

MICROCONTROLLER-BASED FETAL HEART MOTION EMULATOR

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ABSTRACT

The previous fetal heart motion emulator system was operated and controlled by a computer. The system was inflexible to be transported from one place to another and required a high cost to build due to the expensive cost of a computer. Nowadays, portable and cost effective systems are required. A solution to these problems is to design an embedded system that provides a portable fetal heart motion emulator. This emulator can be applied to assist biomedical engineer in testing a new fetal heart rate monitoring instruments. Here, the system used a microcontroller to emulate the fetal heart valve motions. A couple of aluminum strips were used in the design to represent mitral and aortic valves which were attached to a couple of electromechanical servo motors respectively. The evaluation on the operation of the emulator was done by transmitting ultrasonic waves from an ultrasound device to the valves' motion of the emulator. The Doppler ultrasound signals obtained from the emulator were compared with signals obtained from real fetus to ensure the signals produced closely mimic the real signals.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Monitoring of fetal heart rate (FHR) is important before and during labor to provide medical professionals with essential data relating to the wellbeing of the fetus. This data is used in aiding them to make decisions regarding the physiological condition of the fetus. The information obtained may indicate amongst other things the necessity for surgical intervention if the fetus shows signs of hypoxia [1]. Changes in the fetal heart rate might be used to diagnose fetal distress [2]. Studies have shown that FHR patterns are sensitive predictors of certain fetal diseases such as hypoxemia and academia. Therefore, the main objective of FHR monitoring during pregnancy is to prevent fetal death by ensuring that there is not a problem with the pregnancy that puts the mother or fetus at risk [3].

The choice of monitoring methods depends on the practitioner's orders, the institution's policies and procedures, and patient requests or needs. Those methods are auscultation, palpation or electronic fetal monitoring. If fetal monitoring will be intermittent, a continuous or combination of both auscultation and electronic fetal monitoring is going to be the monitoring method [4]. However, electronic FHR monitoring offer more cost effective means of surveillance than auscultation does.

Doppler ultrasound is one of the electronic fetal monitoring methods most commonly used to indirectly measure FHR. This is due to the fact that ultrasonic signals are able to penetrate human tissues very well without obliterating them [2]. Besides that, Doppler ultrasound signals (DUS) can detect movements, not electrical energy or sound. The