934	2.245159864	2.123203278	incidental	alarms
14:22:17	27	29	26	2.802129269	1.345947981	1.243124127	incidental	alarms
14:22:27	27	29	28	3.77788353	1.30975461	0.80465734	incidental	alarms
14:22:37	515	575	540	10.93678284	4.823992252	4.630722523	incidental	alarms
14:22:47	151	150	53	28.11200523	11.50099087	11.04461765	incidental	alarms
14:22:57	28	27	30	3.810489178	1.321841955	1.225100756	incidental	conversation
14:23:07	28	21	25	3.588833332	3.297245979	1.623665452	conversation	alarms
14:23:17	28	5	31	4.337031364	1.542915463	1.365833402	conversation	conversation
14:23:27	28	10	25	3.826195002	1.292457223	1.056930423	conversation	conversation
14:23:37	27	139	39	6.210716724	4.731399536	3.01632905	conversation	alarms
14:23:47	54	163	161	15.39936161	12.98440456	10.37187481	conversation	alarms
14:23:57	27	39	56	4.574797153	1.054690123	0.826096416	conversation	alarms
14:24:07	28	30	7	1.046790719	1.044104934	1.027809262	conversation	alarms
14:24:17	29	26	27	3.560585737	2.895953417	2.722746849	conversation	alarms
14:24:27	42	145	34	7.475886822	6.122803211	5.115092278	conversation	alarms
14:24:37	27	49	48	5.124500275	4.331405163	4.283764362	conversation	alarms
14:24:47	551	554	527	5.142971992	4.753363132	4.356653214	conversation	alarms
14:24:57	52	51	24	7.251577377	6.546813011	2.458556652	conversation	alarms
14:25:07	55	27	14	3.130869627	2.569172144	1.187230706	conversation	alarms
14:25:17	141	151	28	6.358185768	5.438684464	3.437332392	conversation	alarms
14:25:27	27	145	147	6.514137268	3.42183423	3.269988537	conversation	alarms
14:25:37	12	9	131	3.33723855	3.078137398	2.723371983	conversation	conversation
14:25:47	117	115	124	14.22468281	12.14705563	9.012540817	conversation	alarms
14:25:57	156	151	73	4.37443161	4.15144825	3.061911821	conversation	alarms
14:26:07	27	12	9	2.698652506	1.761046767	0.991763651	machinery	conversation
14:26:17	143	147	149	2.456121922	2.376675844	2.282536983	machinery	alarms
14:26:27	152	151	150	5.746739388	4.245556831	2.853684425	machinery	alarms
14:26:37	28	21	34	4.751237392	0.969172716	0.962122858	machinery	conversation
14:26:47	136	133	138	5.149169922	4.903017044	4.793756485	machinery	alarms
14:26:57	28	23	119	5.076906681	2.424602509	1.735145688	machinery	alarms
14:27:07	25	51	28	1.921126485	1.898246646	1.811532497	machinery	alarms
14:27:17	28	27	21	4.865671635	3.02214098	1.460920215	machinery	alarms neutral
14:27:27	27	151	149	5.026008129	3.743047714	2.436625957	machinery	alarms
14:27:37	27	128	151	5.550057888	2.681246758	1.777306557	machinery	alarms
14:27:47	134	138	136	7.474253178	6.976080418	5.371792316	machinery	alarms
14:27:57	28	21	15	4.47353363	1.330658317	0.850514829	machinery	alarms
14:28:08	27	26	55	2.151736975	1.644249439	1.49890089	machinery	alarms
14:28:18	28	120	13	3.414346457	1.948920846	0.725260794	machinery	alarms
14:28:28	19	150	21	1.608497143	1.490173936	0.926643193	machinery	alarms
14:28:38	27	138	140	3.939167976	1.987244129	1.635384798	machinery	alarms
14:28:48	27	11	28	3.367008448	1.446322799	1.245889306	machinery	conversation
14:28:58	27	13	15	2.18998456	0.940152109	0.77273941	machinery	incidental
14:29:08	501	53	549	9.223461151	8.79083252	8.472768784	alarms	alarms
14:29:18	489	28	493	4.883031368	4.495944977	2.865291834	alarms	alarms neutral
14:29:28	189	27	185	9.122590065	3.791307449	2.567850351	alarms	alarms displeased
14:29:38	142	512	229	16.28835106	15.96070004	12.4248333	alarms	alarms
14:29:48	323	91	321	31.82233238	11.99202633	11.57143116	alarms	alarms tense
14:29:58	91	322	324	18.06955338	9.634752274	9.087903023	alarms	alarms
14:30:08	93	95	27	17.91080284	4.426354408	3.258761644	alarms	alarms tense
14:30:18	27	20	29	6.169540405	1.720032692	1.588703871	alarms	conversation frustrated
14:30:28	56	82	24	5.73029089	1.951060176	1.811835051	alarms	alarms
14:30:38	28	27	9	4.102149487	3.575804234	2.356558561	alarms	alarms
14:30:48	27	28	12	4.723105431	2.164969921	1.434097767	alarms	alarms neutral
14:30:58	17	10	54	1.297272444	1.237224579	1.066417575	alarms	incidental
14:31:08	37	8	10	3.180339813	2.068088055	1.736163735	alarms	conversation
14:31:18	43	46	47	18.67030144	15.32499886	11.50626659	alarms	alarms annoyed
14:31:28	28	148	13	3.252566814	1.61956501	1.449410439	alarms	alarms tense
14:31:38	9	19	5	2.238597631	1.305418134	1.151694894	alarms	incidental frustrated
14:31:48	27	29	31	5.278033733	1.612689018	1.419395566	alarms	conversation
14:31:58	13	22	87	1.560978413	1.514557958	1.456640124	alarms	alarms neutral

User test data: Jiwon

15:34:25	27	28	29	4.649060249	3.5375247	1.218516946	incidental	alarms
15:34:35	25	19	7	2.3171525	1.434974551	1.1033988	incidental	alarms
15:34:45	28	54	52	9.03886795	3.467441797	2.6831007	incidental	alarms
15:34:55	28	25	13	2.932265043	1.768224478	1.088409185	incidental	alarms
15:35:05	57	47	25	3.322274208	1.996452928	1.842850566	incidental	alarms
15:35:15	27	56	60	5.955713749	3.307775259	1.475275397	incidental	alarms
15:35:25	27	26	29	3.998114586	1.858543515	1.144407749	incidental	conversation
15:35:35	48	57	59	3.004626751	2.824011803	2.805366755	incidental	alarms
15:35:45	28	13	32	8.383062363	1.956995487	1.780521393	incidental	conversation
15:35:55	28	27	54	5.997546673	2.373152494	1.949213386	incidental	conversation
15:36:05	56	22	550	5.444364548	2.541113615	1.955647111	incidental	alarms
15:36:15	27	544	29	6.433924675	3.270435095	1.539159417	incidental	alarms
15:36:25	58	50	26	6.076436043	5.921990871	5.845228195	incidental	alarms
15:36:35	9	135	18	1.000345826	0.955043793	0.919612169	incidental	alarms
15:36:45	25	11	17	3.071307898	2.411989927	1.38168931	incidental	incidental
15:36:55	27	248	191	5.247439861	3.736461878	3.528650045	incidental	alarms
15:37:05	55	28	537	8.267560959	4.657581329	3.78694129	incidental	alarms
15:37:15	27	12	29	5.759988785	1.704980254	1.097588181	incidental	conversation
15:37:25	28	27	30	5.115778446	1.901258707	1.00969243	conversation	conversation
15:37:35	43	45	42	27.57291222	13.56744957	11.17013359	conversation	alarms neutral
15:37:45	28	47	128	10.11931705	9.106186867	7.741375923	conversation	alarms
15:37:55	28	286	445	4.585098267	3.60614419	3.481886625	conversation	alarms
15:38:06	28	32	16	6.063032627	2.08506918	2.057082653	conversation	alarms
15:38:16	57	56	506	10.86387348	5.238829136	5.091310024	conversation	alarms
15:38:26	38	43	13	7.207251549	2.237887859	1.883550525	conversation	alarms
15:38:36	28	17	55	3.028325558	2.236908197	1.73830092	conversation	alarms
15:38:46	60	142	55	13.47841549	6.184933662	3.770647764	conversation	alarms
15:38:56	496	83	51	7.904444695	6.382527828	4.774605274	conversation	alarms
15:39:06	44	43	28	17.81204224	10.48321533	9.190882683	conversation	alarms
15:39:16	28	474	56	6.711685658	3.99195528	3.600019693	conversation	alarms
15:39:26	25	141	9	1.25385654	1.188026309	1.124331951	conversation	alarms
15:39:36	528	552	511	17.94819069	17.11728096	16.60152245	conversation	alarms
15:39:46	119	122	117	16.9025116	10.84471416	5.798255444	conversation	alarms
15:39:56	27	56	26	2.114571571	1.904428005	1.383525729	conversation	alarms
15:40:06	130	51	160	3.12309742	2.79638505	2.541218758	conversation	alarms
15:40:16	25	23	10	1.849452376	1.601099133	1.479453564	conversation	incidental
15:40:26	25	13	16	1.686682463	1.497665644	1.385080218	machinery	incidentalneutral
15:40:36	122	127	130	4.781165123	4.170338154	3.406019211	machinery	alarms
15:40:46	27	133	10	5.337959766	3.382359982	2.214487076	machinery	alarms
15:40:56	28	30	13	4.319637775	1.067523003	0.751780272	machinery	alarms
15:41:06	28	14	19	4.624732018	1.944813967	1.380652785	machinery	incidental
15:41:16	27	57	165	7.22336483	2.407237768	2.385436535	machinery	alarms
15:41:26	53	63	56	31.24959946	18.62298012	17.62074089	machinery	alarms
15:41:36	129	27	11	8.761685371	6.636906624	3.185451984	machinery	alarms
15:41:46	28	30	20	20.37532616	4.585150242	2.501611233	machinery	alarms
15:41:56	28	169	12	2.873136282	2.111442804	2.06038332	machinery	alarms
15:42:06	13	21	15	2.72927022	2.121870279	1.985887527	machinery	alarms
15:42:16	130	487	484	5.87142992	4.82656765	4.530397892	machinery	alarms
15:42:26	26	18	120	1.59770298	1.450454116	1.211845756	machinery	alarms
15:42:36	27	124	28	6.60850811	1.716716766	1.634809613	machinery	alarms
15:42:46	27	28	29	5.448685169	3.718815327	1.521103024	machinery	conversation
15:42:56	28	27	498	6.086047649	1.938821077	1.772669911	machinery	alarms
15:43:06	28	493	482	5.296457767	5.084425926	4.822442532	machinery	alarms
15:43:16	27	28	487	5.019150734	3.654251337	2.316306591	machinery	alarms
15:43:26	27	12	55	6.546087265	1.410562396	1.064283252	alarms	conversation
15:43:36	28	27	14	6.258899212	1.610511065	1.367621899	alarms	alarms
15:43:46	11	51	15	2.104042053	1.791398883	1.774894357	alarms	alarms neutral
15:43:56	232	325	229	8.907125473	8.043885231	6.641419411	alarms	alarms
15:44:06	231	94	91	18.65148354	9.791207314	9.710584641	alarms	alarms
15:44:16	94	325	326	24.42816734	23.08727264	10.76447296	alarms	alarms
15:44:26	92	91	90	21.23665619	14.96143913	7.315200329	alarms	alarms
15:44:36	27	11	22	5.549755573	1.556075692	1.19172585	alarms	conversation
15:44:47	28	27	11	4.871792316	4.405148506	1.601672292	alarms	alarms
15:44:57	27	28	8	4.279597759	3.785203218	1.028474808	alarms	alarms
15:45:07	28	9	25	4.821256161	1.543714523	1.338441849	alarms	conversation
15:45:17	8	10	143	2.656351328	2.121887922	1.456040859	alarms	conversation
15:45:27	28	9	10	5.880917072	1.795799613	1.231263876	alarms	conversation
15:45:37	45	41	43	30.01897812	9.818226814	8.804474831	alarms	alarms
15:45:47	27	53	524	6.979133606	4.921055794	3.606314898	alarms	alarms
15:45:57	27	28	29	5.821588039	1.737487912	1.147939801	alarms	conversation
15:46:07	28	27	490	4.448826313	3.800175905	1.440690994	alarms	alarms
15:46:17	27	28	34	6.827897072	3.88398838	1.06381762	alarms	conversation