

Fetal Heart Rate and Activity Monitoring via Microsoft® Smart Phones

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Topical Area: Point of Care Diagnostics and Remote Patient Monitoring

For expectant mothers, particularly those with high-risk pregnancies, regular prenatal checkups can be crucial in alerting an obstetrician or midwife about potentially life-threatening complications. Researchers at Edith Cowan University, together with clinicians at the Mercy Hospital in Mount Lawley, Australia aim to improve access to prenatal care in isolated communities by designing an affordable, portable fetal monitor that expectant mothers can use to check for signs of fetal distress and relay vital information to healthcare professionals.

Living hundreds of kilometers from the nearest hospital or health center in many cases, Indigenous women in remote and rural Australia experience premature births, fetal deaths and other complications at more than twice the rate of other Australian women. Limited access to fetal monitoring technologies such as ultrasound scans and heart rate tracing is a major factor in this alarming trend.

With financial, software and hardware support from Microsoft External Research, Tan and Masek, working with a team of researchers and students, have developed software that can be downloaded at no cost to any Windows Mobile smart phone. When connected to a low-cost fetal monitor, the smart phone will enable expectant mothers to track and keep a record of the fetal heart rate and activity in the womb and transmit that data to obstetricians or midwives at urban or regional health centers (see Figure 1). The system also can be used to track and relay critical information during premature births.

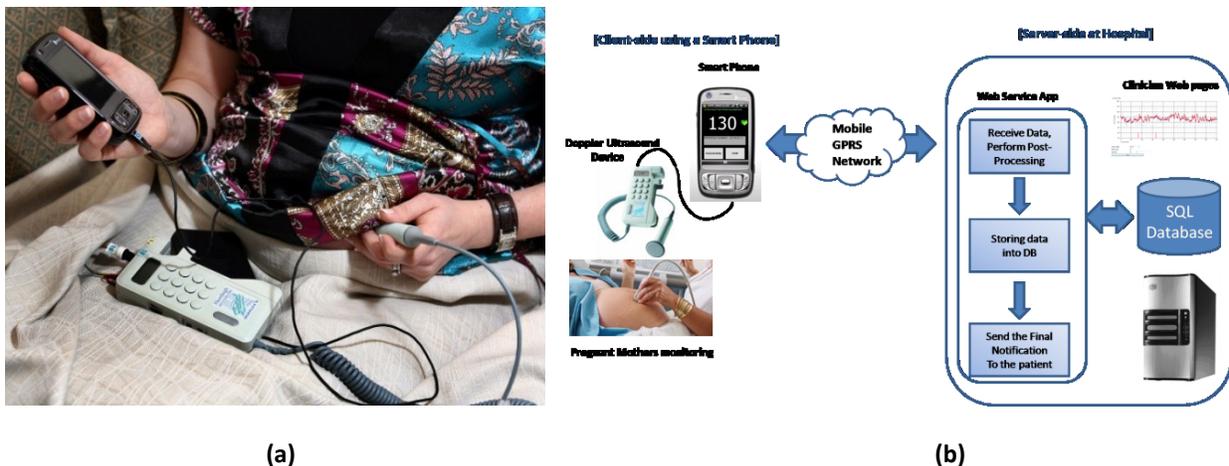
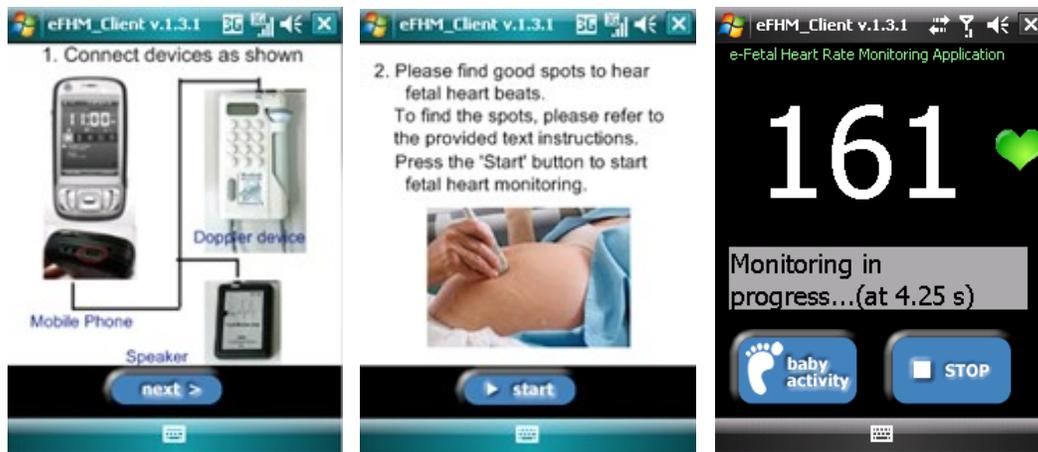


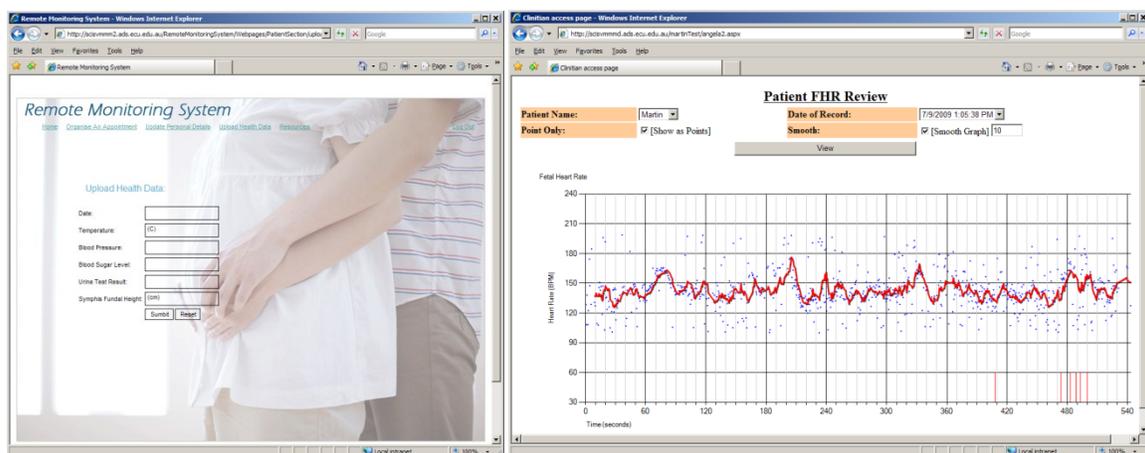
Figure 1: (a) The mobile phone is connected to a portable Doppler monitor and the mother tracks the fetal heart rate with the Doppler probe (Photo by Getty Images for Microsoft Research). (b) A system diagram of the system.

In addition to transmitting data to a hospital or medical center, the smart phone software can process this information and provide important details, such as the fetal heart rates and fetal movements to an expectant mother and her physician or midwife (see Figure 2). Tan and Masek's system fills an important gap in the available technology, particularly for rural and remote use. On one end of the spectrum are inexpensive handheld monitors that can pick up a baby's heartbeats but cannot process the information or transmit it in real time. On the other end is high-end portable monitoring equipment that is designed to transmit information to doctors remotely but costs hundreds of thousands of dollars. By contrast, the smart phone-based fetal monitoring software and portable Doppler ultrasound device together will cost about US\$50 per unit.

In their presentation, Tan and Masek will present the successful outcomes, including how the system fared in a practical environment, from a recent trial with expectant mothers at the Mercy Hospital, Mount Lawley. The scalability of the system, based on trial outcomes, will also be discussed.



(a)



(b)

Figure 2: (a) The wizard-style interface on the smart phone helps unskilled mothers to connect the system components and get ready for monitoring. (b) Server-side interfaces at the hospital based monitoring server