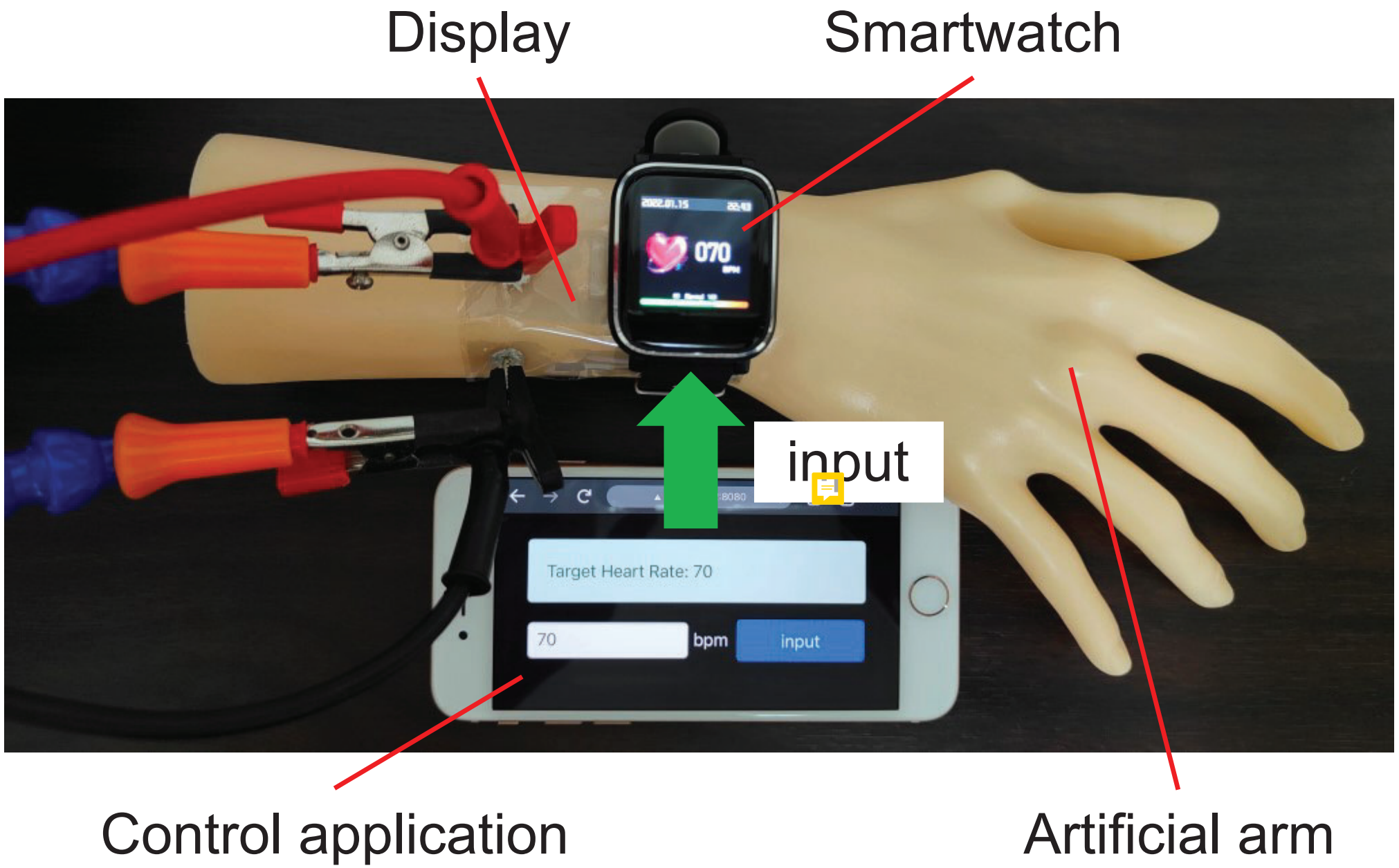

Display
Smartwatch
input
Target Heart Rate: 70
70
bpm
input
Control application
Artificial arm

Fig. 2

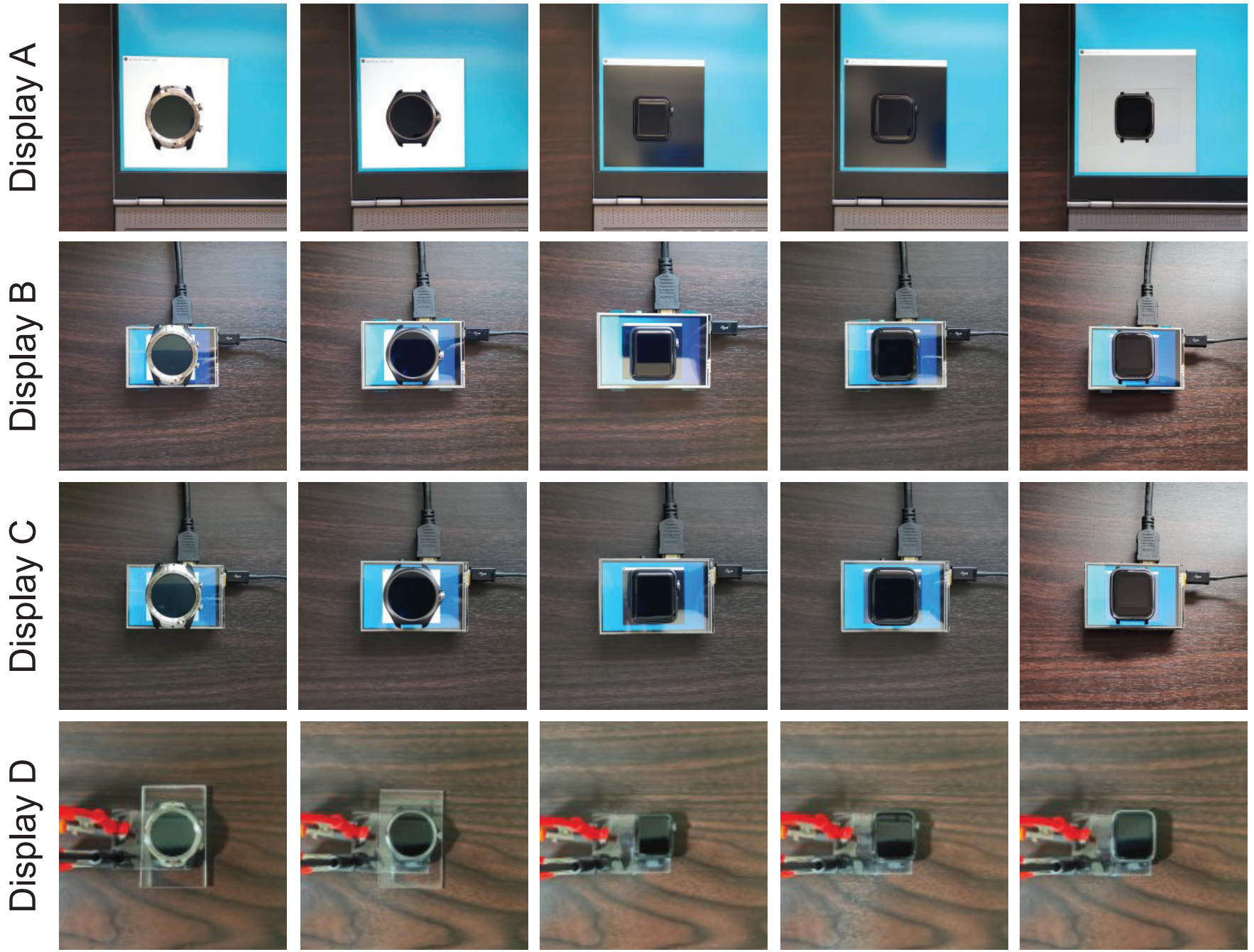

Display A
Display B
Display C
Display D
TicWatch Pro
PUMA Smartwatch
Apple Watch Series 3
Apple Watch Series 5
SMART R

Fig. 3

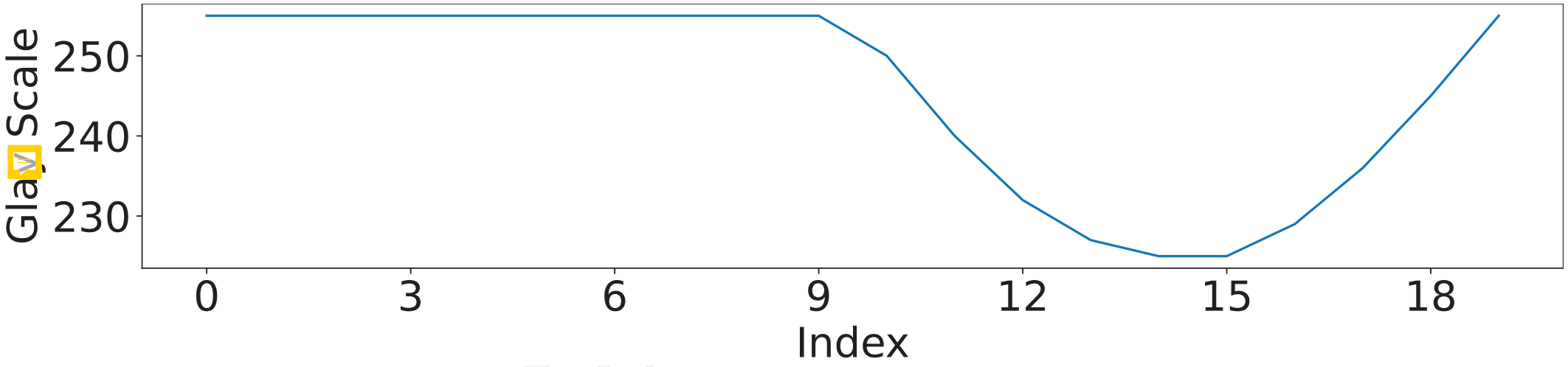


Fig. 5

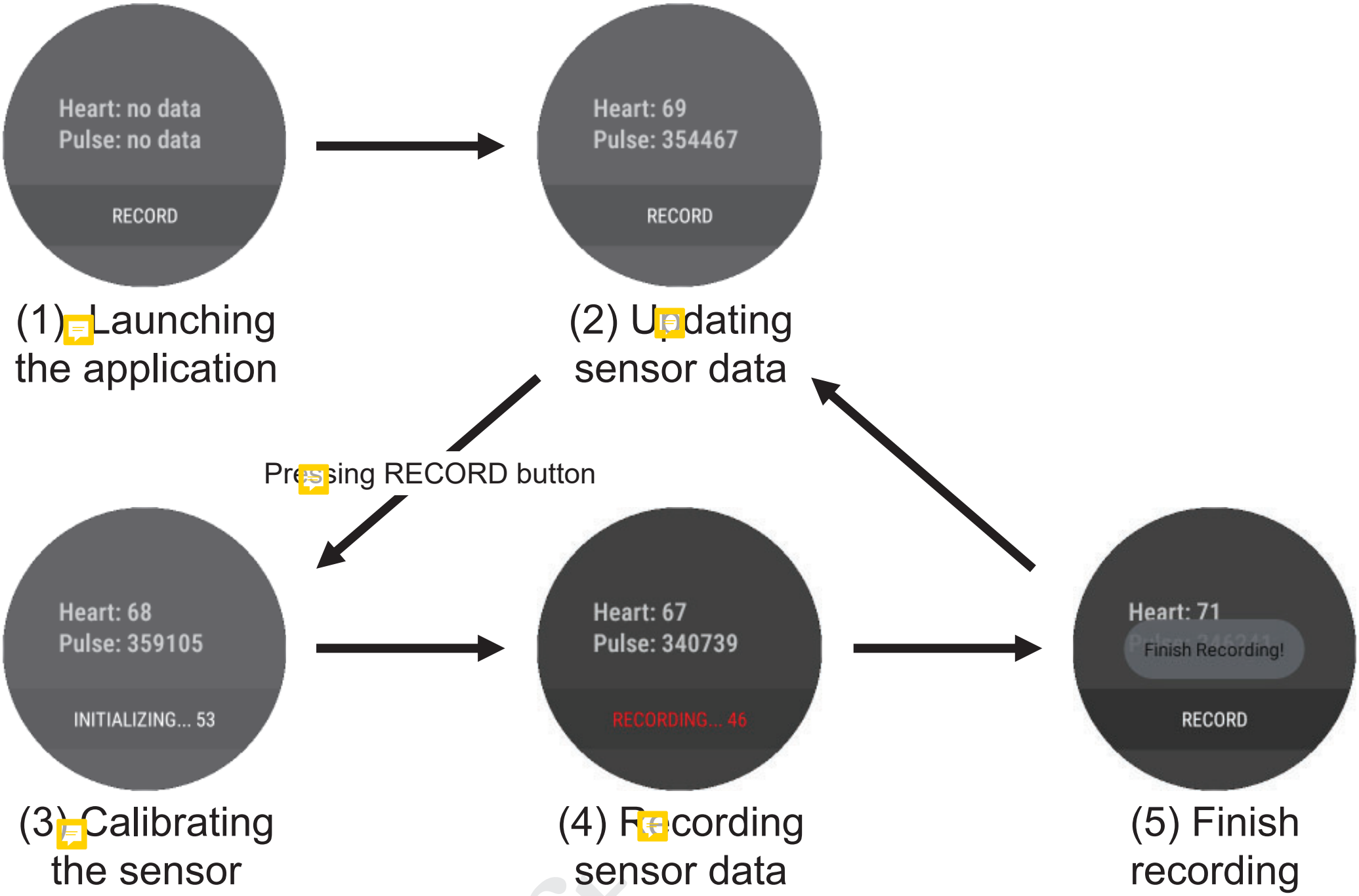
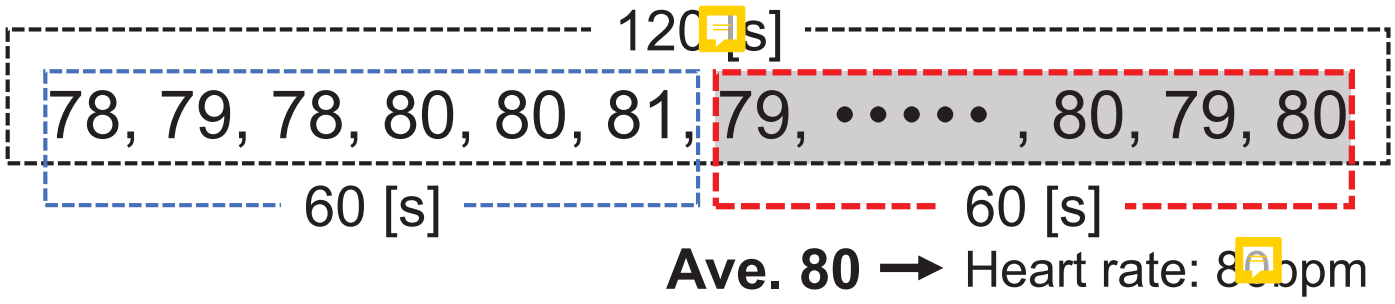
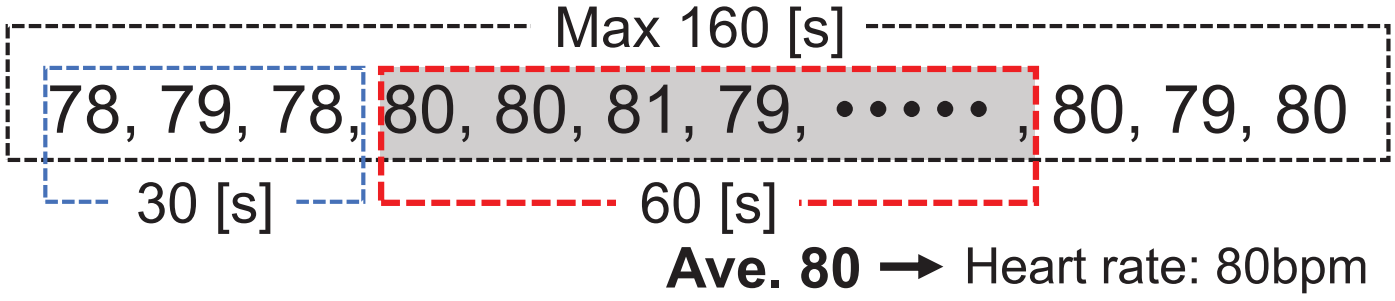

Heart: no data
Pulse: no data
RECORD
(1) Launching the application
Heart: 69
Pulse: 354467
RECORD
(2) Updating sensor data
Pressing RECORD button
Heart: 68
Pulse: 359105
INITIALIZING... 53
(3) Calibrating the sensor
Heart: 67
Pulse: 340739
RECORDING... 46
(4) Recording sensor data
Heart: 71
Finish Recording!
RECORD
(5) Finish recording

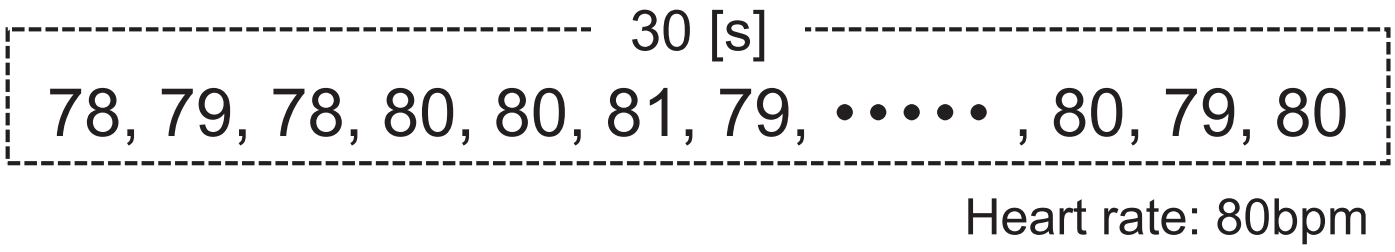
Fig. 7


120 [s]
78, 79, 78, 80, 80, 81, 79, ••••• , 80, 79, 80
60 [s]
60 [s]
Ave. 80 → Heart rate: 80bpm

(a)


Max 160 [s]
78, 79, 78, 80, 80, 81, 79, ••••• , 80, 79, 80
30 [s]
60 [s]
Ave. 80 → Heart rate: 80bpm

(b)


30 [s]
78, 79, 78, 80, 80, 81, 79, ••••• , 80, 79, 80
Heart rate: 80bpm

(c)

Fig. 8

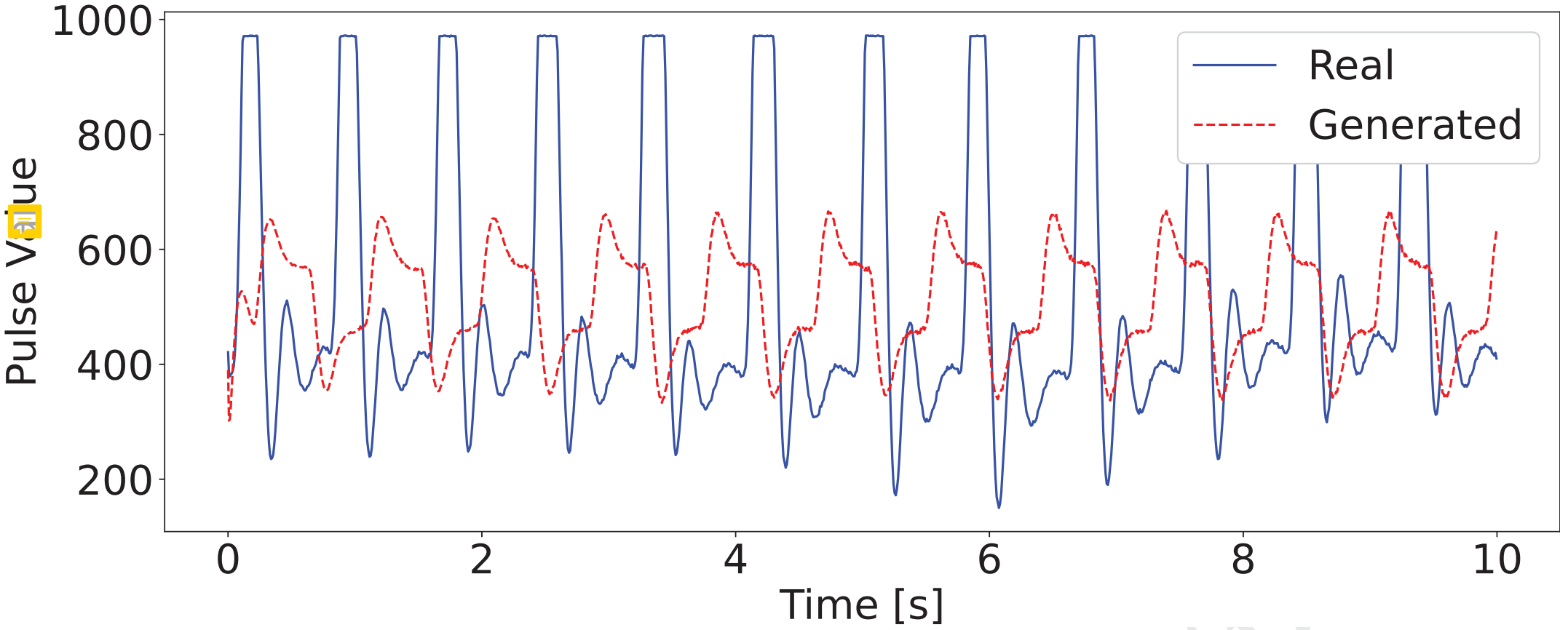

1000
800
600
400
200
Pulse Value
0
2
4
6
8
10
Time [s]
Real
Generated

Fig. 11