

## Chapter 15

# Development of Portable Medical Electronic Device for Infant Cry Recognition: A Primitive Experimental Study

**Natarajan Sriraam**

*M. S. Ramaiah Institute of Technology, India*

**S. Tejaswini**

*M. S. Ramaiah Institute of Technology, India*

**Ankita Arun Chavan**

*M. S. Ramaiah Institute of Technology, India*

### ABSTRACT

*Infant cry is considered as the first biological signal communicated by the newborns to the mother and the outside world. In NICU, there is a huge need to monitor the physiological conditions of the premature and full term infants. In such environment, the cry signal conveys significant information in terms of the distress of the infant and thereby needs of the infants can be well attended. Establishment of the portable device is thus essential for such scenario. This work enumerates a primitive experimental study on developing portable electronic medical device for infant cry recognition. The setup comprises of a voice recorder, NI My RIO processor with a Lab view followed by the LCD Tablet for display. The cry signals were recorded by placing the voice recorder in the incubator and were qualitatively assessed by the clinician and confirm its suitability for the experimental study. A threshold based classification was employed which sends the voice based alarm to the tablet. The continuous monitoring of such facility in NICU provides the behavioral status of the infant*

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## **INTRODUCTION**

Infant cry, a biological signal that connects the mother and newborn is considered as valuable information for clinical diagnosis by the neonatologists (Kusaka et al, 2008; Bard et al., 2008; Chang et al.2016). The infant cry helps in recognizing the physical state of the baby such as pain, hunger, discomfort, wet diaper, fear, illness etc. In a typical neonatal intensive care unit (NICU), where pre-mature newborns & full term babies are undergoing treatment, their physical behavioral status needs to be known for any clinical decision. The cry signal reflecting the physical and psychological state of the newborns provides the opportunity for the clinical as well as mother to understand their needs. Though NICU'S combines advanced technology and trained healthcare professionals to provide specialized care, continuous monitoring of babies to cater the needs is a challenging task. It has been reported that the crying behavioral pattern of infants were closely associated with the maternal emotional distress during the post pattern period (Kusaka et al, 2008).

The analysis of the biological infant cry reveals the physical state of the babies including hunger, pain, fear, wet diaper etc. It is the audio frequency (250Hz to 600Hz) that distinguishes the normal cry from pathological cries. In the last two decades, attempts have been made to analyze the cry signals but no technology has been developed to monitor the pre-mature/full term babies in a NICU environment. Studies revealed that due to lack of facilities and continuous monitoring of the babies in the incubator and warmer, the mortality rate is exponentially growing high.

Further current clinical practice mainly relies on the subjective behavioral observation of infants in NICU. There is still lack of sophisticated monitoring system to screen and detect the patho-physiological changes of the infants.

This research work highlights a primitive experimental study on developing portable medical electronics device for infant cry recognition. The portable device comprises of three units, namely: voice recorder, real-time NI myRio processor and LCD tablets. The study simulates the typical NICU unit environment with recording of premature infants & full term babies in an incubator and warmer.

## **Literature on Infant Cries Detection**

Literature works have been emphasized that analysis of infant cry an important field. This part briefly describes the recent methods for analysis of infant cry and pain assessment.

Dhanashri U.S. Talauliker and Nayana Shenvi (2015) have studied the characteristic of cry for preterm and full term infants. The cry characteristic reflects the development and possibly the integrity of central nervous system (CNS). They noticed that there is a difference between the cry patterns of preterm and infants with neuro-physiological conditions with fundamental frequency. Their aim was to preprocessing for eliminating silenced region of cry signal and estimates the fundamental frequency (pitch) using time & frequency domain analysis. The study was of main importance to exploring brain function at early stages of child development for timely diagnosis of neonatal disease malfunction.

D. Bard, P. Runefors, E. Arnbjornsson et al. (2008), discussed about the hypothesis that cry can be used as a tool to detect signs of nociceptive pain. The pitch frequency is extracted from cry with time domain methods. The fluctuations of these were analyzed in filter. The comparison was done between the original and new results.

Sandhya and Premanand (2016) studied the mechanism of different types of cry. The dataset for the work consisted of 27 babies which represents of 7 hunger cries, 4 sleepy, 10 pain and 6 uncomfortable

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