

Coverage of PPG-based wearable devices during office tasks

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This study aims to evaluate the coverage (percentage of usable data) in heart rate (HR) monitoring terms provided by two photoplethysmography (PPG)-based wearable devices during usual office tasks. These two devices are Polar OH1 and Maxim MAXREFDES103. The Polar OH1 is a versatile armband device that has three green LED channels to measure PPG signals. The Maxim MAXREFDES103 is a wrist-worn device composed by a sensor board which includes a microcontroller, two photodiodes, two green LED channels, one red LED channel and one IR LED channel. In addition, a conventional Holter-type electrocardiogram (ECG) monitor (Medicom MTD) was used as reference.

19 healthy subjects (9 female and 10 male) were simultaneously monitored with the three devices mentioned above while performing five different office tasks that are usual while doing office work: *mechanography*, *use of telephone*, *writing notes*, *use of archives*, and *other actions*. Each one of these tasks was performed during 5 minutes with a 1-minute break between stages. Three green LED channels of the OH1 and the two green LED channels of the MAXREFDES103 were analyzed. HR was estimated by pulse detection from all these channels separately, and compared to the HR estimated with the reference ECG device. The HR estimated by wearable devices was considered acceptable when it differs from the reference HR less than 10% in 10 seconds length windows.

Obtained results (see Table) show that the best average coverage across stages (more than 70%) was given by the channel 1 of the OH1 device, while more than 50% of coverage was obtained by the channels of the Maxim device. The lowest coverage values were obtained for the *use of archives* task, where the movement is more significant than in the other stages of the protocol. In addition, the OH1 has obtained higher coverages than the MAXREFDES103 in all the stages. A possible reason for this observation is that the position of the OH1 device (upper arm) is less affected by motion than the position of Maxim device (wrist).

Obtained coverages for different channels and stages (%).

Task	Polar			Maxim	
	CH1	CH2	CH3	CH1	CH2
Mechanography	70.35	66.32	69.65	44.39	45.96
Use of telephone	78.60	80.00	80.53	72.81	73.51
Writing notes	87.19	82.81	84.39	65.79	67.37
Use of archives	50.53	51.40	52.98	39.12	37.19
Other actions	66.60	67.41	62.15	40.08	44.13
Mean of the channel	70.65	69.59	69.94	52.44	53.63