

# Oura Ring: The World of Wearable Health Monitoring Rings and Their Competitors

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**Abstract**—This report evaluates the Oura Ring’s technology, company, and market presence, and compares it with the Ultrahuman Ring AIR, RingConn, and Samsung Galaxy Ring. It examines sensor capabilities, data handling, and accuracy to help readers assess device performance and make informed conclusions.

**Index Terms**—Oura Ring, Wearable Technology, Sensors, Health Monitoring, Data Privacy

## I. INTRODUCTION

Wearable technology has increasingly become a central tool for monitoring health, wellness, and performance. Among these devices, smart rings offer a compact and discreet alternative to wrist-worn trackers, providing continuous physiological monitoring with research-grade accuracy. The Oura Ring, developed by Oura Health Oy, has been at the forefront of this market, combining advanced sensors with a user-friendly interface to deliver actionable health insights [1]. In this paper, Oura Ring is compared with other notable smart rings, including Samsung’s Galaxy Ring, RingConn, and the Ultrahuman Ring AIR, focusing on differences in sensor technology, data handling, and overall performance.

## II. COMPANY HISTORY AND MARKET

Oura Health Oy, a Finnish company founded in 2013 by Petteri Lahtela, Kari Kivelä, and Markku Koskela, pioneered the popularization of smart rings. The company launched its first-generation ring through a 2016 Kickstarter campaign and officially presented it at the Slush tech conference in 2017 [1]. Initially designed to track sleep and recovery using heart rate, temperature, and motion sensors, the ring later incorporated continuous heart-rate monitoring, blood oxygen measurement, and cycle tracking. By the mid-2020s, Oura had become the most widely adopted smart ring, with over 2.5 million units sold and broad utilization in health research [1], [6]. The device has evolved through multiple generations, each improving comfort, sensor accuracy, and overall functionality, culminating in the Oura Ring 4, which integrates red, infrared, and green LED sensors, a digital temperature sensor, and a 3D accelerometer [6].

The market has since seen the entry of competitors with varying focuses. Ultrahuman (2019) emphasizes metabolic and performance metrics with its Ring AIR [2], [5]. RingConn (2021) offers a non-circular design without a subscription

model [3]. Samsung, a longstanding electronics company founded in 1938, integrates its Galaxy Ring into the broader Galaxy ecosystem [4]. Despite differing approaches, all devices target health-conscious, tech-savvy users seeking continuous, personalized data to optimize wellness and performance [3]–[5].

Oura Rings appeal particularly to individuals focused on sleep, recovery, and overall physiological optimization. While initially emphasizing sleep tracking, the ring now monitors heart rate, blood oxygen, and temperature, providing actionable insights to improve weaknesses or maintain strengths [1]. Competitors such as Samsung, Ultrahuman, and RingConn offer overlapping features, including heart rate and sleep monitoring, but differ in their design philosophies and integration capabilities [3]–[5].

Compared with wrist-worn smartwatches and fitness trackers, wearable rings occupy a distinct niche. They offer discreet form factors and high-precision sensors capable of capturing research-grade physiological signals. Smartwatches, in contrast, often prioritize notifications, applications, and multimedia functionality rather than detailed, continuous monitoring of sleep and recovery metrics. Consequently, while wearable rings share some overlap with general fitness devices, they stand out for their sensor accuracy, compact design, and emphasis on actionable wellness insights [1], [6].

## III. SENSORS

The Oura Ring uses infrared photoplethysmography (PPG) sensors to measure heart rate, heart rate variability, and respiration. By placing LEDs on both sides of the finger, the ring captures a deeper, clearer signal than the green-light sensors in most wrist wearables, producing readings that approach medical-grade ECG accuracy. Its negative temperature coefficient (NTC) sensor tracks skin temperature directly on the finger, detecting changes as small as 0.1°C and reporting deviations from a personal baseline [8]. A 3D accelerometer monitors daily movement, sleep restlessness, and sleep stages, excelling at linear motion tracking, whereas rate gyros detect rotational movement but struggle with steps or running. Unlike accelerometers, which measure linear acceleration along orthogonal axes, gyroscopes measure angular velocity, providing information about orientation and rotational motion. Together,

accelerometers and gyroscopes complement each other: accelerometers capture translations and general activity, while gyroscopes improve the detection of wrist or finger rotations, posture changes, and complex motion patterns. The integration of both sensors allows the ring to better estimate sleep posture, detect subtle hand movements, and refine activity tracking that would be less accurate with a single sensor type.

#### IV. DATA HANDLING

The Oura Ring stores data locally on the device and transfers it via Bluetooth to the Oura app, which encrypts and securely saves the information in the cloud for long-term tracking and analysis [1], [5], [11]. Its sensors provide research-grade precision for heart rate, heart rate variability, sleep, and temperature, with validation studies comparing readings against gold-standard medical devices such as electrocardiograms (ECGs) and polysomnography [8], [9]. The Ultrahuman Ring AIR also syncs metabolic, activity, and sleep-related data to its app, allowing users to track energy expenditure and recovery metrics over time, though accuracy can vary depending on sensor calibration and activity level [2], [14]. Samsung's Galaxy Ring collects physiological measurements, including heart rate and sleep duration, sending them to the Galaxy Wearable app and Samsung Health for cross-device access and integration into the broader Samsung ecosystem [4], [12]. While Samsung focuses on convenience, connectivity, and user engagement, its measurements are generally less precise than Oura's, especially for sleep staging and HRV analysis.

All three devices rely on encrypted Bluetooth transfer and cloud servers to protect data integrity and security. Oura strengthens this with continuous monitoring, vulnerability scans, and layered defenses across its cloud infrastructure [10]. In contrast, RingConn shares a larger portion of user data with partners such as Meta and TikTok, limiting granular control over personal health information [13]. The Oura Ring also supports integration with third-party health and analytics platforms, enabling advanced longitudinal studies, trend analysis, and personalized health interventions over time [5], [7]. Ultrahuman and Samsung offer limited API or external integration options, focusing primarily on their internal app dashboards, which constrains research use outside the company ecosystem.

Overall, while all three rings provide continuous monitoring and cloud-based analysis, Oura stands out for its validated sensor accuracy, robust data security, and flexible research-oriented data access. Ultrahuman emphasizes metabolic and performance tracking, Samsung prioritizes ecosystem integration and user convenience, and RingConn offers basic tracking with a subscription-free model. Comparing these devices illustrates the trade-offs between precision, convenience, and research utility, highlighting Oura as the most suitable option for high-fidelity, research-grade health monitoring while remaining accessible to general wellness users.

#### V. DATA ACCESS

Users primarily access Oura Ring data through the app, which displays metrics such as heart rate variability (HRV),

skin temperature, sleep duration, and more. The app provides intuitive visualizations, trend analyses, and personalized insights, allowing users to monitor changes over days, weeks, and months. They can also use the Oura web dashboard to analyze, export, and compare data over time, facilitating long-term tracking and integration with other research or wellness platforms. In contrast, the Ultrahuman Ring AIR, RingConn, and Samsung Galaxy Ring also provide apps for tracking measurements, but only the Ring AIR offers an online dashboard for reviewing health data.

While all apps support basic visualization, Oura's integration with third-party health apps such as Apple Health, Google Fit, and Strava enables the addition of physiological activity, and contextual data from multiple sources. This allows users and researchers to perform more advanced analyses, including correlating sleep quality with exercise, activity patterns, and other lifestyle factors, generating richer insights over extended periods and supporting both individualized health optimization and research-driven studies.

#### VI. USE IN RESEARCH SPACE

A Yale study of young adult drinkers [6] measured the effects of alcohol on HRV, sleep quality, and daily activity using the Oura Ring. Participants who received feedback on how alcohol affected their bodies reduced their alcohol consumption. This demonstrates a use of wearable technology beyond health tracking, as a tool for behavioral intervention. Participants also reported that the ring felt easy to use, engaging, and informative.

Researchers analyzed sleep quality using Oura Ring data alongside environmental sensors for temperature and humidity [7]. The study found correlations between sleep quality and environmental conditions, although external factors could still influence the results. This highlights the ring's effectiveness in both accurate sleep tracking and environmental health monitoring.

In direct comparison with PSG, the gold standard of sleep measurement, the Oura Ring closely matched global sleep measures such as TST, TIB, SOL, SE, and WASO, with small biases and few outliers exceeding limits of agreement. Sleep stage classification also proved comparable, with similar misclassification patterns across dominant and non-dominant hands [8]. These results show that the Oura Ring can serve as a reliable, consumer-friendly alternative to PSG for research requiring multi-night sleep monitoring.

The Oura Ring also enables convenient tracking of heart rate and heart rate variability (HRV) compared with electrocardiography (ECG). It achieves high accuracy for heart rate and RMSSD (root mean square of successive differences between normal heartbeats), moderate accuracy for AVNN (average of normal heartbeat intervals) and pNN50 (percentage of intervals differing by more than 50 milliseconds), and lower accuracy for SDNN (standard deviation of beat-to-beat intervals). Accuracy improves when data are averaged over the night, making the ring useful for monitoring overall nightly

trends, though ECG remains more precise for detailed cardiac analysis [9].

## VII. COMPANY DATA USE

As stated in [10], Oura protects user data by encrypting it, performing vulnerability scans, continuously monitoring systems, and deploying layered defenses across its secure cloud infrastructure, networks, applications, and endpoints. The company primarily collects customer data to provide personalized health insights based on HRV, heart rate, skin temperature, sleep duration, daily activity, and more. Oura collects this sensitive information only after obtaining explicit user consent and never sells or rents it to other companies. It integrates third-party services only when users opt in [11].

Similarly to Oura, Samsung and Ring Conn prioritize personal health and wellbeing insights based on user health data [12] [13]. Ring Conn shares the most user data, providing it to partners such as Meta and TikTok, and makes opting out of marketing sharing difficult. Oura gives users the most control by requesting consent before sharing data with cloud providers, analytics services, and research partners, offering strong privacy protection and limited exposure to third-party advertising. Samsung, as a large electronics company that also handles phones, tablets, and other wearables, collects additional data such as device and financial information. While some consent may be required, the Samsung ecosystem may track certain information by default.

## VIII. CONCLUSION

The Oura Ring leads the wearable market for health and wellness, excelling at monitoring sleep, recovery, and physiological signals. Its PPG, temperature, and accelerometer sensors deliver near medical-grade accuracy, while its app and web dashboard securely store and provide access to data. Researchers have used it for behavioral interventions, sleep studies, and heart rate variability monitoring, finding performance comparable to polysomnography and ECG. Compared with competitors like Ultrahuman, RingConn, and Samsung, Oura delivers precise, validated measurements and strong privacy controls, establishing its value as both a consumer-friendly and research-capable device.

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