

Huawei FinRC in wearables development

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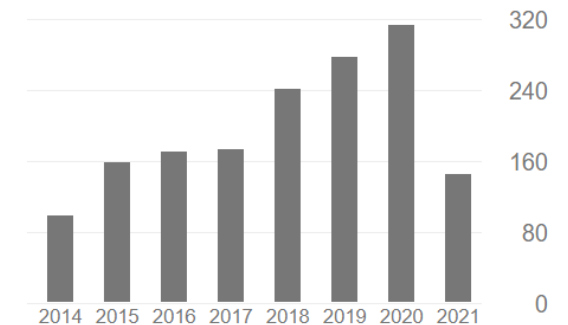


Petri Wiklund

- MSc. 2009, PhD. 2016 University of Jyväskylä,
Sports and Exercise Medicine
- Researcher, University of Jyväskylä 2009-2016
Health and Fitness technology
- Post-doc researcher University of Oulu, Finland 2017-2019
Life-Course Epidemiology/role of health behavior on chronic disease
- Research associate (hon) 2017-2020 Imperial College London, UK
Research on the molecular mechanisms linking adverse early life exposures and long-term health outcomes
- Associate professor (hon) Shanghai Jiao Tong University, China 2018-
Research on exercise prescription for chronic disease/the effect of ageing and fitness on metabolic health
- Principal Research Scientist, Huawei, Helsinki RC, Finland, 2018-
Sports, Fitness and Health analytics algorithms development for wearable devices



Citations	1651	1318
h-index	23	21
i10-index	33	33



Wearables shipment increased in 2020



	2019	2020
Smartwatch brand excluding kids watches (shipped units)		
Apple	37.1 million	43.6 million
Huawei	4 million	18 million
Samsung	8 million	11 million
Fitbit	5.86 million	7.5 million
Huami	3.5 million	4.1 million
Garmin	2.75 million	3.4 million

Source: <https://www.wearable.com/news/wearables-popularity-soars-in-2020-8322>

Why wearables development in Finland?

- Finland has deep roots in wearable sports technology and a trailblazer in heart rate measurement-related research
- World-class universities in sports, biomedical engineering, signal processing, data science and software engineering
- The best availability of experienced and innovative scientists and engineers
- Finland offers a unique combination of high-quality health and data with a full focus on data privacy and security
- Government committed to further developing Finland as a competitive environment for health-sector research, innovation and business



Huawei Helsinki R&D center

Helsinki R&D Center

- 350 people working in the R&D center
- Rf-technology, antenna, 5G-technology, security, cloud
- Wearable technology development team
 - Multidisciplinary team with backgrounds in biomedical and software engineering, data science, physiology, mobile phone technology
- Human motion and performance laboratory
 - State of the art technology
 - Concept design and testing
 - Product development
 - Data collection



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Finnish technology in Huawei smart watch

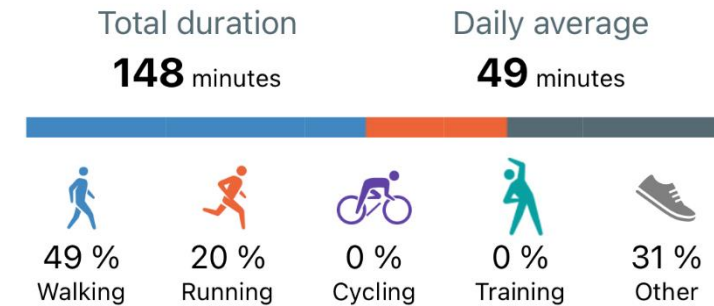


TruSport

We track user activities and exercise performance. We assess user's physiological response to exercise training and monitor their recovery. We provide accurate scientific data and give actionable feedback to exercise better, perform better and feel better – starting now!

Duration 0:21:55	Calories 131 kcal
Avg pace 10'51" /km	Avg speed 5,53 km/h
Avg steps 119 steps/min	Avg stride 77 cm
Steps 2 628 steps	Avg heart rate 102 bpm
Elevation gain 38,3 m	Total descent 30,8 m

Automatic activity recognition



Sports features

- ✓ VO2max
- ✓ Personalized training zones
- ✓ Training load monitoring
- ✓ Training stress and effect estimation
- ✓ Recovery time advisor
- ✓ Real-time performance condition monitoring
- ✓ Calorie counter

Cardiorespiratory Fitness (VO2max)



- VO_{2max} reflects the ability of the respiratory and circulatory system to carry oxygen under maximum exertion.
- Since oxygen is critical to running fast for extended periods of time, a high VO2 max is a great representation of aerobic fitness.
- Huawei's algorithm analyzes the relationship between speed and heart rate from walking and running sessions to estimate VO_{2max} level
- In Watch 3 Pro, dual-frequency GPS enables more accurate running speed detection
- The new TruSpeed algorithm allows VO2max estimation also when GPS is not available, including indoor track or treadmill running

Training stress and effect



Training stress

Aerobic training stress refers to the stress put on your aerobic energy system during moderate to high intensity activity. Long-term, routine aerobic workouts can improve your aerobic capacity.

1,0–1,9: Recovery – Aerobic recovery.

2,0–2,9: Maintained – Comfortable for maintaining aerobic capacity.

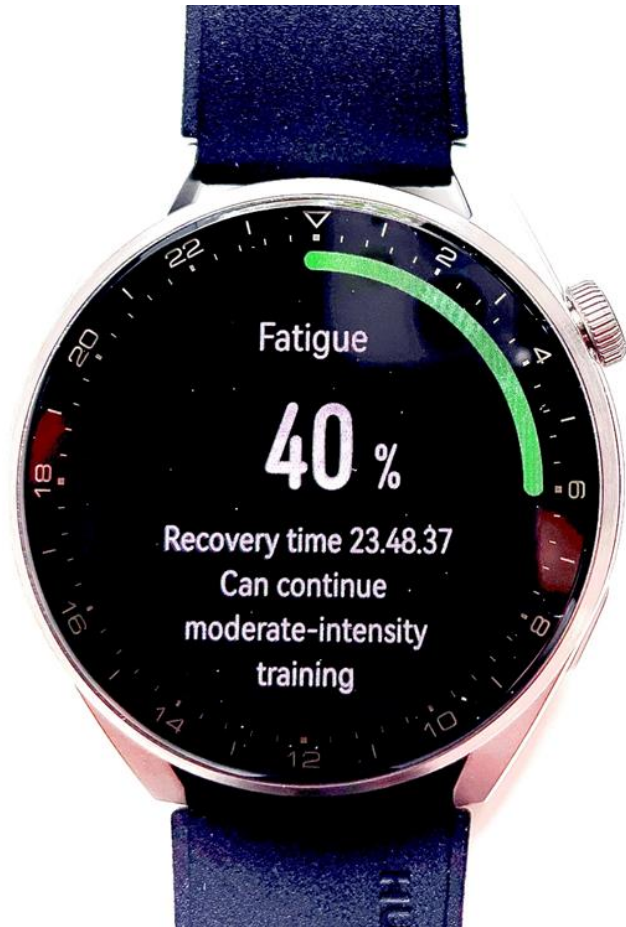
3,0–3,9: Improved – Good for improving aerobic capacity.

4,0–4,9: High impact – Pushes aerobic capacity.

5,0: Excessive – This level can be dangerous. Continue with caution.

- Monitoring the internal load is an integral part of all successful training programs
- Understanding the physiological stress placed on user during a training session and providing information on the effects of the training session on cardio-respiratory fitness
- Huawei measures the training stress based on the exercise intensity and duration while taking into consideration user's fitness level
- Training stress is visible to user in real-time, which allows user to modify the exercise intensity on the go

Fatigue and Recovery



- Adequate recovery is essential for health and fitness improvement
- Huawei recovery status feature show when user is fully recovered and gives exercise advice based on the current fatigue level.
- Recovery status estimates the fatigue caused by the current exercise session while taking into account users fitness level and the training stress and any residual fatigue from previous exercise sessions

Energy expenditure



- Calorie tracker provides user daily calorie counts
- Calculates calories burned during exercise based on user characteristics such as gender and weight as well as fitness level and exercise intensity
- Counts calories from multiple types of exercise modes, including walking, running, cycling, rowing, cross-trainer
- Huawei's algorithm analyzes the relationship between speed and heart rate from walking and running sessions to estimate VO2max level
- Calorie counter validated by SJTU – Market leading accuracy



Jyväskylä, Finland

- The Faculty of Sport and Health Sciences ranks in the global top 10
- Jyväskylä University and its physiology labs are the hub of sports science in Finland
- SportsLab owned by Research Institute for Olympic Sports (KIHU)
- Projects in PPG HR sensor validation
- Collection and sharing of performance data



University of Jyväskylä



TOWARDS INTELLIGENT HEALTH AND WELL-BEING NETWORK OF PHYSICAL ACTIVITY ASSESSMENT (TINPA NETWORK) CONSORTIUM



German Sport University
Germany



LISBOA

UNIVERSIDADE
DE LISBOA

University of Lisbon
Portugal



University College Dublin
Ireland



HUAWEI

NIH NORWEGIAN SCHOOL
OF SPORT SCIENCES

Norwegian School of Sport Science
Norway



ugr | Universidad
de Granada

University of Granada
Spain



University of Southern Denmark,
Denmark





Consumer wearable and smartphone devices

“WITHOUT A STANDARD, THERE IS NO LOGICAL BASIS FOR DECISION MAKING OR TAKING ACTION”

JOSEPH M. JURAN

Consumer wearable and smartphone devices provide an accessible means to objectively measure aspects of physical activity such as step-counts, heart rate, energy expenditure, and VO_{2max} . With the increasing proliferation of this technology, consumers, practitioners, and researchers are interested in leveraging these devices as a means to track and facilitate physical activity behaviour change. However, while the acceptance of these devices is increasing, the validity of many consumer devices has not been rigorously and transparently evaluated.

