Medically monitoring premature babies with cameras

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Credit: Marc Delachaux / 2017 EPFL

Researchers at EPFL and CSEM have developed a contactless and wireless camera system to continuously monitor the vital signs of premature babies. This system could replace skin sensors, which cause

false alarms nearly 90% of the time. Preliminary tests will soon be carried out on newborns at University Hospital Zurich, a partner in the project.

In the near future, premature babies kept warm in neonatal incubators could be medically monitored using cameras rather than with sensors attached to their skin. This system is about to be tested on preemies at University Hospital Zurich (USZ-CH). The underlying technology was developed by EPFL, CSEM and USZ as part of the Swiss research program Nano-Tera.

The camera system was developed to improve the way babies' heart rates and breathing are monitored. "Skin sensors placed on the babies' chests are so sensitive that they generate false alarms up to 90% of the time, mainly caused by the babies moving around," said Jean-Claude Fauchère, a doctor at USZ's neonatal clinic. "This is a source of discomfort for the babies, because we have to check on them every time. It's also a significant stress factor for nurses and a poor use of their time – it distracts them from managing real emergencies and can affect quality of care."

With the camera system, no physical contact is required. The baby's pulse is detected by analyzing its skin color, which changes ever so slightly every time its heart beats. Breathing is monitored by measuring movements of its thorax and shoulders. At night, infrared cameras take over, which means that monitoring can be carried out non-stop.

The optical system was designed by the CSEM researchers, who chose cameras that are sensitive enough to detect minute changes in skin color. They teamed up with researchers from EPFL to design algorithms used to process the data in real time. CSEM focused on respiration, while EPFL worked on the heart rate. "We ran an initial study on a group of adults, where we looked at a defined patch of skin on their foreheads,"

said Sibylle Fallet, a PhD student at EPFL. "With our algorithms we can track this area when the person moves, isolate the skin pixels and use minor changes in their color to determine the pulse. The tests showed that the cameras produced practically the same results as conventional sensors."

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University Hospital Zurich will soon be testing the system on premature babies. Virginie Moser, the CSEM researcher in charge of the set-up at USZ, said: "We plan to take measurements on as many preemies as possible to see whether, under real-life conditions, the results we get

from our algorithms match data collected using on-skin sensors."

If so, the camera system could one day replace skin sensors. In addition to cutting down on false alarms, it would also be more comfortable for the babies.

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