PAEDIATRICS TECHNOLOGY

IN BIOMEDICAL ENGINEERING APPLICATION: PART 1

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PREFACE

The first edition of ***Paediatrics Technology in Biomedical Engineering Application: Part 1*** informs paediatricians, physicians, and nurses the devices that are available in the local market today, and provides the overview of important background information on a medical device that was developed for paediatrics patient. Paediatricians, physicians and nurses used technology to diagnose, treat and monitor the kids' conditions. The main goal of paediatrics technology is to reduce infant and child morbidity and mortality. Besides, to promote healthy lifestyles and to create awareness among the parents. This book is an ideal resource to introduce all Malaysian, particularly who is involved in medical field to understand further regarding devices related to paediatric and child health**.**

Each chapter goes through a detailed description of the Bilirubin-Jaundice (*BiliDice*) *device* (Chapter 1), Visual-Infant (*VisFant*) device (Chapter 2), Vein-Scanner (*VeScan*) device (Chapter 3), Infant-Wrap (*InfaWrap*) device (Chapter 4) and Cardiac-Monitoring (*CarMonit*) *device* (Chapter 5). In addition to some that have never been published before in any journals or conferences. With this book, readers will quickly get up-to-speed on the most recent and future advancements in paediatrics technology, especially for applications in biomedical engineering. This volume will be useful in the future in giving professionals a method for seeing where new devices fit into the spectrum of paediatrics technology contributing to child healthcare.

Chief Editor, 2020
Mohd Azrul Hisham Mohd Adib, PhD

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Chapter 1

Bilirubin-Jaundice (*BiliDice*) Device for Newborn

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1.0 Introduction

Jaundice in newborns is mutual and it is a yellowish or greenish pigmentation of the skin and whites of the eyes due to high bilirubin levels (*Adebami, 2015*). Half of all newborns are affected by jaundice in the first few days of life after birth. In the transition after birth, fetal haemoglobin (HbF) will be destroyed and replaced by adult haemoglobin (HbA). The destruction of HbF releases iron and bilirubin. In other words, when old red blood cells are broken down, the yellow substance which are called bilirubin will be produced. Generally, the bilirubin is then removed from the newborn body as it is metabolised by the liver. However, some newborns with the undeveloped liver cannot do the task efficiently (*Ku & Lazim, 2017*).

Nowadays, in Malaysia, about 60% to 70% of the healthy newborn proficient hyperbilirubinemia were ascending from an augmented production of bilirubin and inadequate capability of the immature liver to collect and

expel it *(Mansor et al., 2012; Osman, Ahmad, & Muharam, 2014)*. Generally, it occurs during the first week after birth. Hyperbilirubinemia is nearly happening in all newborns when the total serum bilirubin (TSB) is greater than 15.0mg/dL. Nevertheless, it can be considered as severe jaundice when the TSB concentration is greater than 12.9mg/mL and 10% of the newborn population is informed misery at this condition (*Chowdhary & Ajay Kumar, 2017)*. The bilirubin level will rise progressively if the strictness is not perceived within the appropriate time interval and if jaundice is left crude. Once it surpasses a certain level, there is a prospect of deafness or certain forms of brain damage that may occur *(M, Mohammadi, P, & Indikar, 2013)*.

Newborns with jaundice within the first 14 days of the infant life are brought to the doctors to determine how high the level of bilirubin is, as well as to receive phototherapy treatment. Various clinical assessments need to be executed, including evaluation of the history, physical examination and severity of jaundice. Commonly, blood samples are taken and various laboratory experiments are implemented to access the precise bilirubin level *(Ramy et al., 2016)*. As the method is repetitive, it causes trauma to newborns and also needs experts to perform this test. Two methods have been introduced currently to detect bilirubin levels non-invasively; colour comparison and optical method *(Ali et al., 2015; Dennery, Seidman, & Stevenson, 2001)*. However, both methods are still under on-going research due to the accuracy and stability of the parameters set up, as well as the sensor used.

In this chapter, a portable and smart device, Bilirubin-Jaundice (*BiliDice*) device, which is meant for the quantification of jaundice level using RGB colour sensor detection based on the non-invasive method is introduced as shown in **Fig. 1**. This device operates easily to detect and monitor bilirubin levels at regular intervals. The non-invasive technique is a bit painful and traumatic to the newborns