



SMART HEALTH

A WEARABLE 5-CHANNEL ECG CHIP TO MONITOR FETAL HEART RATE AND MOBILITY

Pregnancy is often a time of excitement, but it also comes with uncertainty. It can feel like there are many unknowns, especially in terms of the baby's wellbeing and during the times between doctors' appointments. At-home pregnancy monitoring systems could take away some of that uncertainty and provide valuable insights and data. Unfortunately, today's wearable solutions are typically limited to tracking maternal health parameters, spot-checking or contraction monitoring – and are unable to provide a real-time, continuous report of a baby's wellness.

WHERE TODAY'S FETAL MONITORING APPROACHES FALL SHORT

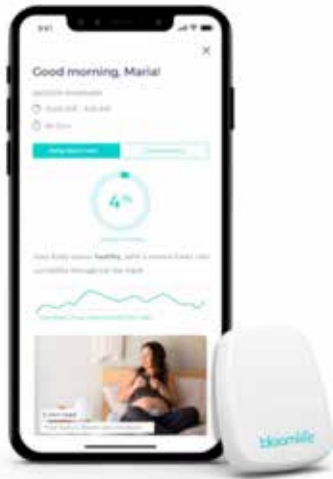
Today, fetal wellbeing indicators (such as a fetus' heart rate) can only be monitored in the hospital since it requires specialist cardiotocography (CTG) ultrasound monitoring equipment. During CTG examinations, fetal heart rate is measured for a duration of 20 minutes to identify accelerations or decelerations, indicative of a baby's wellbeing or distress (respectively). Besides being cumbersome to use, CTG machines are bulky and expensive, limiting their use to the hospital ward.

In the last 20 years, consumer-grade ultrasound technology has emerged – allowing pregnant women to listen to their

baby's heart beat from home. Yet, this technology only provides a snapshot of the fetal heart rate; and that is not sufficient to draw any conclusions on the fetus' wellbeing or distress.

LAYING THE FOUNDATION OF A CUSTOM-BUILT SOLUTION FOR LONG-TERM, RELIABLE RECORDING OF THE FETAL ECG

Imec and Bloomlife – an imec spin-off – introduce a prototype of the world's first wearable 5-channel electrocardiogram (ECG) chip to continuously and accurately monitor fetal heart rate and mobility, two important indicators of a baby's wellbeing. With the development of this chip, a major hurdle



has been taken in the creation of a wearable ECG system that can accurately measure the fetal ECG as early as week 20 in a woman's pregnancy.

The chip can be integrated in a small and comfortable wearable, and with the companion app, it enables pregnant women to monitor their baby in the comfort of their home.

Bloomlife's purpose-built BeatleIC chip, which leverages imec's unique integrated circuit (IC) technology know-how, is the only chip on the market today that has all required characteristics to continuously and accurately track a fetus' wellbeing indicators – such as heart rate and mobility – throughout the second half of a woman's pregnancy. Existing chips either consume too much energy to be of any practical use in wearable solutions or are not capable of tracking the right fetal parameters.

Built on imec's 55 nm CMOS technology, the BeatleIC chip features

- A 5-channel ECG sensor to enable simultaneous recording of all perinatal health related signals
- Low power consumption to enable long-term and continuous use (featuring a battery lifetime of approximately one week)
- High accuracy to enable fetal ECG data acquisition at very low amplitude levels (between 3 and 15 μV peak-peak)

WHAT'S IN IT FOR YOU? EXPERIMENT WITH OUR LIVE USER INTERFACE!

Marking the BeatleIC chip's public introduction, a demonstrator is available that concentrates on the signal acquisition part and the technology that is needed to register a fetus' ECG. A live user interface displays a 5-channel ECG signal from a patient simulator at very low amplitude levels – comparable to a fetus' ECG.

The joint developments of imec and Bloomlife to detect fetal heart rate and mobility are expected to translate into a product for remote monitoring of fetal wellbeing from the home, providing peace of mind to moms, improving access to care, and providing doctors with a platform for improved pregnancy monitoring and risk assessment.

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