WITHINGS

58
BPM

WITHINGS

100

50

THE TECH BEHIND

ScanWatch

Automatic heart rate measurement

Hybrid smartwatch with ECG, heart rate and oximeter

CLINICALLY VALIDATED

The Tech Behind the Measurement

The heart is a muscle that rhythmically contracts to pump blood through the circulatory system. During physical exercise, the heart reacts by beating faster to increase the flow of oxygen-rich blood to the body's muscles, which allows for sustained physical exertion.

The cardiovascular system will adapt to meet the demands of sports, exercise and physical activity. Like any muscle subjected to repeated effort, the heart will get bigger and stronger, allowing it to contract more efficiently and pump more blood with each beat.

The heart beat (or pulse rate) is considered the most important vital sign. Withings has designed a product that is able to automatically measure your heart, simply by wearing a watch on the wrist. ScanWatch uses a multi-wavelength PPG (photoplethysmography) sensor to measure accurately your pulse rate and heart rate variations over time with clinical accuracy, and to detect irregularities in those metrics.

Developed with cardiologists, and clinically validated, this is the first time ever that a hybrid smartwatch can notify users they are at risk for highly prevalent yet underdiagnosed cardiovascular conditions such as atrial fibrillation.

The development of ScanWatch

In all industrialized countries, cardiovascular diseases are one of the main causes of mortality and morbidity. Over the past 25 years, the number of cases of cardiovascular disease (CVD) has increased in all European countries. In 2015, more than 85 million people in Europe lived with CVD. And every year they cause 3.9 million deaths and account for 45% of all deaths in Europe [1].

The prevalence of cardiovascular disease increases with age. Furthermore, their incidence increases mechanically because of the aging of the population. For example, the incidence of heart failure and atrial fibrillation doubles approximately every 10 years.

The diagnosis of cardiovascular disease is most often made at a late stage, during serious events (stroke, heart failure) that are life-threatening. The prevention of complications by the early diagnosis of these diseases is therefore an issue of public health. The availability of an automatic device, usable by all, connected, to evaluate the most prevalent type of arrhythmia, constitutes a considerable progress to meet this challenge. That is what ScanWatch offers.

We have integrated a PPG sensor into ScanWatch to be able to measure the heart rate throughout the day.

By analysing the variations of the heart rate, ScanWatch is able to detect signs of arrhythmia (condition in which the heartbeat is irregular, fast or slow) such as atrial fibrillation.
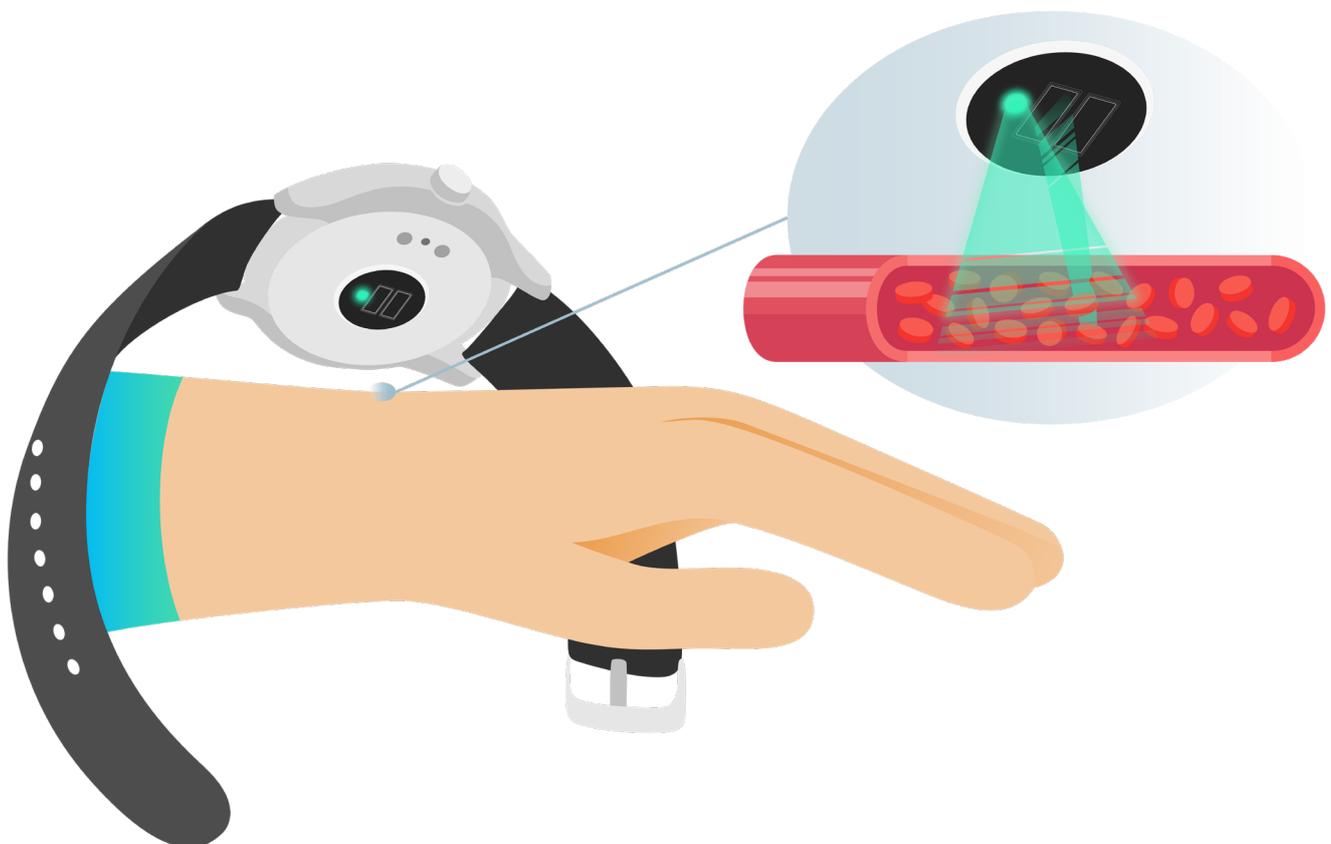
ATRIAL FIBRILLATION

Atrial fibrillation (or AFib) is the most common cardiac arrhythmia and is one of the leading causes of stroke, heart failure, and cardiovascular morbidity in the world [2]. It is responsible for almost a third of the strokes in developed countries, and affects 8 million people in Europe and 5 million in the US [3]. It may be symptomatic (palpitations) or—more often—asymptomatic. In this case, it can remain "silent," which is why earlier detection of possible signs of the disease by ScanWatch can enable better care and help to avoid complications.

Until recently, diagnosis of AFib required an ECG (electrocardiogram) recorded in the doctor's office. Therefore, the "diagnostic window" for AFib detection was restricted to the duration of the medical consultation. We developed ScanWatch's PPG sensor to be able to detect signs of AFib, without going to the doctor's office.

Dive into the tech behind the automatic measurement of the heart

WHAT IS PPG?

ScanWatch uses the pulse oximetry method, which is an indirect, non-invasive method, meaning it does not involve the introduction of instruments into the body. Pulse oximetry is an application of photoplethysmography, using optical methods to detect blood volume changes in the microvascular bed of tissue. In a photoplethysmography (PPG) sensor, an LED emits a light wave at the skin. Part of this wave will be reflected or scattered by the blood vessels of the wrist, reflected back to the watch and recorded by a photodiode. ScanWatch uses a PPG sensor with three different LEDs: green, red, and infrared. Withings launched an extensive research program to optimize the placement of the LEDs that emit light, to choose the right components and wavelengths to use, and to design a complex algorithm to control the measurement. We were able to reduce the need for high intensity, thus increasing the watch battery life and the accuracy of the measurements.
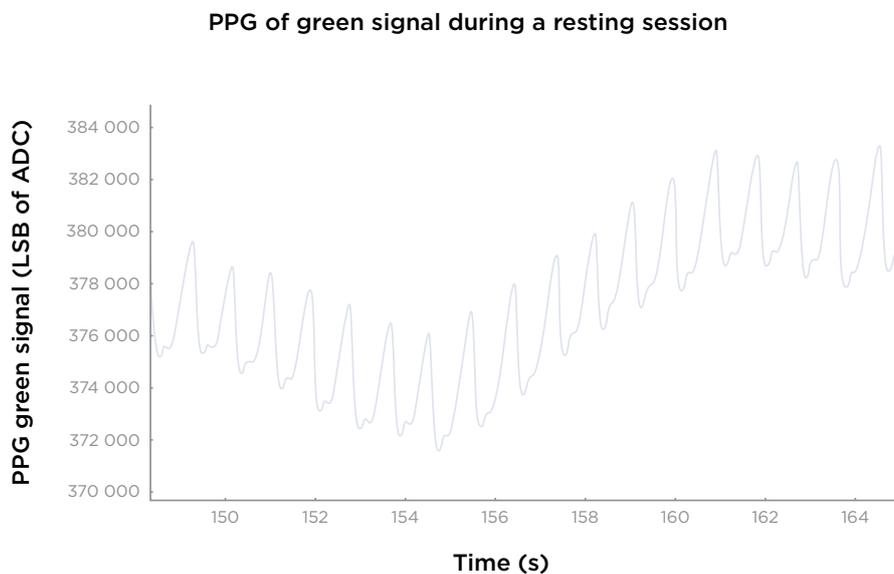

WITHINGS

HOW DOES HEART RHYTHM MEASUREMENT WORK?

ScanWatch uses the green LED paired with light-sensitive photodiodes to detect the amount of blood flowing through your wrist at any given moment. When your heart beats, the blood flows in your wrist and the green light absorption is greater. By flashing its LED lights hundreds of times per second, ScanWatch can calculate the number of times the heart beats each minute — your heart rate. The optical heart sensor supports a range of 30–230 beats per minute. In addition, the optical heart sensor is designed to compensate for low signal levels by increasing both LED brightness and sampling rate.

Figure 1 shows what the sensor records during a resting session:

PPG of green signal during a resting session

However, disturbances can appear on this curve, coming from blood flow variation caused by body motions such as running, walking or even typing on a computer keyboard.

ScanWatch's algorithm compares the PPG signal to the watch's accelerometer signal, and is able to detect all the pollution in the heart rate signal and eliminate it with great accuracy.

WITHINGS

From a physiologic recording to a leverageable data for healthcare practitioners

WHICH CONDITIONS CAN SCANWATCH DETECT?

High and Low high rate (HR)

The heart rate will always fall between a lowest and highest possible value, which is personal to every single person. The lowest value is called resting HR (heart rate), and the highest is called maximum HR, the latter can be reached if running at maximum speed. While everyone has different resting and max HR, scientists estimate those values based on the age and gender. Measuring the heart rate allows to detect when you are resting or exercising.

ScanWatch goes beyond that. It takes a HR measurement every 10 minutes, and therefore is able to monitor your heart rate, display your daily HR graph, and alert you whenever a high or low HR is detected while you are resting.

Heart Arrhythmia

A healthy heart doesn't beat as regularly as a metronome—it actually changes its rhythm with each beat. This constant variation in milliseconds between your heartbeats is your heart rhythm.

Some situations result in an increase in variation, while others cause the intervals between beats to stay more constant. Heart rhythm has natural highs and lows, but it can also be a potential sign of AFib.

Atrial fibrillation is caused by a disorganized firing of electrical impulses in the right atrium near the sinoatrial node—the area that acts as the natural pacemaker of the heart. AFib symptoms are irregular or may not even be known to users. Through its embedded PPG sensor, ScanWatch has the ability to alert users of a potential issue even if they don't feel palpitations. When ScanWatch detects an irregular heartbeat through its heart rate sensor, it will prompt the user, via the watch display, to take an electrocardiogram reading. Furthermore, the data recorded by the watch is helpful for doctors and healthcare professionals to monitor their patients cardiovascular health, and can be easily shared.

RESULTS YOU MAY SEE

ScanWatch will send you a notification when it detects one of the following:
- High HR
- Low HR
- Signs of AFib, in this case it will prompt you to take an ECG reading with your watch

You will receive one of these notifications only if you are resting, as it is normal to have a high heart rate when exercising.

You can modify the High and Low HR thresholds in the Health Mate app.

WITHINGS

Seamless tech serving medical screening

AN AUTOMATIC MEASUREMENT

When using the Workout Mode, ScanWatch measures your heart rate every second. This information, as well as other data it collects, helps ScanWatch estimate how many calories you've burned. In addition, ScanWatch measures your heart rate throughout the day and the night when you're motionless, and periodically when you're walking. Since ScanWatch takes these background readings based on your activity, the time between these measurements will vary.

WHAT IS THE BENEFIT OF HAVING IRREGULAR HEARTBEAT NOTIFICATIONS ON THE WRIST?

Compared to standard methods of measurement to detect atrial fibrillation, wearing a watch is much easier. Monitoring vital signs on a daily basis becomes completely seamless.

ScanWatch automatically detects irregular heartbeats and signs of AFib and alerts you instantaneously on your watch, and in the app on your smartphone. ScanWatch helps to detect potential cardiovascular diseases before doing the standard clinical tests with healthcare professionals, thus gaining time to take action.

HOW CAN YOU SHARE YOUR RESULTS OR ACT ON THEM?

Each record of a heart rate measurement can easily be found in the Health Mate app.

ScanWatch is the first hybrid smartwatch that can alert users they are at risk for highly prevalent cardiovascular conditions such as atrial fibrillation. We have worked with cardiologists and healthcare practitioners to make it entirely reliable.

Clinical studies were conducted in Hôpital Européen Georges Pompidou (HEGP) in France, for AFib detection, to certify Scanwatch as a class IIa medical device in Europe and a FDA-cleared class II medical device in the US.

WITHINGS

Bibliography

[1] European Cardiovascular Disease Statistics 2017, European Heart Network, available online.
[2] European Society of Cardiology Guidelines, 2016, p. 7
[3] Hanis Zulkifly, Gregory Y. H. Lip, Deirdre A. Lane, Epidemiology of atrial fibrillation, IJCP 2018, vol 72, issue 3, e13070.

WITHINGS