Non-Invasive Infant Respiration
And Temperature Monitor

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INTRODUCTION

The non-invasive infant respiration and temperature monitor detects the respiration rate and temperature of a sleeping infant and outputs the respiration rate, temperature and an alarm for lack of respiration or high temperature. This monitor reduces the risk of crib death, or Sudden Infant Death Syndrome (SIDS) caused by a cessation of breathing known as apnea.

The non-invasive infant respiration and temperature monitor uses a pressure pad placed along side the infant's rib cage to detect pressure changes caused by respiratory movement. It also includes a temperature sensor placed beneath the infant in order to detect fever. An infant positioning pad is used to prevent the infant from moving away from the pressure pad or off of the temperature sensor. A liquid crystal display (LCD) outputs the respiration rate and temperature. A warning message is displayed on the LCD for a 10-second pause in breathing or temperatures over 99° Fahrenheit. A buzzer also sounds for lack of breathing or fever.

SUMMARY OF IMPACT

The non-invasive infant respiration and temperature monitor reduces the risk of crib death for all infants including those at risk for SIDS. Risk factors include infants born to mothers who smoked during pregnancy, infants born to teenage mothers and infants with siblings lost to SIDS. By continually monitoring the breathing rate of these infants, the likelihood of crib death occurring diminishes greatly. The monitors currently available for infants at risk for SIDS are available by prescription and involve wires attached to the infant. These include the transthorasic electrical impedance monitor, which uses electrodes attached to the infant's chest, and the pulse-oximetry monitor attached to an extremity such as the foot or finger of the infant.

The non-invasive infant respiration and temperature monitor has no attachments to the infant. Contact points are limited and the tubing and wiring can easily be secured to the mattress in order to eliminate strangling and electric shock hazards.

The non-invasive infant respiration and temperature monitor would also serve parents of healthy children by alerting them to fever or unexpected instances of apnea.

TECHNICAL DESCRIPTION

The non-invasive infant respiration and temperature monitor consists of hardware and software as well as non-electrical physical components. The hardware consists of sensors, circuitry and a microprocessor.

Programming was done on a Motorola HC11 microprocessor using the C Language. Other components include an air-filled pouch used to detect respiration and an infant positioning pad that ensures proper contact between the monitor and the infant.

In order to detect the respiration rate, a highly sensitive pressure sensor is attached to the air-filled pouch. The output from the pressure sensor is amplified and filtered for high-frequency noise before being input to the A/D Converter of the microprocessor.

A solid-state temperature sensor is embedded in the infant-positioning pad beneath the infant in order to sense the infant's body temperature. The output from the temperature sensor is amplified and biased before being input to the A/D Converter of the microprocessor.

An LCD is connected to the microprocessor and displays respiration and temperature information as well as alarm messages. A piezo-electric buzzer is also attached to the microprocessor and sounds for lack of respiration lasting 10 seconds or longer as well as fever.

The microprocessor has been programmed to analyze the pressure signal and calculate the respiration rate. The respiration rate in breaths-per-minute is output to the LCD. If no respiration is detected for 10 seconds, a buzzer sounds and a warning message is displayed on the LCD. The microprocessor has also been programmed to calculate the temperature and display it in degrees Fahrenheit on the LCD. A buzzer sounds for temperatures above 99°F.

The monitor continues to monitor respiration and temperature when an alarm sounds. If the alarming condition returns to an acceptable range, the monitor resumes normal operation. Otherwise, the alarm must be acknowledged by cycling microprocessor power.

The total cost for the project was approximately $80.