

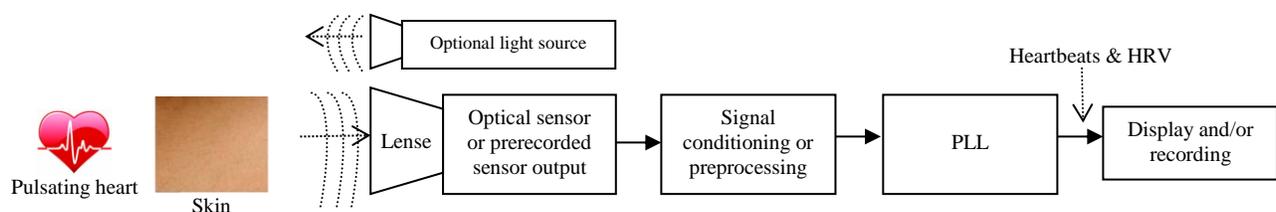
Technology Commercialization Opportunity

CardioSense™ – Real-time contactless cardiac monitoring

Inventor(s): Gil R Tsouri and Sohail Dianat.

Technology Description

The invention is a method of detecting and tracking cardiac activity by making use of a Phase Locked Loop (PLL). The invention provides real-time beat-by-beat detection using low computation power and low power consumption.



Ambient light or light from a dedicated light source illuminates the skin of the subject being monitored for cardiac activity. Since the pulsating heart pumps blood to the skin in a periodic pattern, the intensity of reflected light off the skin has the same periodic behavior. The reflected light is gathered by a lens that focuses light onto an optical sensor which provides an electrical signal. Alternatively, a pre-recorded stream of sensor output can be analyzed in place of the real-time sensing. An RGB webcam is one example of such a sensor and the potential source for a recorded stream. The real-time or pre-recorded electrical signal undergoes signal conditioning and preprocessing, e.g., filtering for limiting frequency range, Automatic Gain Control (AGC), noise reduction, etc. The processed signal is fed as input to a Phase Lock Loop (PLL). The PLL is used to lock on to the periodic pattern of the beating heart and track its changing behavior as is reflected in the electrical signal at the PLL input. By doing so, the PLL provides a mirror of cardiac activity including the occurrences of heartbeats, Heart Rate Variability (HRV) and heart rate disorder.

Keywords: Contactless Cardiac Monitoring, Biomedical Instrumentation, Healthcare.

Technology Readiness

Simulations and analysis proved feasibility of the approach. A prototype device is currently being built.

Idea	Concept	Prototype	Alpha Version	Beta Version	Released
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The developers of CardioSense will work with licensees to finalize the development and move towards a “released version.”

Intellectual Property

CardioSense is the subject of pending U.S. patent application 20140276118.

Applications

The invention can be used to perform noncontact monitoring of a subject's beat-by-beat cardiac activity. Beat-by-beat cardiac activity is indicative of many physical and mental states and conditions. Elevated pulse, arrhythmia and stress/relaxation levels through the relationship between HRV and vagal tone activity are some examples. Many applications can be developed based on this invention. Some examples follow:

- Long term, continuous and automated monitoring of patients in healthcare facilities and residential environments (currently monitoring is occasional and requires a qualified care provider).
- Monitor patients in prolonged CAT scans (currently not possible because no electrodes are allowed in the scanner).
- Monitoring babies without electrodes (their skin is easily irritated).
- Flag suspicious individuals in places with heightened security sensitivity such as airports.
- Assistive tool for interrogations and questioning by law enforcement agencies.
- Monitoring drivers in cars for over-relaxation and over-stressful states, both equally dangerous for passengers' safety.

The invention can be implemented using software on a PC/smartphone/tablet for processing signals coming from RGB cameras in real time or from a pre-recorded video stream. Face tracking can be used to track the specific portion of skin, on or near the face, that is being observed.

CardioSense can be implemented in hardware using analog and/or digital electronics to form a very compact device that could replace the finger-probe oximeter. This device can be placed on a subject's collar where the skin of the neck is used to continuously track cardiac activity.

A similar device can be integrated into eyeglasses, allowing the wearer to evaluate the cardiac activity of a person he is interacting with. The PLL output signal can be easily converted to an audio signal, allowing the wearer to hear the other persons pulse. The applications of such glasses range from diagnosis of patients to law enforcement.

Target Customers

Medical instrumentation companies, healthcare providers, automotive companies, law enforcement agencies.

Opportunity

RIT's Intellectual Property Management Office (IPMO) is interested in working with those parties who are qualified and interested in the commercialization of this CardioSense technology. Arrangement types include licensing the application to existing organizations or new organizations that have expertise in the field or related fields.

Contact

Those interested in learning more about this opportunity should contact: Mr. William E. Bond, Director of Intellectual Property Management at RIT (585) 475-2986, bill.bond@rit.edu

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