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Smart wireless system for monitoring and analyzing the health of the fetus

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Abstract

In the USA, there are Over 4 million births annually with 25% of pregnancy ends in miscarriage. Fetal death can happen in high risk pregnancy and 50% of the low risk pregnancy. The cost of a single miscarriage is about $4000; this cost includes hospital care before and after the fetal death. Fetal death can be minimized by frequent and effective monitoring of the wellbeing of the fetus. One of the major indicators of the well-being of the fetal and the health of the pregnancy is the pattern of the fetal movement inside the mother's abdomen. Fetal neuro-muscular activity is one of the basic physiologic functions of the developing organism and is necessary for normal neural, muscular and skeletal development of the fetus. Feto-placental unit dysfunction or severe impairment of nutrient supply by the maternal circulation are thus expected, and do, lead to decreased fetal neuromuscular activity. Recognizing the dependence of the fetal movement on the health of the pregnancy it is recommended that induction of labor should be carried out for decreased fetal activity.

At present time fetal movement is recorded and assessed by using in-hospital techniques such as Doppler ultrasound. The purpose of this research is to develop a prototype of a portable compact smart system that monitors, records, and analyzes fetal movement on semi continuous real-time. The system has a compact sensor compound strapped around the mother's abdomen and transmits wirelessly its recording to a computer (can be in the hospital) that the physician has an access to it whenever he/she desires. The computer is programmed with a pattern recognition algorithm that analyses the recorded signal. This monitoring of the fetal movement pattern will allow the physician to intervene at the right time to prevent, if possible, any miscarriages. The system has the following distinguishable characteristics that make it unique in the market.

1. The system uses pressure sensors rather than ultrasound. Continuous exposure of the fetal to ultrasound waves may have negative side effects on the fetal. Pressure sensors do not emit any waves; they just sense the pressure change on the abdomen when the fetal moves and hits the wall of the abdomen.

2. The sensor compound is compact; the mother can comfortably wear it while she is doing her daily routine.

3. The system works remotely; this means that the patient may not be in the hospital to use; she can be at home or work.

Biography

Dr. Nazeih Botros is the Coordinator of the Biomedical Engineering Program at Southern Illinois University Carbondale. He is also a Professor in Department of Electrical and Computer Engineering at Southern Illinois University Carbondale. He obtained his Ph.D. degree from University of Oklahoma in 1985. His research focuses on smart devises, modeling and simulation of biological mechanisms, pattern recognition and digital signal analysis. Dr. Botros is a senior member of IEEE and a member of several biomedical engineering advisory committees. He has authored a book in hardware simulation. He has numerous publications in conferences and Journals.

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