

Summary

In the Netherlands, 5% of the children between the ages of 8 till 15 suffer from Dysfunctional Breathing (DB) (Ludden et al, 2019). Instead of a normal breathing pattern, children who suffer from DB are easily out of breath because of irregular, quick, short breathing. This influences the physical and mental wellbeing of children since they are not able to perform in all physical activities, like gym classes. To help children develop a normal breathing pattern, they are guided by a physiotherapist to change the way of breathing. In order to gain process children, need to perform exercises at home, however these are often not engaging. On top of that there is the struggle of monitoring these exercises. Therefore, the Wearable Breathing Trainer (WBT) was developed by the Sustainable and Functional Textiles research group at Saxion Enschede.

The WBT is a smart textile product, meaning that it is a functional textile which can interact with its surrounding by sensing and reaction to different conditions. While developing a smart textiles different steps are followed which each faced different challenges which need to be. The different steps are fabric manufacturing, sensors and actuators, contacting and integration, communication and operating systems and design and interaction design. Previous design choices for the WBT have been made, the scope of this thesis focusses on the contacting and integration step of developing smart textiles tackled (Schneegass & Amft, 2017).

The sensor measuring the breathing pattern of the users of the WBT is the Breathpal. The Breathpal consists of two knitted Respiratory Inductance Plethysmography (RIP) straps of conductive Shieldex yarn which are integrated in the body of the WBT and electronics which are included in the main cabinet and smaller device. The knitted textile is a flexible stretchy material, and the main cabinet and smaller device, other components, are stiff components which are not flexible. The challenge of connecting these parts to each other resulted in the main question of this thesis: **“How to create a stable and reliable electrical connection method between a snap button and the knitted conductive RIP straps of the Breathpal the Wearable Breathing Trainer?”**

To answer this question research on different electrical connection methods of smart textiles has been done. Several promising connection methods are presented, the one which is the most common within smart textiles the snap button. Even though, it is the most common connection method, researched showed that there is a lack of knowledge on the electronic characteristics which are important to know when defining if the electrical connection method is stable, the contact resistance and how this is influenced by forced applied when attaching and detaching the snap button (Stanley et al., 2021). By listing all the challenges faced while assessing a stable and reliable electrical connection method a list of requirements was made.

To answer the main research question, it is important to measure the electronic characteristic contact resistance. This was the motivation to set up two experimental designs to test different types of snap buttons and different types of stabilizers. Addressing the amount of resistance and comparing this to each other a recommendation on a stable and reliable connection method is given.

Four different types of snap buttons were combined with three different types of stabilizers and without stabilizer, resulting in 16 different samples. The two different experimental designs were executed comparing these 16 types of samples. The outcome of these experimental design showed promising results for the combination of the Jersey Snap button with vinyl as stabilizer. This combination also meets other requirements which were made based on literature study on the subject, discussions with experts, and the challenges that are faced. Concluding on the answer to the research question: **“How to create a stable and reliable electrical connection method between a snap button and the knitted conductive RIP straps of the Breathpal the Wearable Breathing Trainer?”** The combination of a Jersey snap button with vinyl as stabilizer.