

Electronic cardioarteriograph

An easy-to-use affordable device to measure several cardiovascular parameters from unsupervised measurements easily obtained at hands, feet or both.

The challenge

Cardiovascular diseases are the leading cause of death yet plenty of patients remain undiagnosed until acute stages of the disease, or need periodic monitoring after intervention. Existing devices need skilled users, measure a limited number of parameters, often with time-consuming, cumbersome procedures. There is a need for comfortable, easy-to-use, connected devices intended for personal periodic health monitoring that do not disrupt daily routines and can be used anywhere.

The technology

Hands and feet are very convenient interfaces for cardiovascular measurements and are often used to obtain the heart rate and the ECG by establishing a contact with a conductive electrode on each hand and feet. We add the electronic measurement of arterial blood pulses detected by the changes in the electrical impedance measured between both hands or between the feet through the so-called impedance plethysmogram (IPG). We have designed a device able to simultaneously obtain the ECG and a proximal and two distal IPGs by using only four conductive contacts, which can be for example two contacts with two different fingers of each hand, two contacts with fingers in one hand and two contacts with two points on the opposite wrist, two contacts with each arm or wrist, or two contacts with each foot or leg. Time intervals between different features of the ECG and the IPGs yield several Pulse Arrival Times (PAT), which can be used to measure systolic time intervals (STI) that inform about cardiac contractility and valvular diseases, and Pulse Transit Times (PTT), which inform about central and peripheral arterial stiffness, related to factors such as ageing, hypertension, and risk of cardiovascular events, and the autonomous nervous system.

Innovative advantages

- Simultaneous electrical and mechanic cardiovascular and respiratory signals.
- No gel or cream, no contact with the thorax or any body part other than the upper or lower extremities, or both (for aortic PTT).
- No auxiliary personnel or specific training required to apply the device.
- Informs about the heart and major blood vessels and in a short time even when other distal sensors fail, e.g. during peripheral vasoconstriction.
- Can be implemented in many form factors: hand-held devices, handle bars, steering wheels, standing platforms/scales, wearables (wristbands, arm bands, watches), add-on modules to upgrade existing devices (one-lead ECG monitors, bioimpedance analyzers, blood pressure monitors, exercise bicycles...).

Current stage of development

Prototypes for upper-, lower-, and whole-body measurements tested in clinical and non-clinical scenarios.

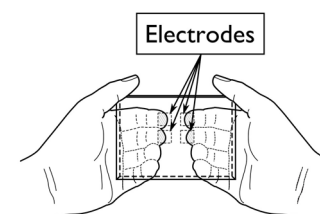
Applications and target market

1. Periodic monitoring: telehealth, home health care, post-surgery follow-up to reduce readmissions, chronic condition monitoring, early diagnose of people with CVD risks, home-based clinical trials. 2. Fast cardiovascular tests: labor medicine, population screening, sports medicine, physical activity control. 3. First responders: rescue workers, medical emergencies. 4. Wellness: fitness assessment, stress prevention and reduction, healthy ageing.

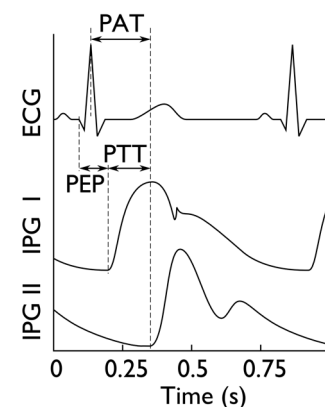
Reference number

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Cardiovascular condition assessment from a device based only on contacts with the extremities



The ECG and a proximal and two distal IPGs are recorded with four electrodes



Systolic time intervals, pulse arrival times and pulse transit times obtained from the three surface signals

Business Opportunity

Technology available for licensing and technical cooperation

Patent Status

Patented in USA and Europe

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