



**LUND**  
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# Breathe Right

Unlock your health code

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Main field of study Industrial Design

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# Abstract

This project presents the design and development of “Breathe Right,” a wearable AI-powered device and app aimed at promoting a regulated and healthy breathing pattern. Our breathing pattern plays a significant role in both our physical and mental health. Even if we don’t realize it, there are proper and improper ways to breathe, and an unregulated breathing pattern can unconsciously harm our health. By maintaining an optimal breathing pattern, we are able to unlock the code for better health and overall well-being. The Breathe Right device addresses unregulated breathing patterns by using AI-powered sensors and gives real-time feedback to alert users when their breathing deviates from optimal and normal. The collected breathing pattern data is analyzed in the app to create a reward system that encourages normal and optimal breathing. The monitor can help users track their progress and development, fostering self-improvement by maintaining healthy habits and breathing right.

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## What Is Breathing

The first thing a human being do when they get out of their mothers womb is breathing. Our first breath is what sparks us into life and it is one of our three main life components, food and water. The Nobel prize in medicine 2019 was awarded to William Kaelin, Sir Peter and Gregg Semenza for their studies that reveals the importance of oxygen on the cells, our bodies are made of billions of cells that are independent on oxygen. Just as candles need oxygen to burn, the cells needs oxygen to live. Without oxygen the cells cannot convert food into usable energy<sup>1</sup>. Their studies shows how important proper breathing is for our overall wellbeing and how it affects our energy levels. We all breathe unconsciously, but are we doing it correctly? And what are the consequences of improper breathing?



1 <https://www.nobelprize.org/prizes/medicine/2019/advanced-information/>



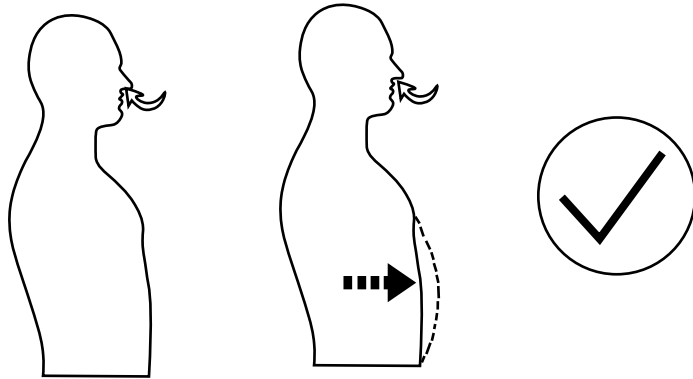
# Expert Meeting

**Per Wollmer**

Professor, Clinical Physiology and Nuclear Medicine, Malmö  
Profile area member

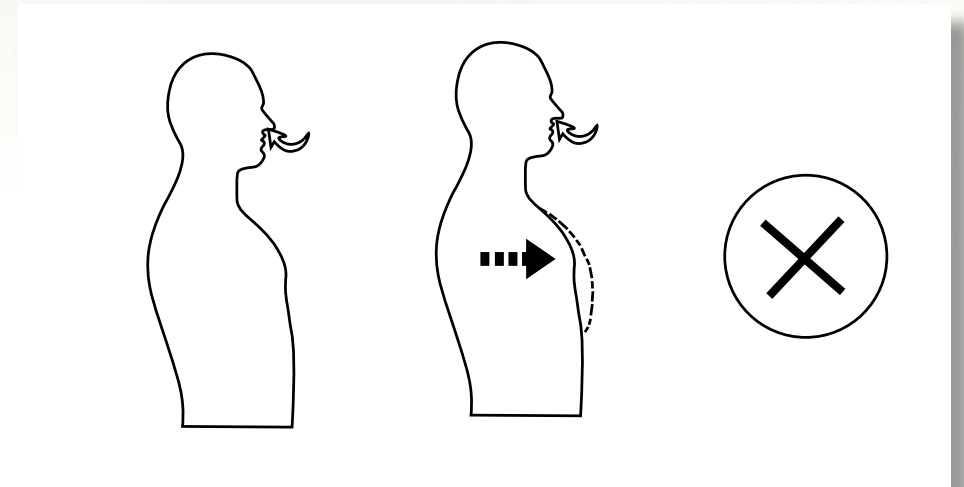
Per Wollmer mentioned that There are improper breathing and correct breathing even though we don't realize it. Our way of breathing can be a role player for our overall health.

Correct breathing: is slow and deep nasal breathing using the diaphragm. The diaphragm muscle is located between the rib cage and the belly button.



Improper breathing is when the diaphragm moves the opposite way it supposed to with each breath. Rather than only using the diaphragm muscle other muscle groups are involved. The diaphragm rises and the chest contracts on the inhale making the breath shallow.

Shallow breathing is fast and small breaths while having muscle tension around the chest and the belly. While shallow breathing the exchange of oxygen and carbon dioxide does not happen fully since the whole breath does not enter the lungs and part of it stays in the throat area which called "dead space" in medical terms. <sup>2</sup>



<sup>2</sup> Per Wollmer Professor, Clinical Physiology and Nuclear Medicine, Malmö.

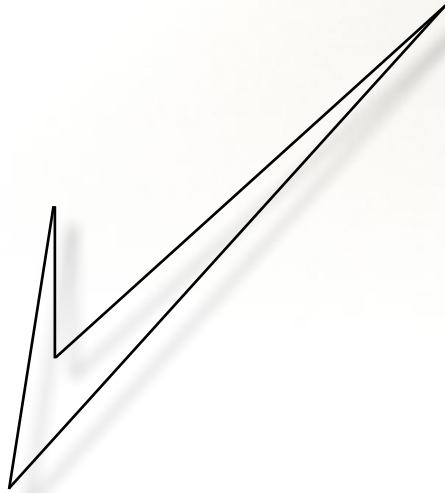
Profile area member, LTH Profile Area: Aerosols.

Personal meeting 11 feb. 2020

## Side Effects Of Improper Breathing

There are many negative effects on our health that are related to improper breathing both in long term and short term. The short term negative effects are Increased Stress , hyper-ventilation , impaired oxygen exchange , anxiety attacks and panic attacks . The long term effects are muscle tension and pain , digestive issue , sleep problems , weakened immune system and cardiovascular problems<sup>3</sup>.





## Conclusion

Our breathing pattern plays a game changing role in both our mental and physical health. By changing our breathing pattern are we able to improve or worsen our health. If our external body through "breathing" have this tremendous impact on modern life disease do we need a change in our way of living to improve our life and health? Do we need an external Artificial guidance that help us to breath properly?



## **Brief**

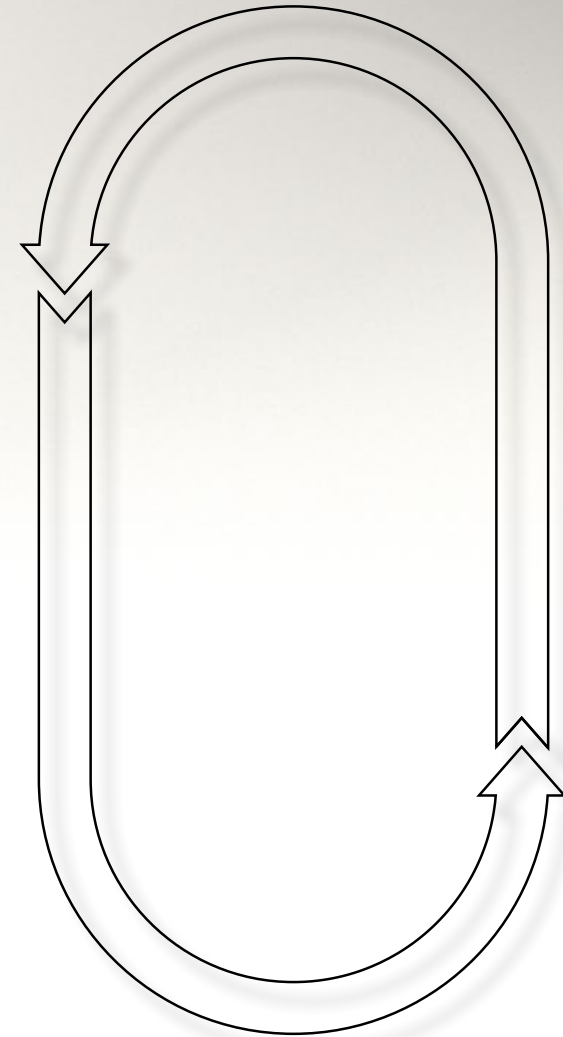
Design a product that helps to control the optimal breathing pattern to improve our health and wellbeing!

# Research

# Body And Mind

1962 conducted Stanley Schachter and Jerome E. Singer an experiment called the Two-Factor Theory of Emotion. The goal with the experiment was how physical arousal and cognitive interpretation influence emotional experience. The findings of the experiment is that the body's physical reaction like feeling flushing and accelerating breathing due to adrenaline or physical activity provides a baseline level of emotional arousal . The study demonstrates how our body and mind are connected and if we get control on our breathing are we able to control our emotions<sup>4</sup>.

We all know the term "calm your body calm your mind" or "take a deep breath" to encourage relaxation. For many years breathing has had a decisive role for our mental state, but until today are we reliable on our smart watches that's gives indications when our Heart rate increases to indicate stress while our breathing have been out of control way before. A paradigm shift of how we use our technology in term of health management must happen. In term of how far we have come in technology development are we able to create an AI-powered breathing monitors and alarms to improve our health.



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4 Mlodinow, J. (2013). *Subliminal*. Pantheon Books. page 184-189

## Wearable Health Monitors

Health monitor is a tool that provides constant health monitoring of instant and active database. Apple and Samsung-watch are examples of activity and sleep tracking devices that provides distinct data for the user. What is the benefits of health monitoring and why are we obsessed with it?

If we track our development by ourself are we able to see our progress, which encourage maintaining the healthy habits for self-improvement. Tracking our progress enhances motivation and seeing the daily results demonstrate dedication<sup>5</sup>. Health monitoring is becoming a global trend and projected to grow from 48,5 billion in 2024 to 71,1 billion in 2029<sup>6</sup>.



5 Clear, J. (2018) 1% metoden. Penguin publishing group. Page 206-208

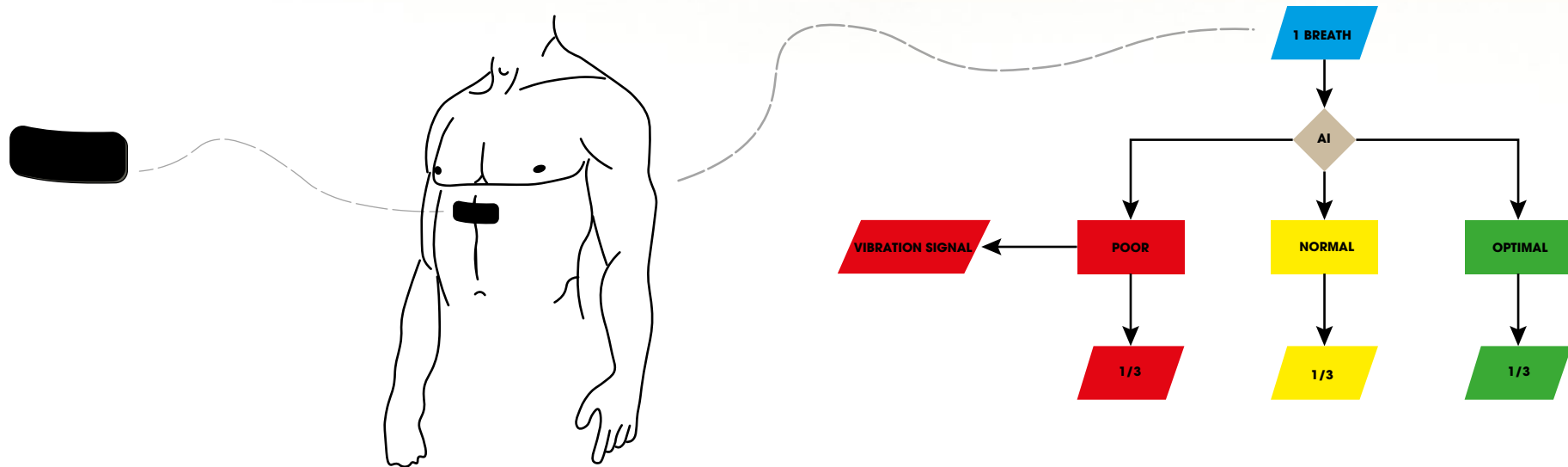
6 <https://www.marketsandmarkets.com/Market-Reports/patient-healthcare-monitoring-systems-devices-market-678.html>

# Idea Theory: AI Powered Breathing Monitor With Reward System

A monitor that can be placed between the rib cage and the belly button for breath-tracking through accelerometers to identify the inhale and exhale movements. Using AI generated algorithms to separate and calculate the poor, normal and optimal breaths while giving slight vibration signal to the user when the breathing pattern is poor. The instructed AI algorithms enables the device to analyze data, perform tasks and make decisions.

The device is connected to an app to collect data and give overview of the users situation. Simplifying the user experience and make the application user-friendly by giving the breaths an identity. Poor breaths are red, normal breaths are yellow and optimal breaths are green.

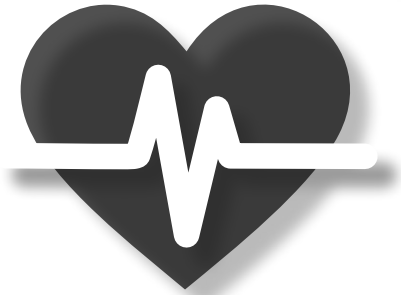
The data gets collected, separated and measured by percentage to the user for getting immediate information about their own breathing patten. The APP-screen displays the current counted breaths for each group in Percent. For example green = 40%, yellow = 45% and red = 15%. Creating a reward system to encaourage optimal breathing by getting higher percentage of Green breaths. The user gets a full overview of information to reflect upon.



# Target Groups

## Health seekers

Health investment is becoming a trend since seeking of becoming a better version of ourselves is human behaviour. A common known statement “health is wealth” makes it obvious that humans priorities their health and wellbeing upon everything else in their life. A product that provides self-improvement services is appealing for people who want to improve their life and health.



## Active people

People who engaged in sport activities are always looking for ways to improve and unlock their performance. Breathing is one of the important pillar's for athletes, Following The right breathing pattern while engaging in sport-activity enhances the overall performance<sup>7</sup>. A Tracker that helps athletes following the right breathing pattern for a specified activity like running is a performance enhancer.



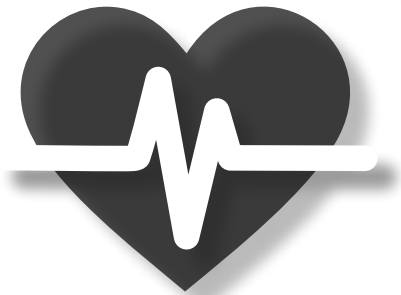
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7 <https://simplifaster.com/articles/breathing-drills-athlete-performance/>

# Interview With Future Users

**Sean Lindgren, 28, nurse assistant**

Sean is seeking for self-improvement and thinks his life situation is affected by his unbalanced mental and physical state. He is often stressed and gets shallow breathing in stressful situations, he forgets totally about getting back into his body. He describe it as a disconnection from his body by staying in his own mind.



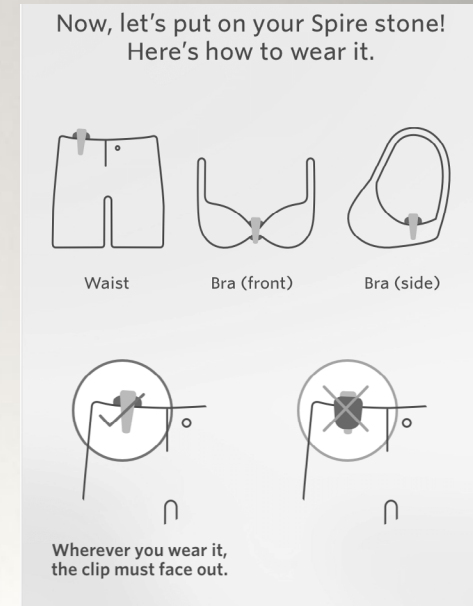
**Anthony, 24, train technician**

Anthony practices sports in his free time, training has influenced his life for the better and thinks working out is the best investment he has done for his health. He has difficulties focusing on his breathing while working out, he either hyperventilate or takes shallow breaths which has worsen his recovery and gets him tired faster while he workout.



## Inspirational Products





## Spire Stone - Breathing Tracker

Breathing tracker device with APP. Spire gives slight vibrations when the breath is intense. A start-up born out of Stanford University's Calming Technology Lab, the Spire Stone was released in 2014 and was eventually retired in 2022<sup>8</sup>.

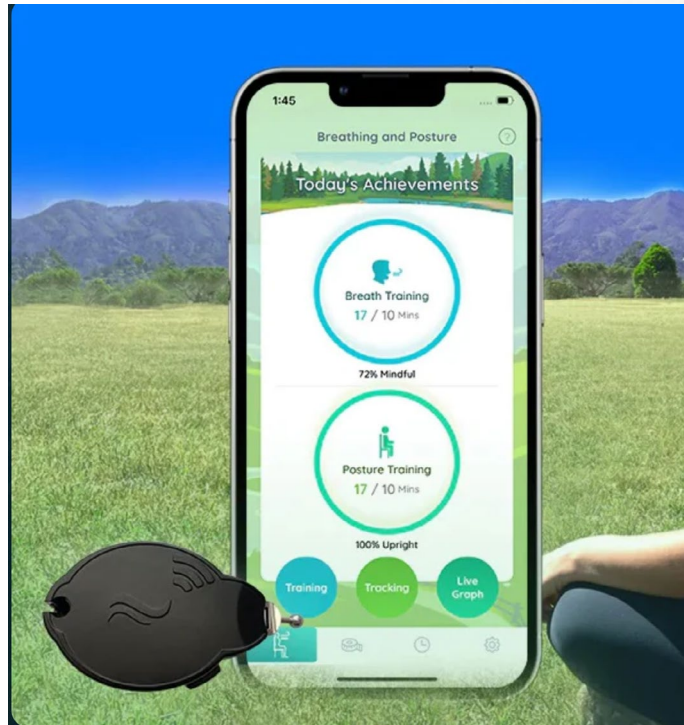
### Weaknesses:

- Clips falling off, not secure, easy to lose
- Uncomfortable
- Bad Bluetooth connectivity
- Inaccurate data readings on breath detection or calorie burnt estimations
- Non sport activity friendly
- Small target group

### Strength:

- wireless charging
- Innovative technology
- Multifunctional

<sup>8</sup> <https://www.davidtang.page/what-happened-to-the-spire-stone/#:~:text=Born%20out%20of%20Stanford%20University%27s,was%20eventually%20retired%20in%202022.>



## Prana - Breathing Tracker

Prana is a groundbreaking wearable device and mobile app that empowers medical researchers to investigate controlled breathing techniques across many health domains. Prana provides guided breathing techniques through vibrations, one buzz for inhaling and two buzz for exhaling<sup>9</sup>.



## Weaknesses:

- Non organic design shape that fits the body
- Medical product for research
- Many vibration signals that could be annoying
- Not for daily use
- Uncomfortable sharp "rope rather than strap"

## Strength:

- Accurate data reading
- Posture training



## Whoop Band - Fitness Tracker

Monitors heart rate data and heart rate variability. 24/7 wearable tracks sleep, strain, recovery, and health with the most advanced fitness and health wearable available today<sup>10</sup>.

10 <https://www.whoop.com/eu/en/>



## Weaknesses:

- Tricky to figure out initially in terms of wearability and App-function understanding.

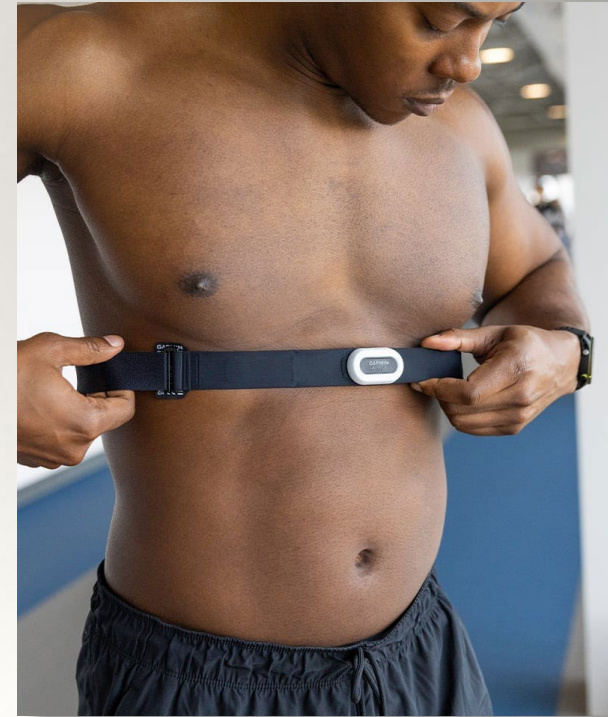
## Strength:

- Accurate data reading
- Secure, wont fall off
- Reward system Application design.
- Organic design
- Flexible
- Comfortable to wear 24/7
- Wireless charge on the go



### Garmin Pro - Chest Strap - Fitness Tracker

Comfortable chest strap that measures heart rate for workouts. Transmits real-time heart rate data to compatible devices, equipment and apps. Running dynamics also help you improve your form<sup>11</sup>.



### Weaknesses:

- Only for athletes
- Only heart rate + running dynamics
- Short time tracking

### Strength:

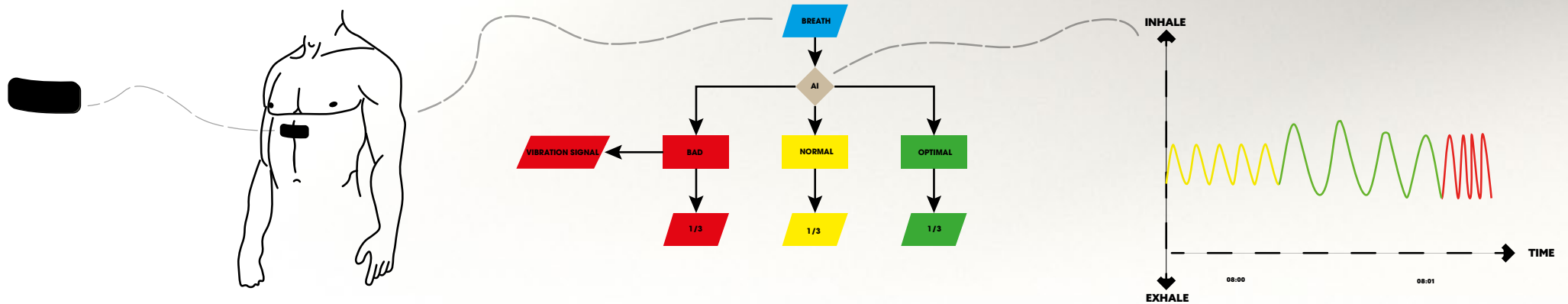
- Accurate data reading
- Secure, won't fall off
- Organic design
- Flexible
- Comfortable

11 <https://www.garmin.com/en-US/p/770963#overview>

## Ideation And Concept Generation

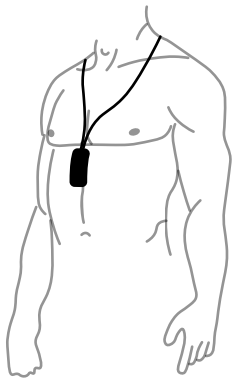
## Functional Design And Device Placement

The monitor should be placed between the rib cage and the belly button for accurate data readings, as this location aligns with the diaphragm, where breathing motion occurs. The device needs to gather information on the speed and range of inhalation and exhalation to determine whether the breath is poor, good, or optimal through AI-powered sensors. Various design options were considered, and a functional analysis study was conducted to identify the most effective design.

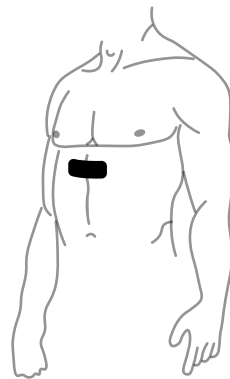


## Different Design Options

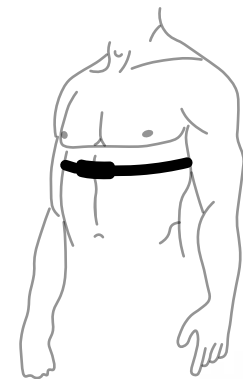
Necklace



Adhesive


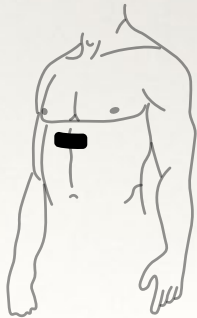
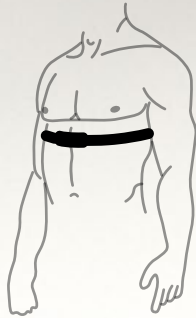


Strap



## Design Goal

1. A comfortable, durable and wearable device that provides accurate data readings for the user.
2. A secure device that won't fall off the body or easily get lost.
3. Charging on the go through a battery pack or charging case.

	Necklace	Adhesive	Strap
Concepts			
Secure	★★★★☆	★★★★☆☆	★★★★☆
Data reading	★★☆☆☆	★★★★★	★★★★★
Comfrtablility	★★★☆☆	★★★☆☆	★★★★☆
Easy to wear	★★★★★	★★★☆☆	★★★★☆
Fexibility	★★★☆☆	★★★★☆	★★★★☆
Sport friendly	★★☆☆☆	★★★☆☆	★★★★★
24/7 wearable	★★☆☆☆	★★★☆☆	★★★☆☆

## Conclusion and Concept Selection

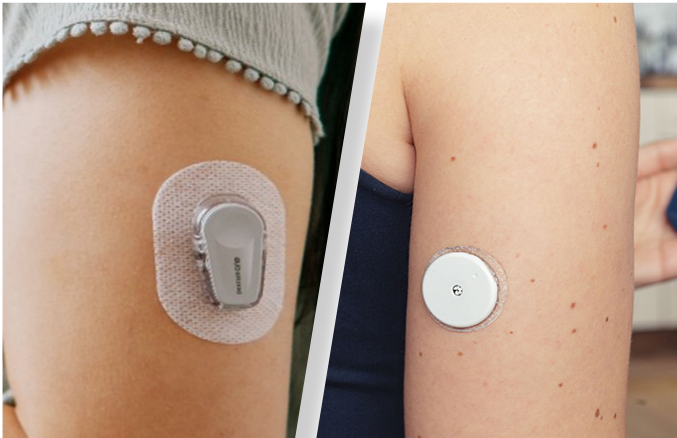
After studying the inspirational products and conducting a functional analysis, it has been determined that the best wearable monitoring devices for accurate data readings are those that attach directly to the body. Therefore, the concepts selected for further development are the adhesive and chest strap designs.





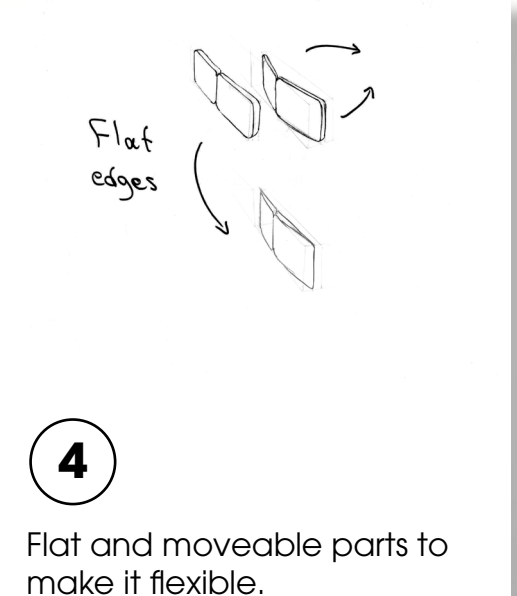
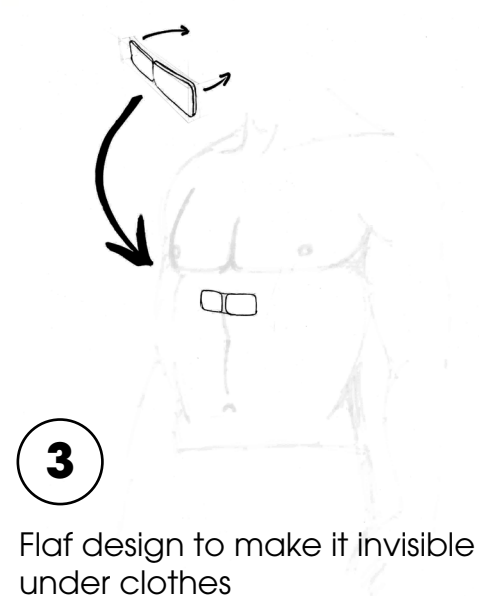
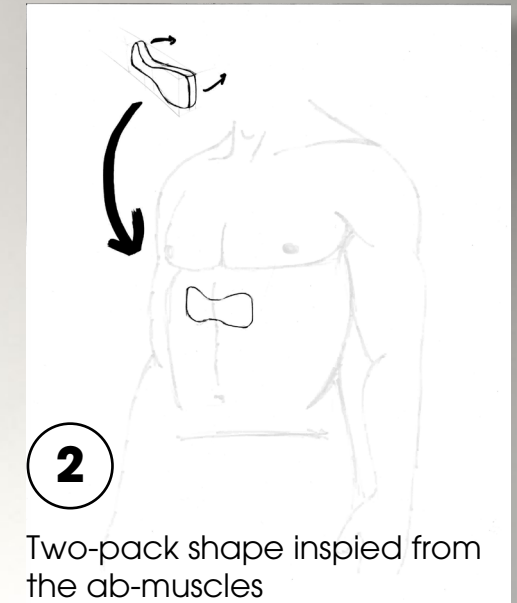
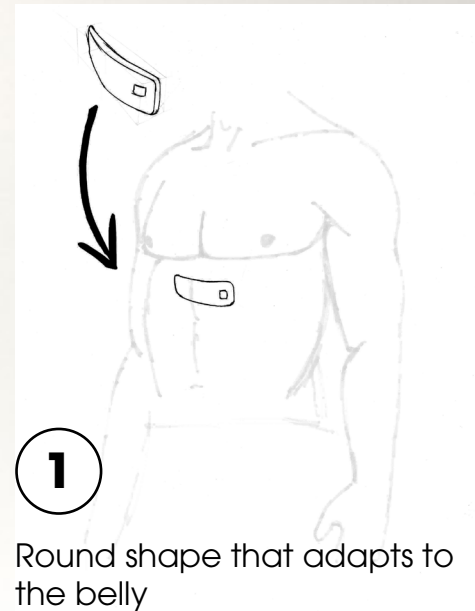
## Acrylic Adhesive Concept

All Medical wearable devices has something in common, they all need an acrylic adhesive that attach to the skin. Acrylic Adhesive is a comfortable solution with fast grip and high tack that has a cohesive internal strength that last up 28 days even when exposed to water, sweat or tears. Self-adhesive wearables like glucose monitors are becoming popular and a part of many people's lives. By applying this method to the breathing monitor it will be able to track the breathing while giving precise and accurate data<sup>12</sup>.

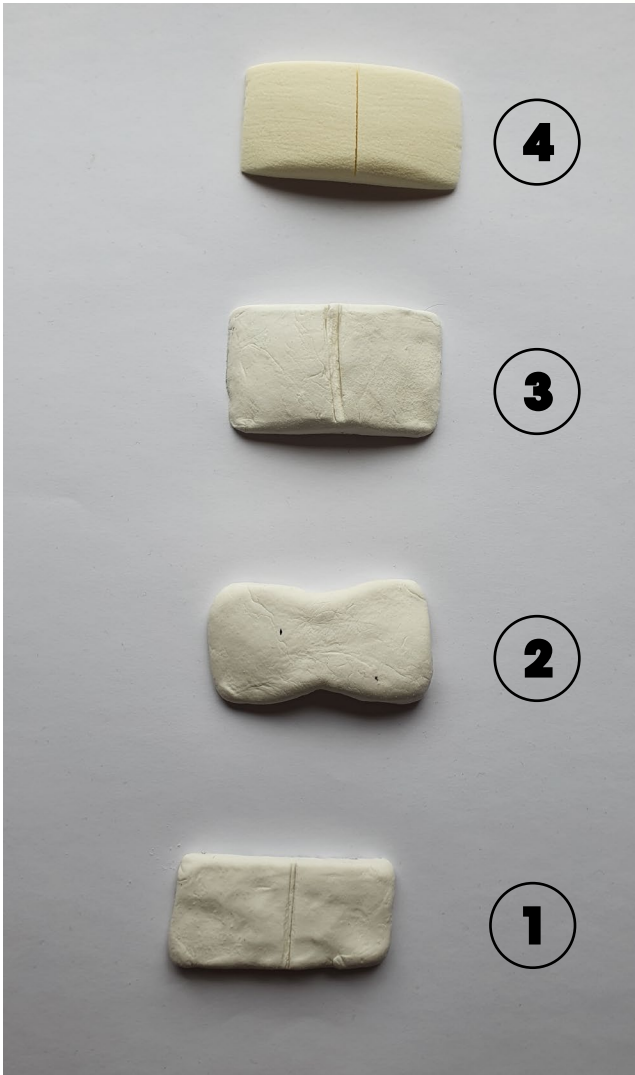


12 <https://www.jbc-tech.com/blog/posts/material-spotlight-3m-28-day-acrylic-adhesive-for-wearable-medical-devices/>

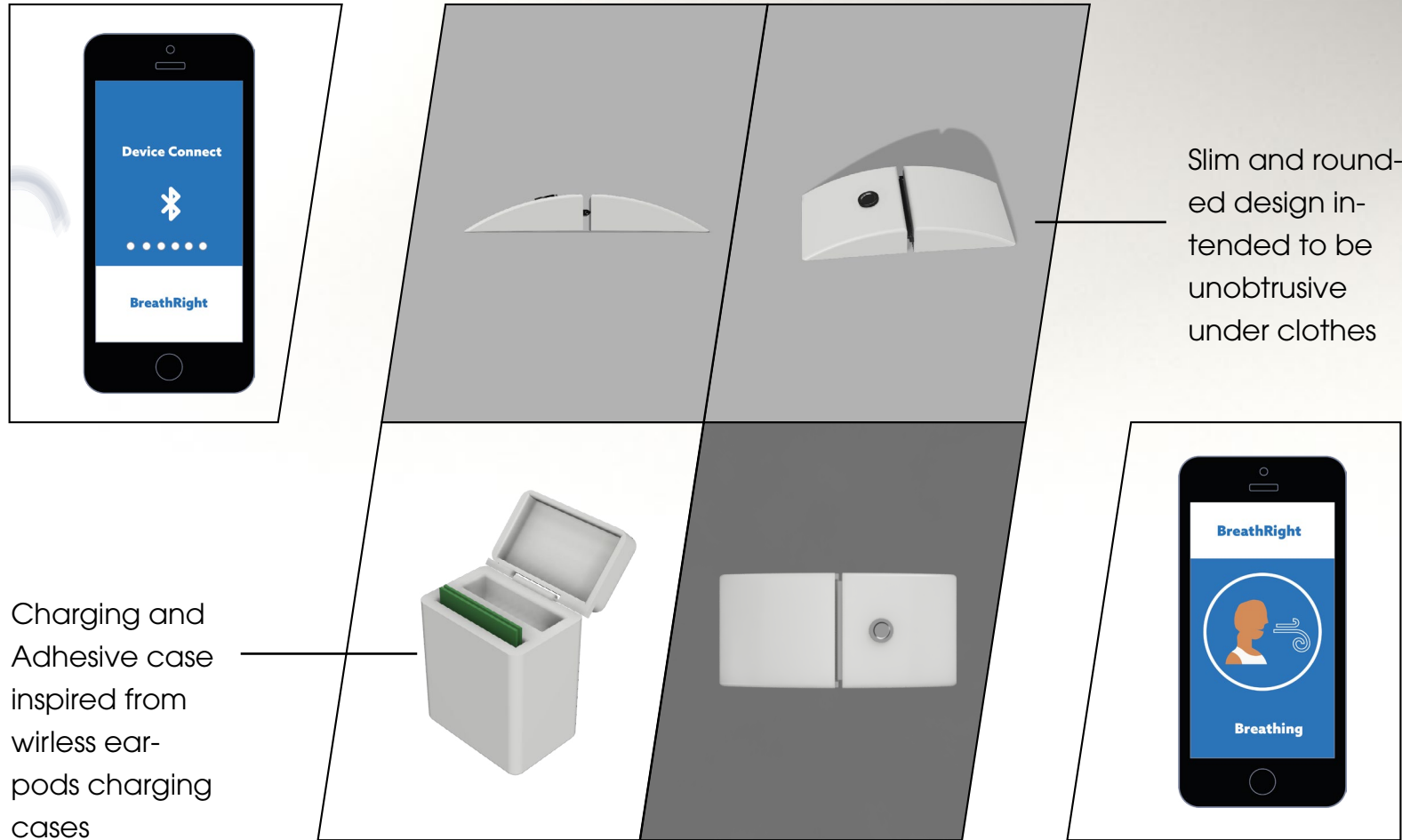
## Concept Development - Different Form Sketches



Mockups

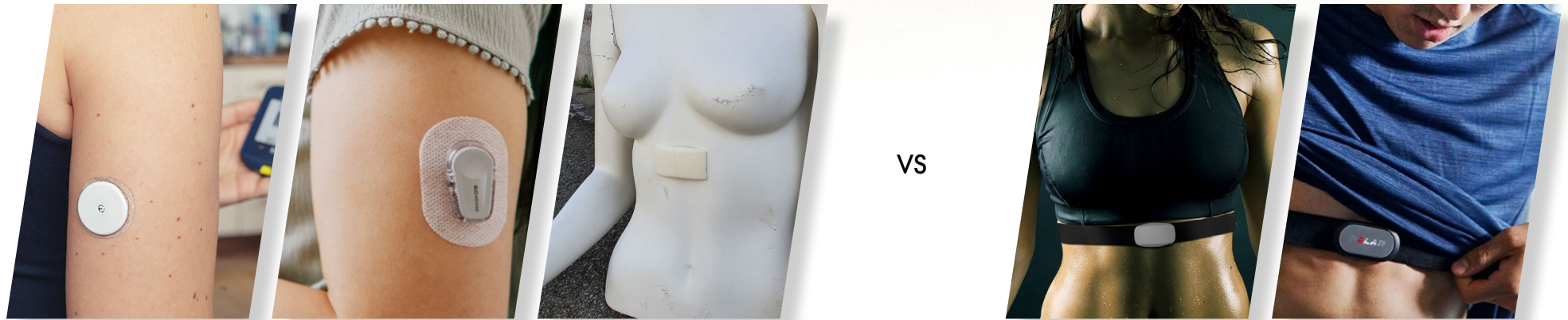


### 3D Model And Application Of Adhesive Concept



## Evaluation of Adhesive Concept

1. Giving the device a medical identity will define the target group and classify it as a medical device rather than a self-improvement tool.
2. The use of replaceable adhesive will make the device less durable and more expensive to maintain, as the adhesive will need to be replaced each time the device is removed and reapplied.
3. Medical adhesives are disposable and designed for single use. If the user removes the device for charging, a new adhesive is required.
4. A security concern is if the user have an active life style: the adhesive might lose its grip on the skin, increasing the risk of the device becoming detached and lost.



## Chest Starp Concept

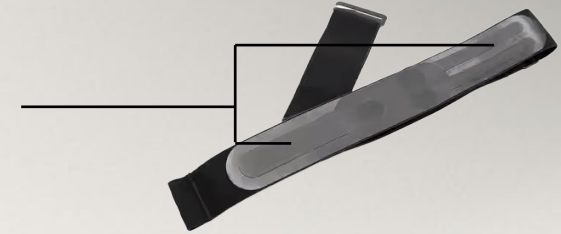
## Chest Strap Heart Rate Monitor Function

Heart rate monitors with chest straps are the most accurate data readers due to the placement of the strap near to the heart and its EKG-tracking system. Electrodiagram system detects electrical activity from the heart through sensors that are inserted into a band that wraps around the chest. The strap functionality is to hold the tracking monitor into its place. By attaching a strap to a breathing monitor, it will be able to track breathing and provide precise and accurate breathing movement data.



## Chest Strap Heart Rate Monitor Breakdown

**Electrodes:** These are the parts of the strap that make direct contact with your skin. They detect the electrical signals generated by your heartbeats. These are flexible electrodes made of flexible conducting material like silver coated fabric.



**Transmitter:** The transmitter is usually located in the central module of the chest strap. It processes the signals from the electrodes and converts them into data that can be transmitted.

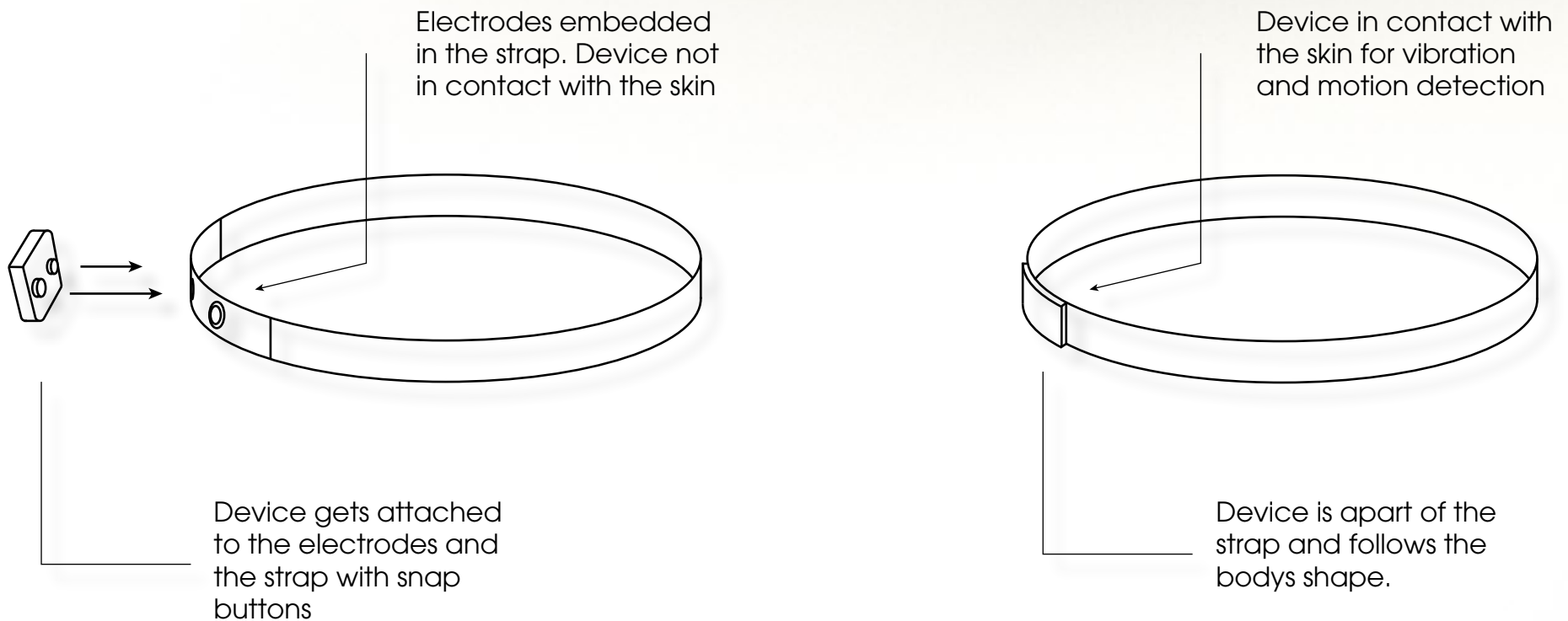
**Strap:** The strap holds the electrodes and transmitter in place against your chest. It is usually made of a stretchy, adjustable material for comfort and a secure fit.



## Converting Chest Strap Heart Rate Monitor To Chest Strap Breathing Tracker

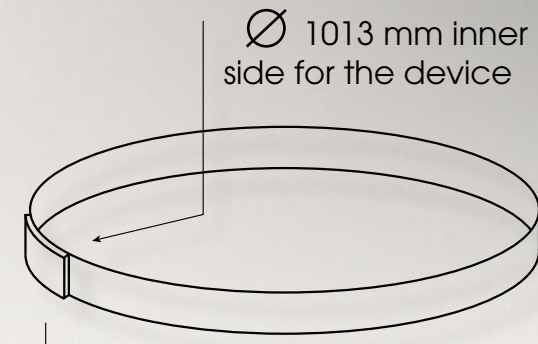
The heart rate monitor and the breathing tracker use different technologies, each delivering distinct outcomes. Chest strap heart rate monitors rely on electrodes embedded in the strap, which connect to a device attached with snap buttons or clips. In contrast, the breathing tracker operates independently with no need for additional external components.

The main components of the breathing tracker are accelerometers and a vibrator, which require full contact with the skin to accurately detect movement and provide the user with a slight vibrating signal. The function of the breathing tracker requires new functional strap design that adapts to the technology and the outcome.

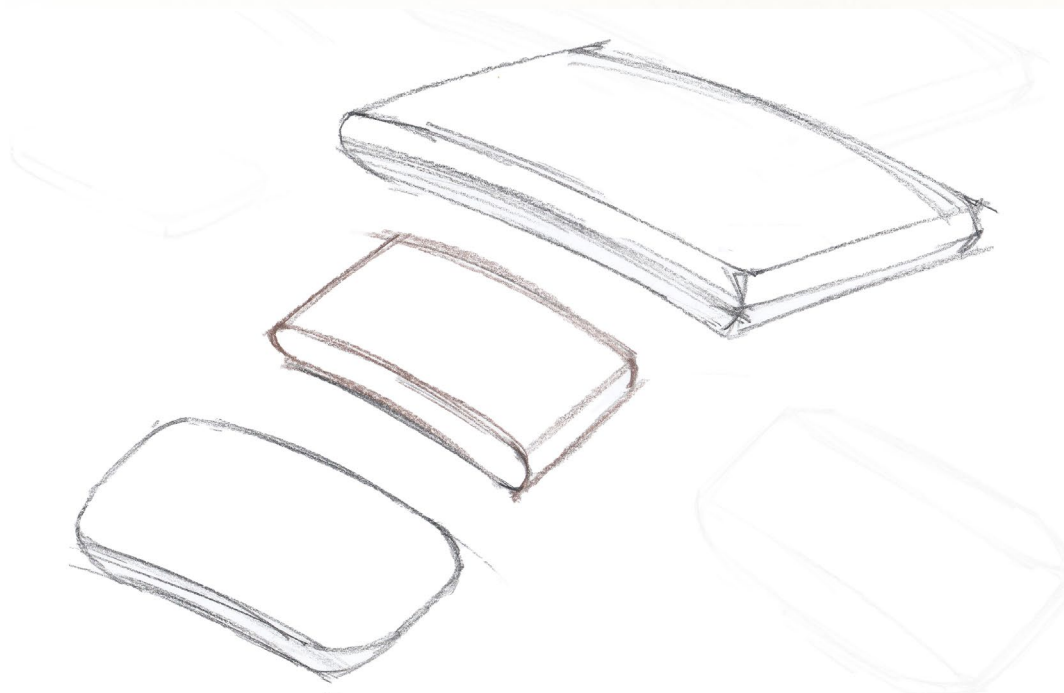


## Chest Strap Concept Development

In consideration of the device should be in contact with the skin, the form of the device have to be organic, having an average radius that follows the human body to achive comfortibility. an Average size of chest diameter between men and women is 1013 mm. Applying this Radius to the part that facing the body will make it comfortable for the user.



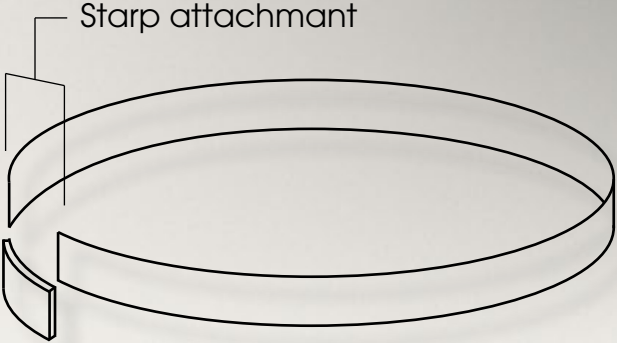
## First Free Form Sketches for The Device





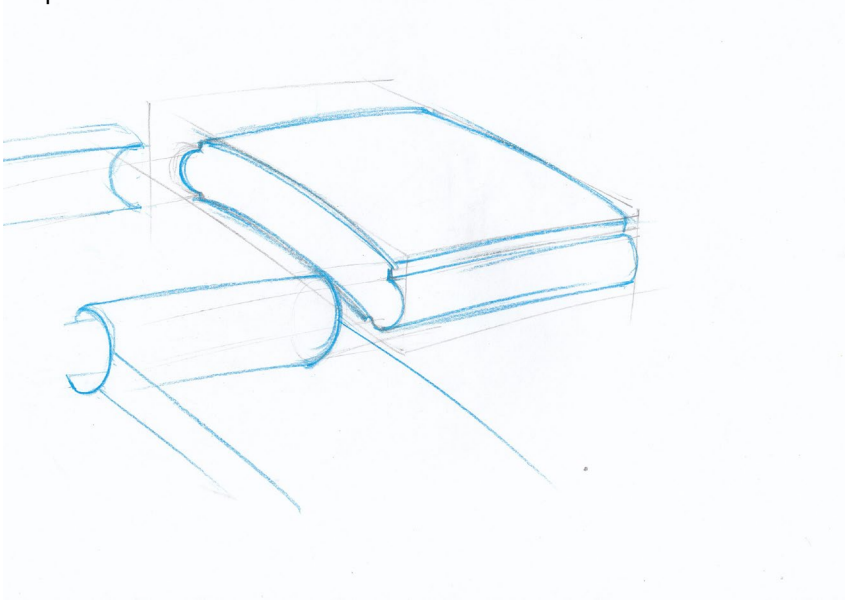
# Strap Attachment

In consideration of the device will be partially following the same line as the strap, there must be an attachment between the device and the strap. The attachment will also work as a donning and doffing method, making the strap replacable when it's worn-out or for personalization. which attachment method are the best, functional and simple for the user?

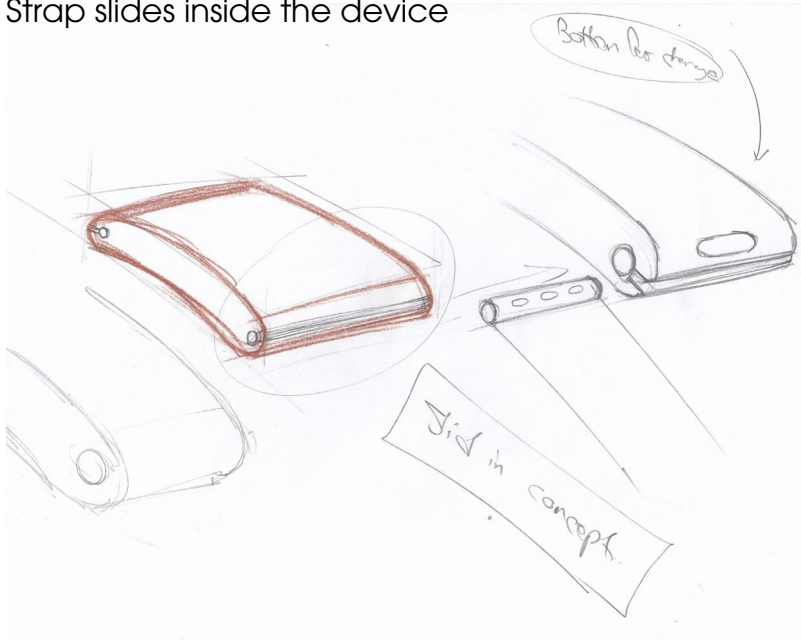


## Attachment Methods Sketches

Strap slides outside the device

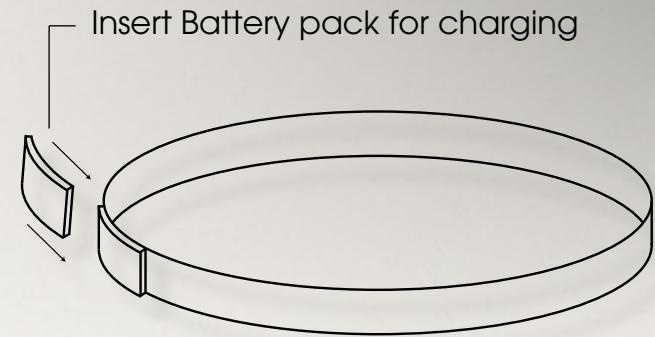


Strap slides inside the device

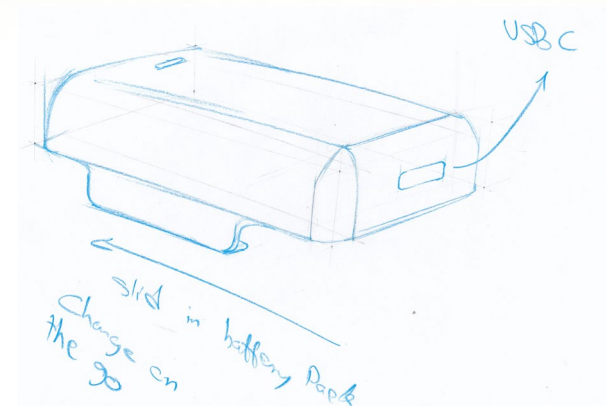
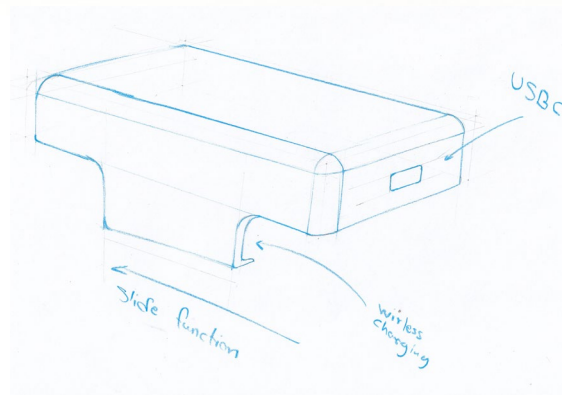
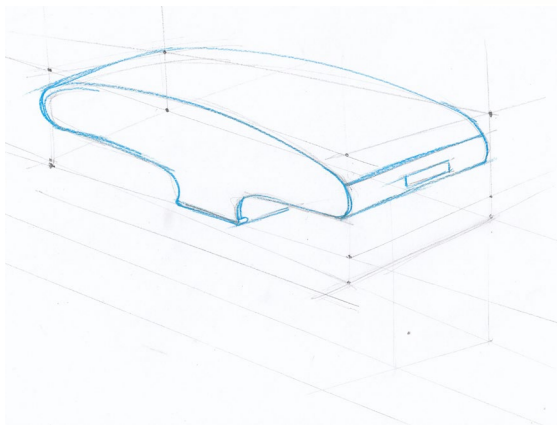


## Charging On The Go Fuction

Many wearable devices have a charge-on-the-go function, either through a battery pack or a charging case. Charging on the go is the future of wearable devices, as it gives users the freedom to use their devices without being dependent on a electrical outlet. In this project i decided to create a Battery pack that charges wirlessly and gets inserted to the device through track and rail system.



## Battery Pack Form Sketches



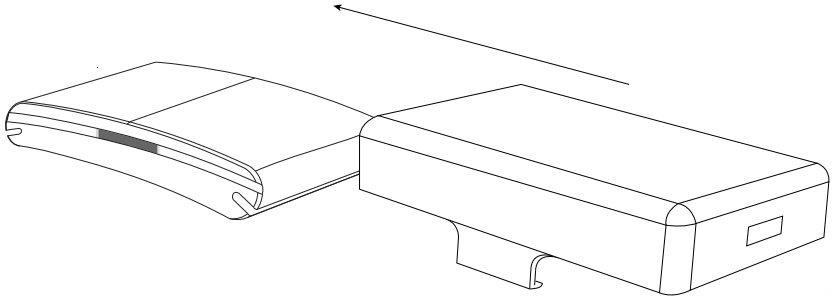
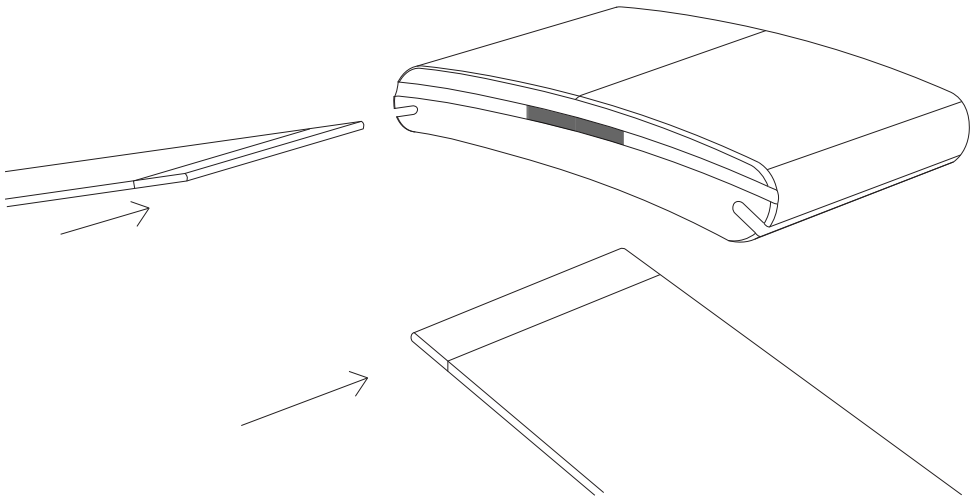
### Final Design Decisions

- 1. Energy-efficient motion sensor that automatically turn the device off when it's not in use without an on/off button.
- 2. Strap attachments through "slides into the device" with spring lock function.
- 3. Battery-pack wireless charging method through battery pack slide with "rails" into the device

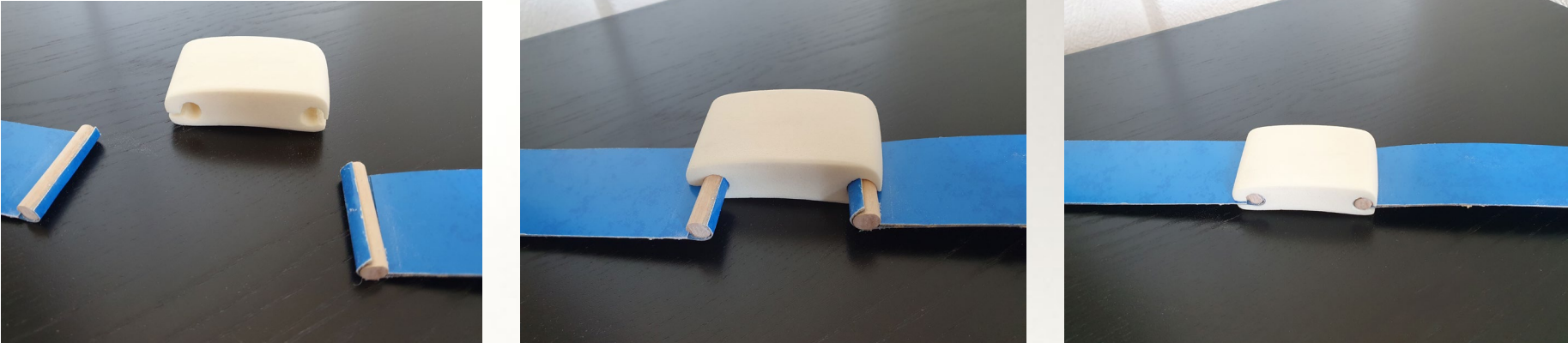
No  Button - works on motion sensor



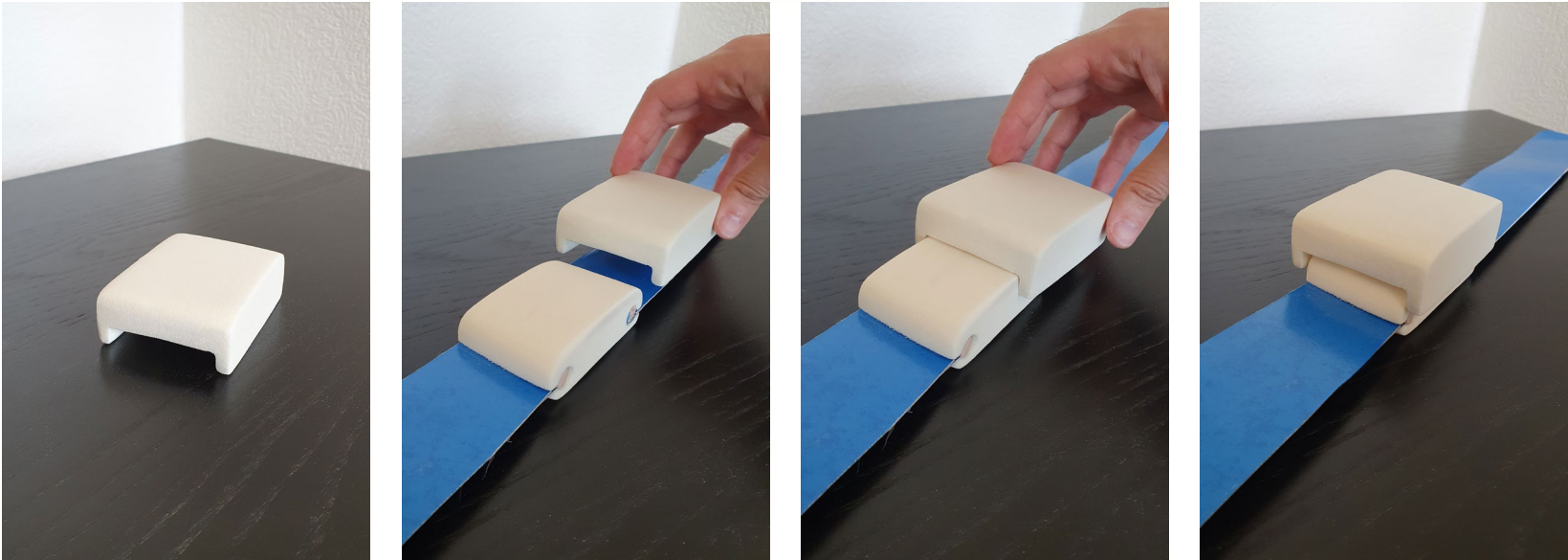
### Final Design Sketch

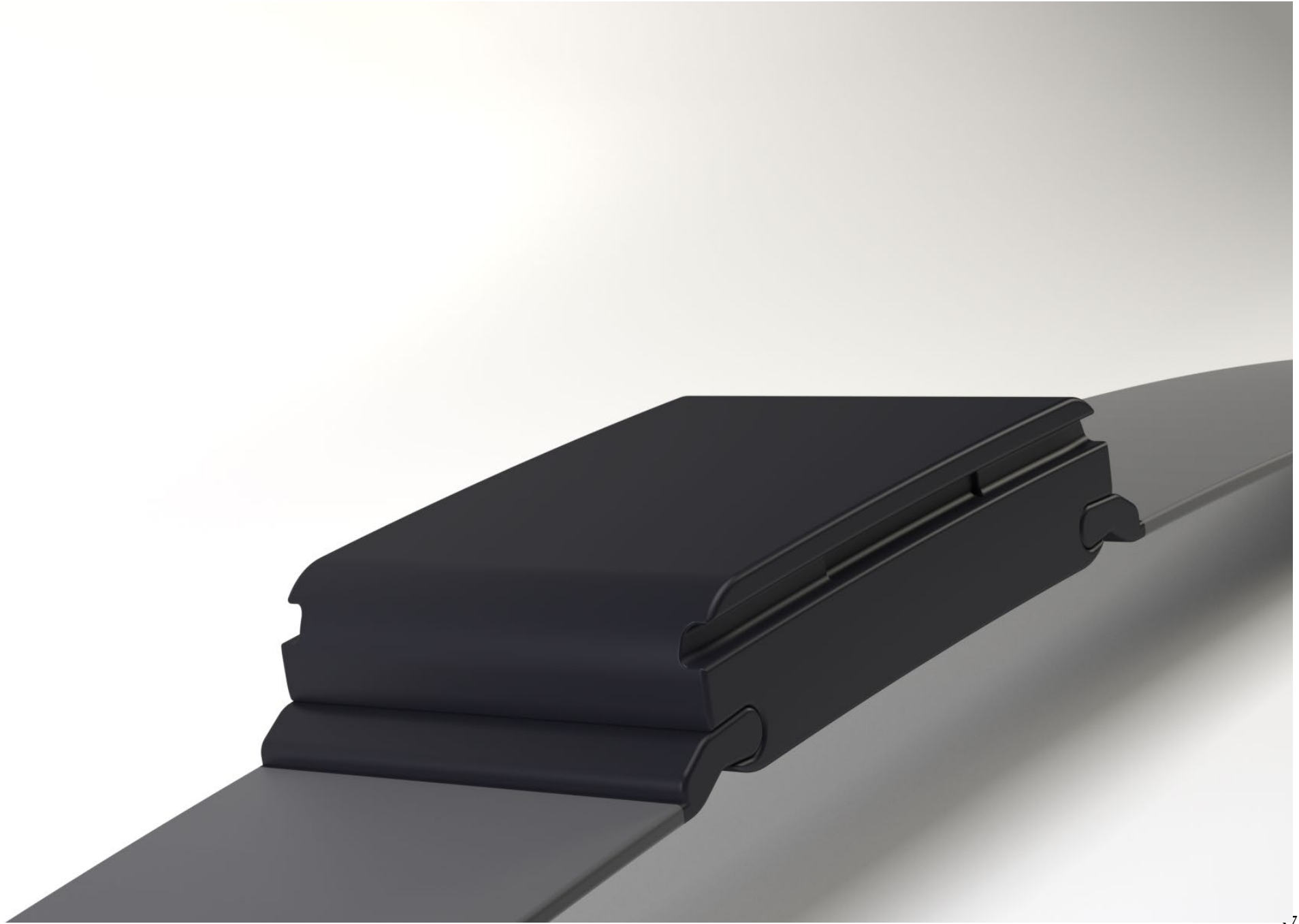


Foam Model Demonstrating Function Scale 2:1

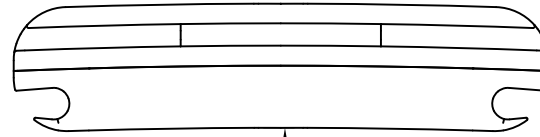


Battery Pack Charging Function

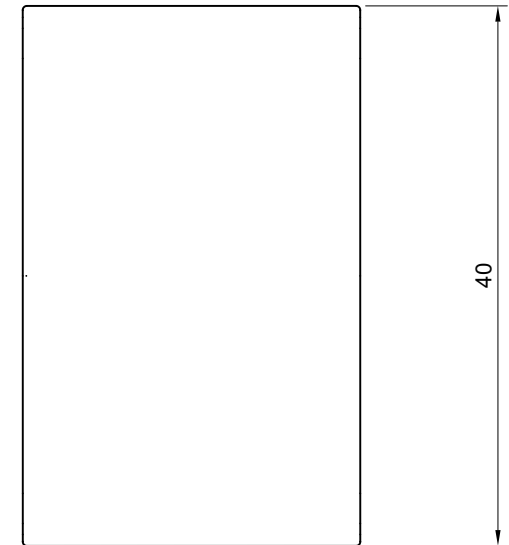
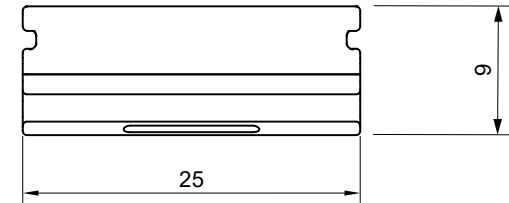




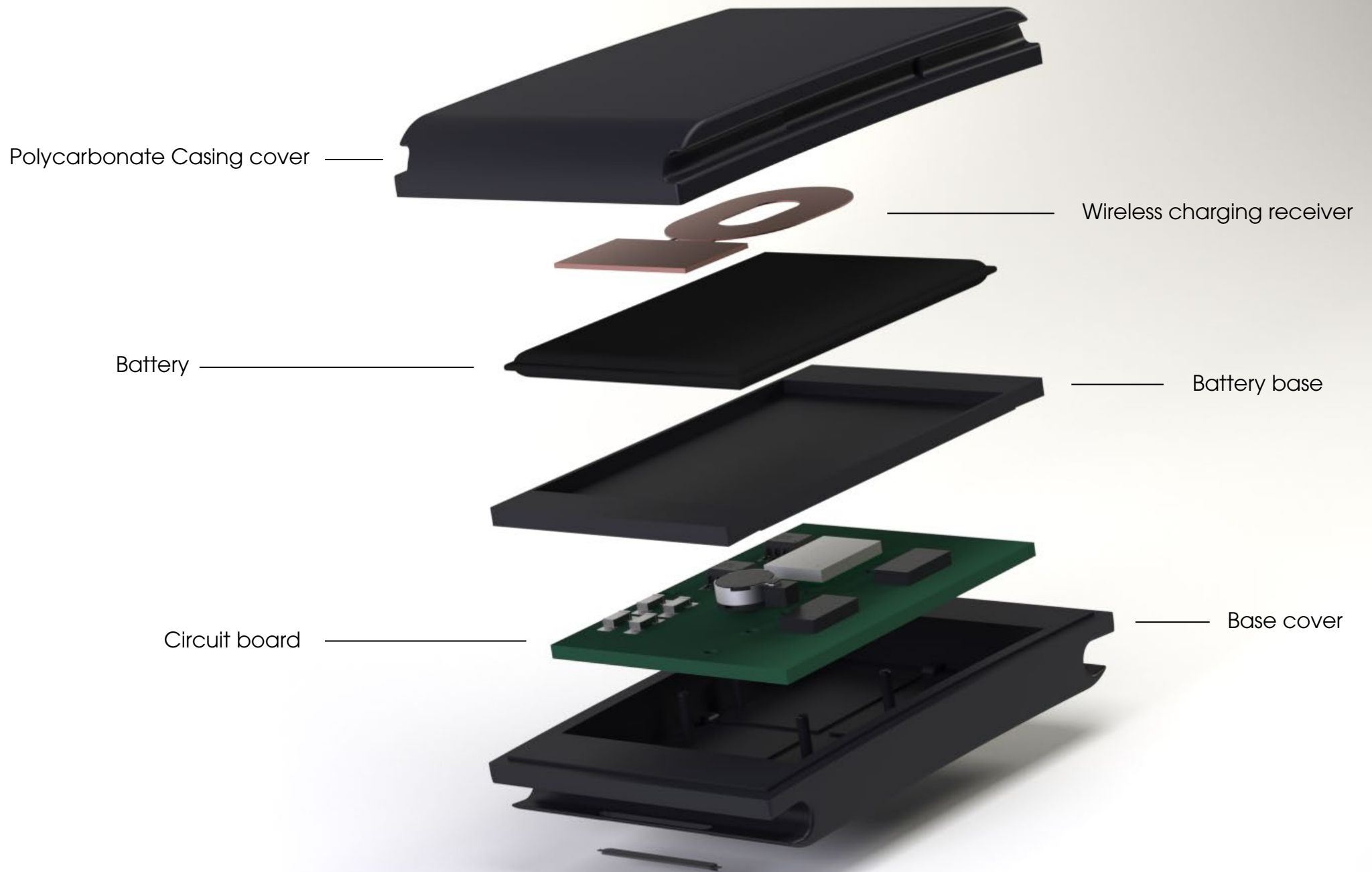




Ø1013



Dept.	Technical reference	Created by <b>abbed alhabashi</b>	Approved by	
		Document type	Document status	
		Title <b>Device technical drawing</b>	DWG No.	
		Rev.	Date of issue	Sheet <b>1/1</b>

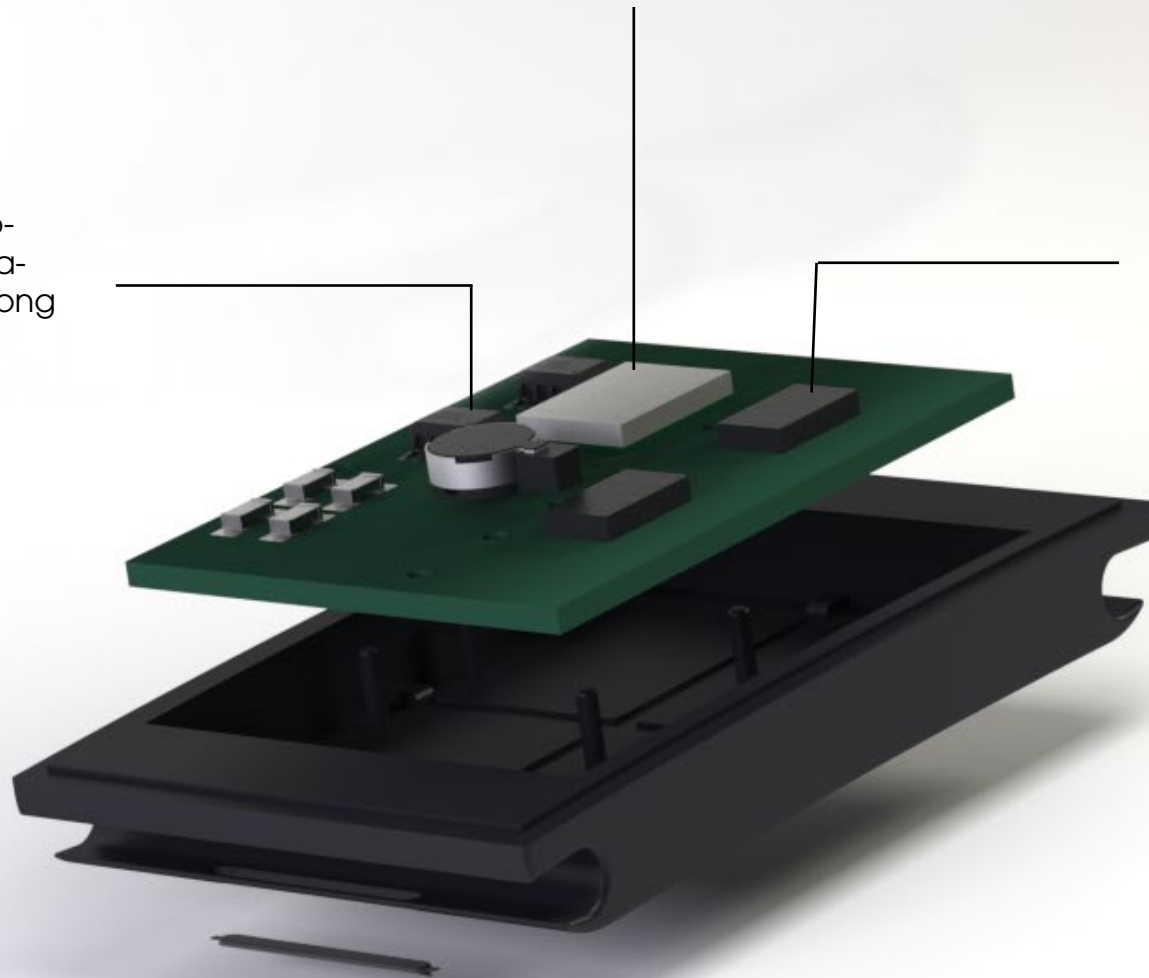




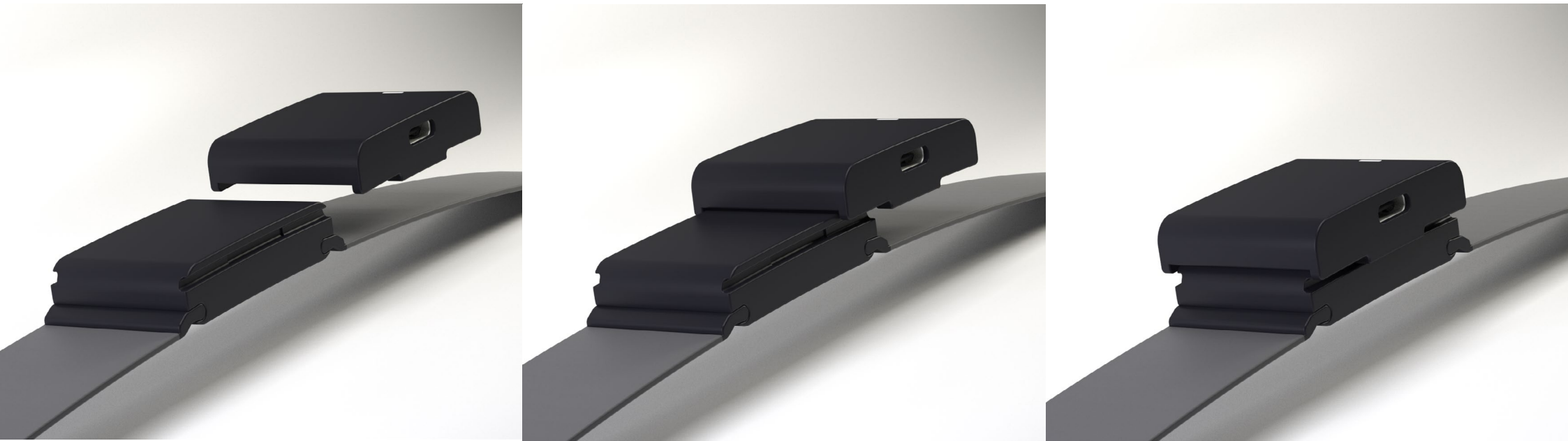
Acelerometer: the function of this component is breath tracking movement.

Vibrator motor: To provide haptic (light vibration) feedback for wrong breathing alerts.

Wireless moduls: blue-tooth for connection with smartphones and Wifi for internet connection.



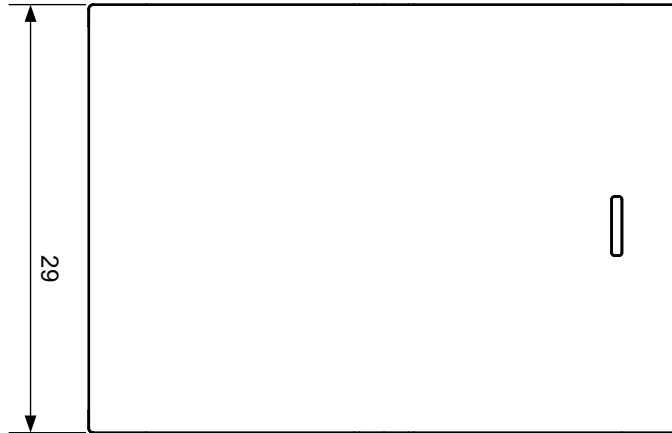
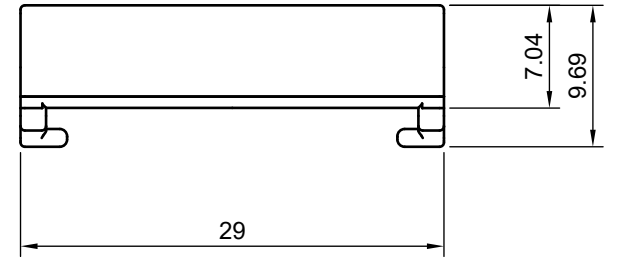
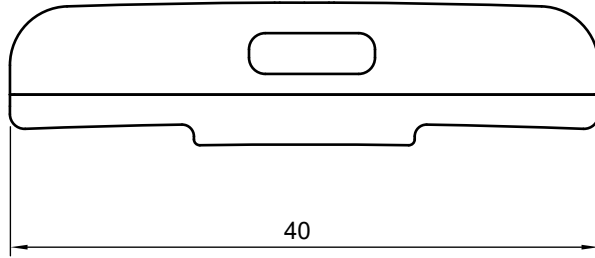
Charge On The Go With Rail And Track Function



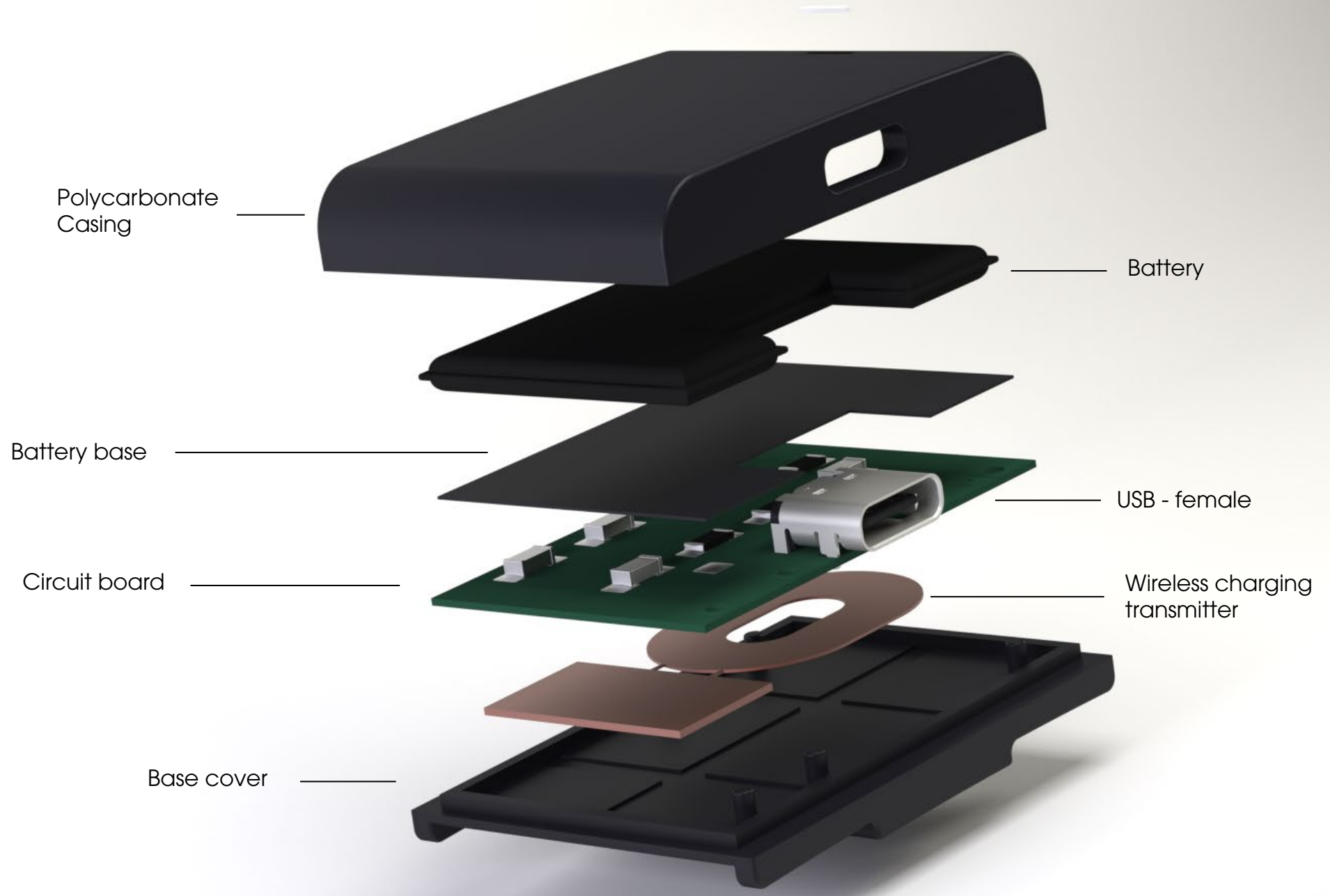
Slide On - Slide Of







Dept.	Technical reference	Created by <b>abbed alhabashi</b>	Approved by	
		Document type	Document status	
		Title <b>Charger technical drawing</b>	DWG No.	
		Rev.	Date of issue	Sheet <b>1/1</b>



Polycarbonate  
Casing

Battery

Battery base

USB - female

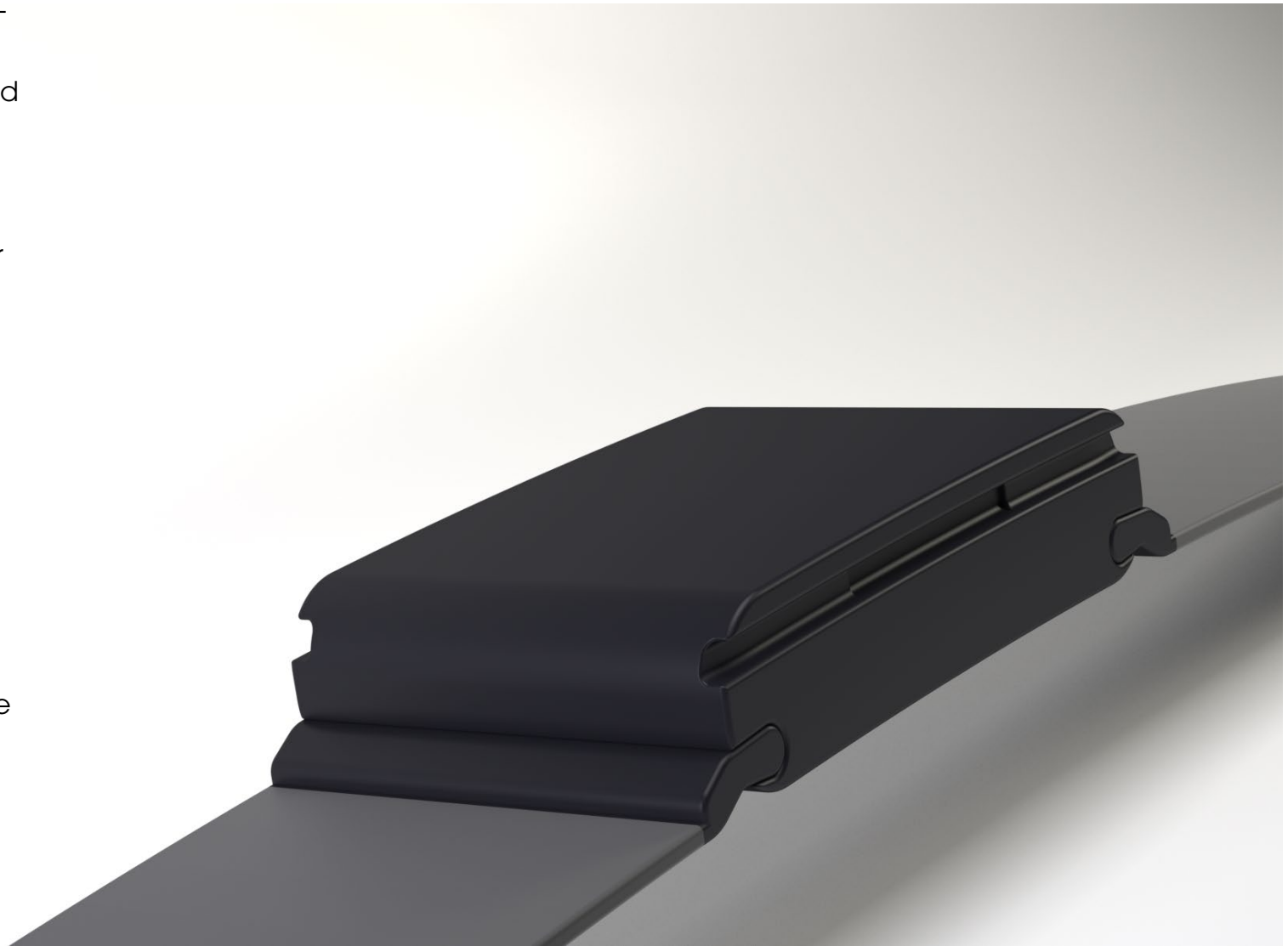
Circuit board

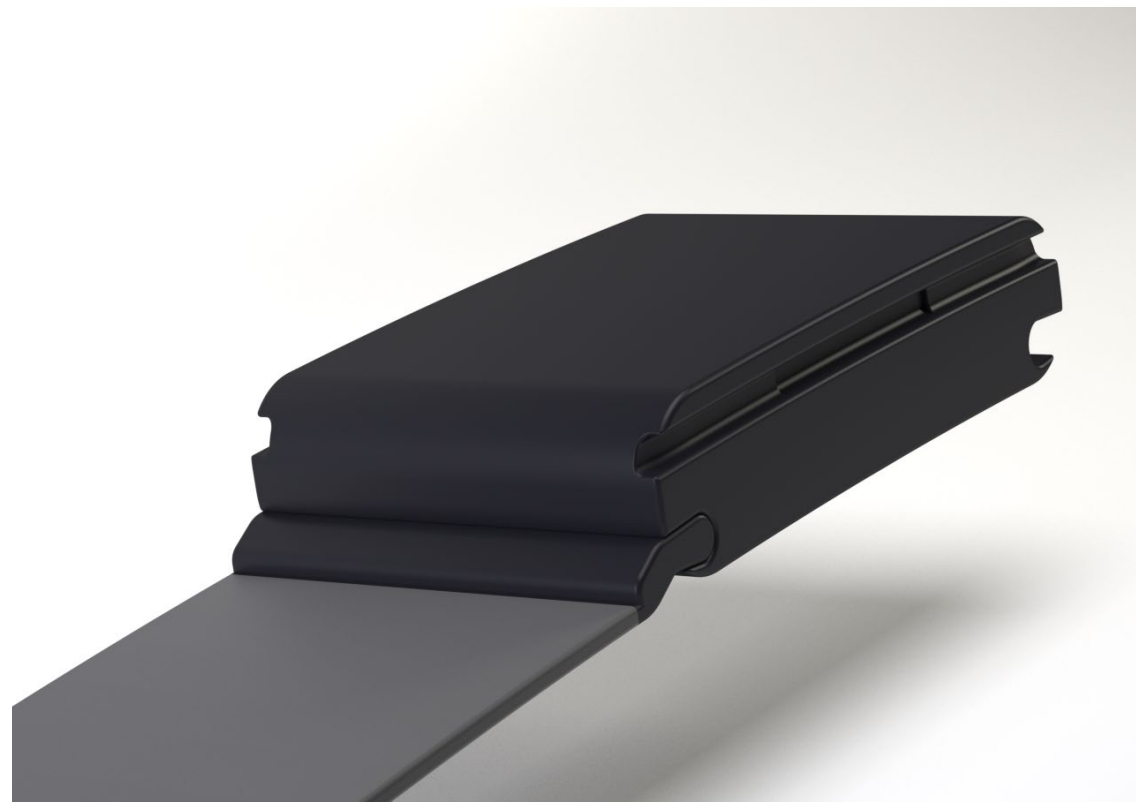
Wireless charging  
transmitter

Base cover

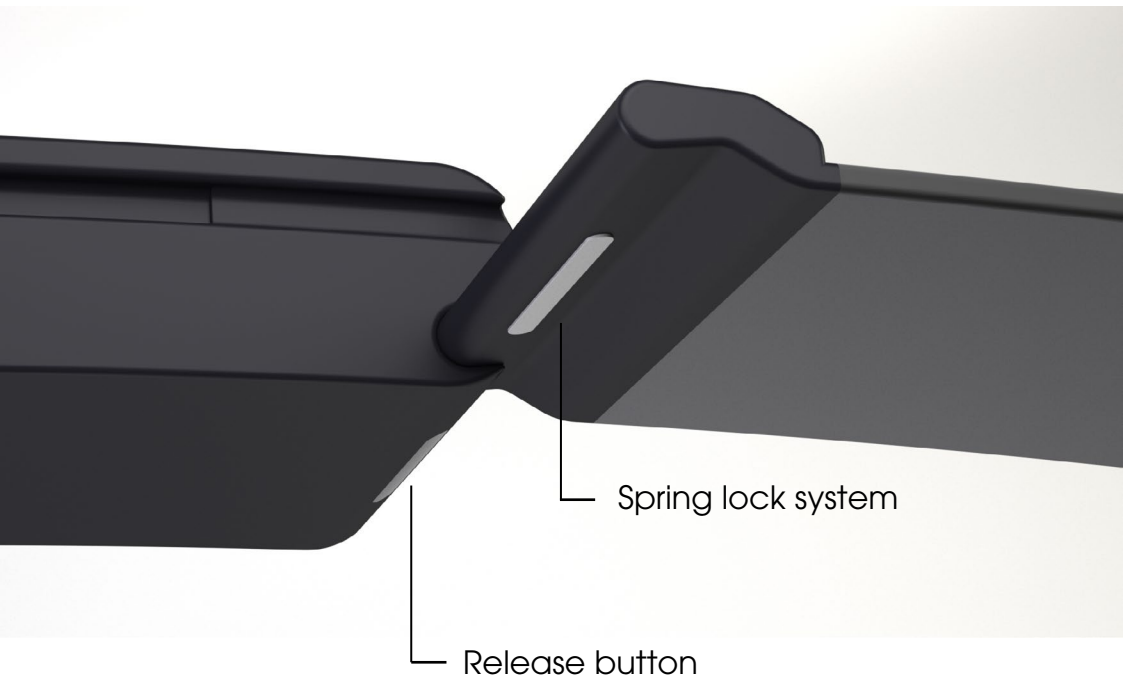
## Color Material And Finish

- **Cover Material:** Polycarbonate is a housing material used for electronics that offers good mechanical properties, including toughness and rigidity.  
**Color:** Matte black is chosen for its non-reflectivity and minimal light absorption, making it ideal for wearable devices that sit under clothing.
- **Strap Material:** The strap is made from a combination of materials, designed to be stretchy and breathable to meet the functional requirements. It's made of elastic materials, such as nylon, spandex, or polyester. This combination of material makes it comfortable, and allows the strap to stretch while breathing and fit the body.  
**Color:** A rubbery grey color is chosen to reflect the material's characteristics and to minimize light absorption, ensuring it remains discreet under clothing.



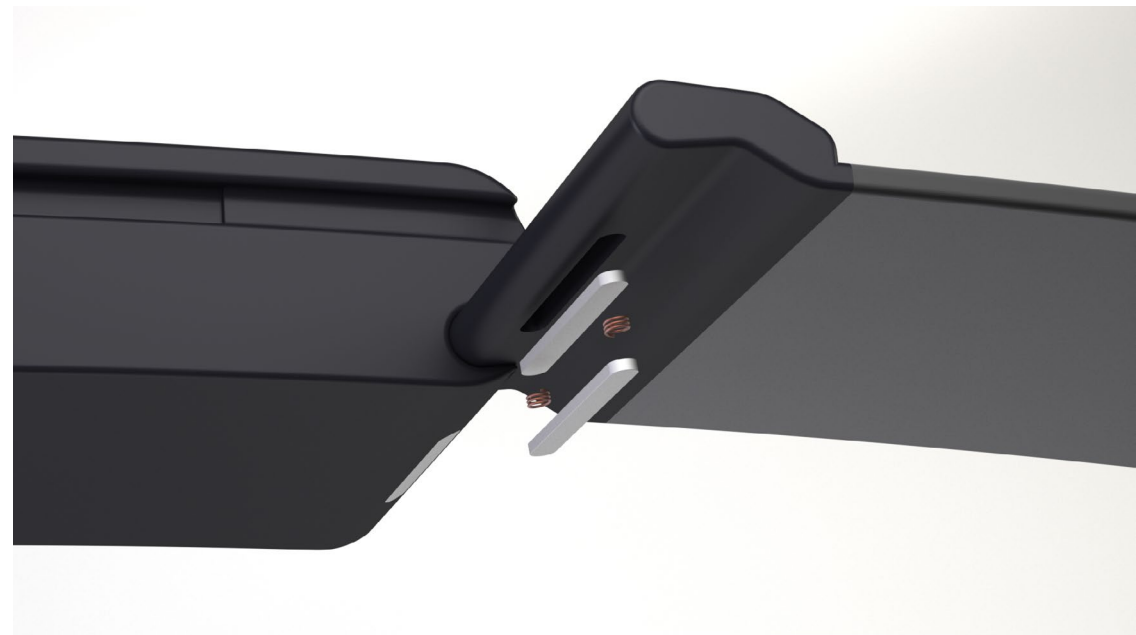


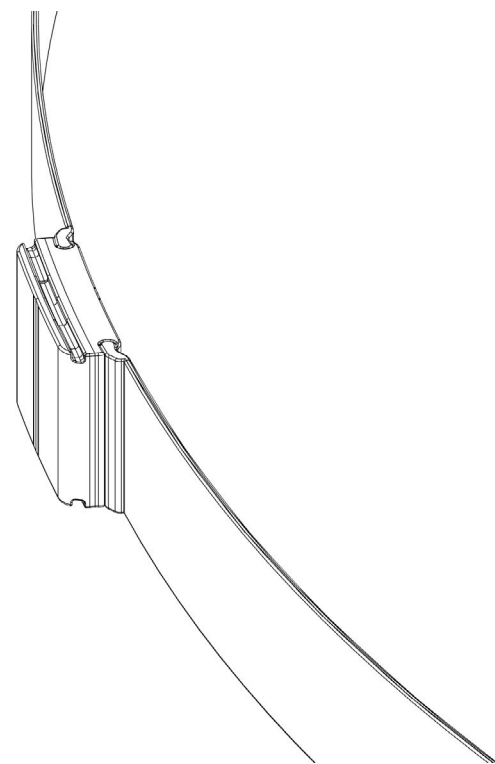
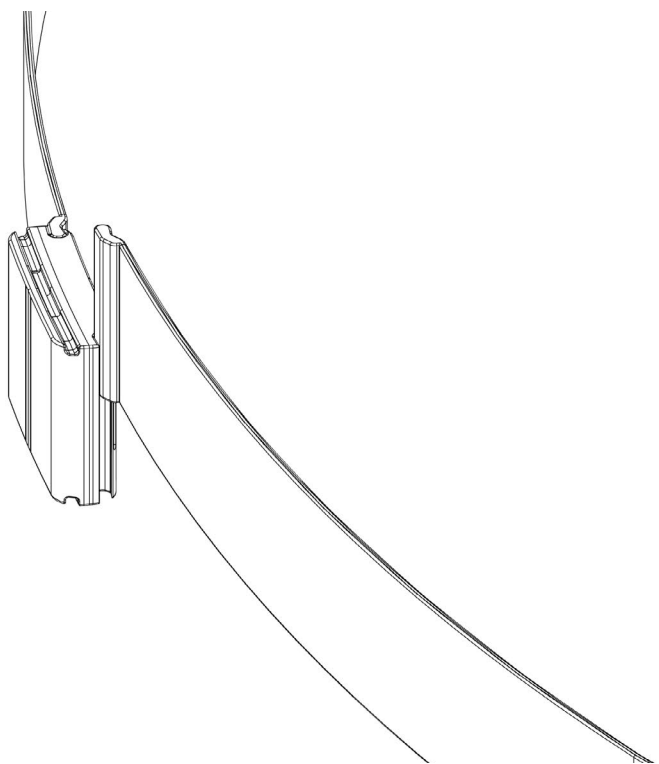
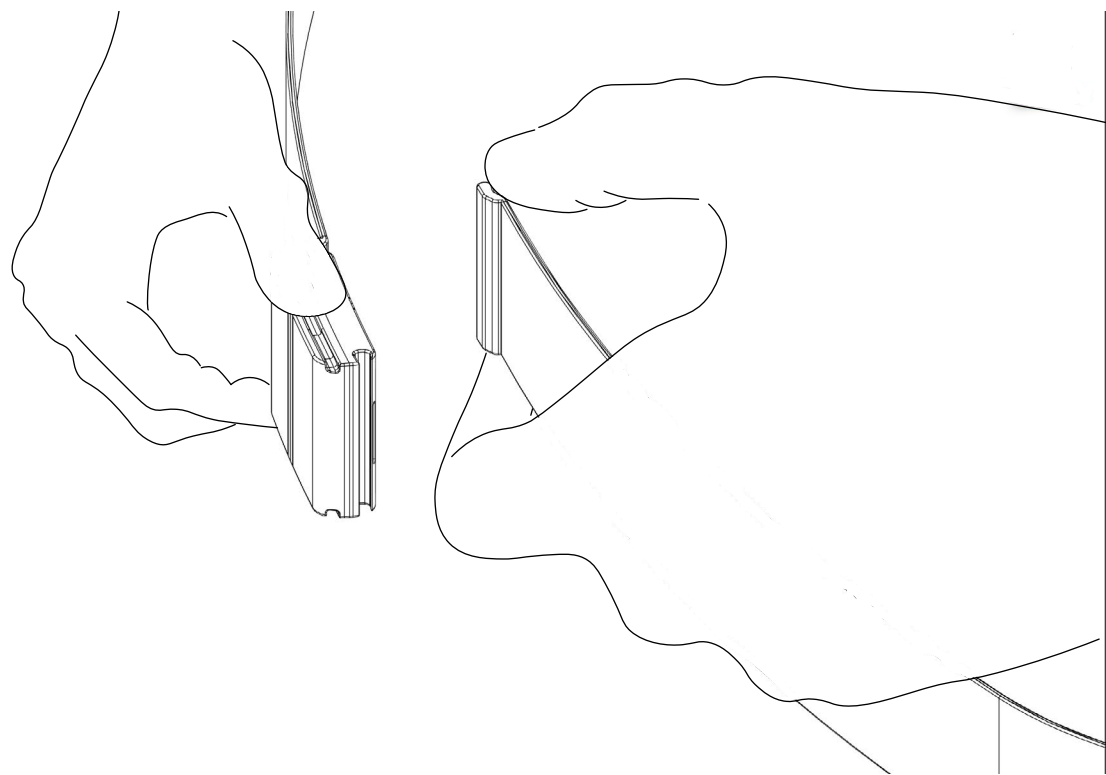
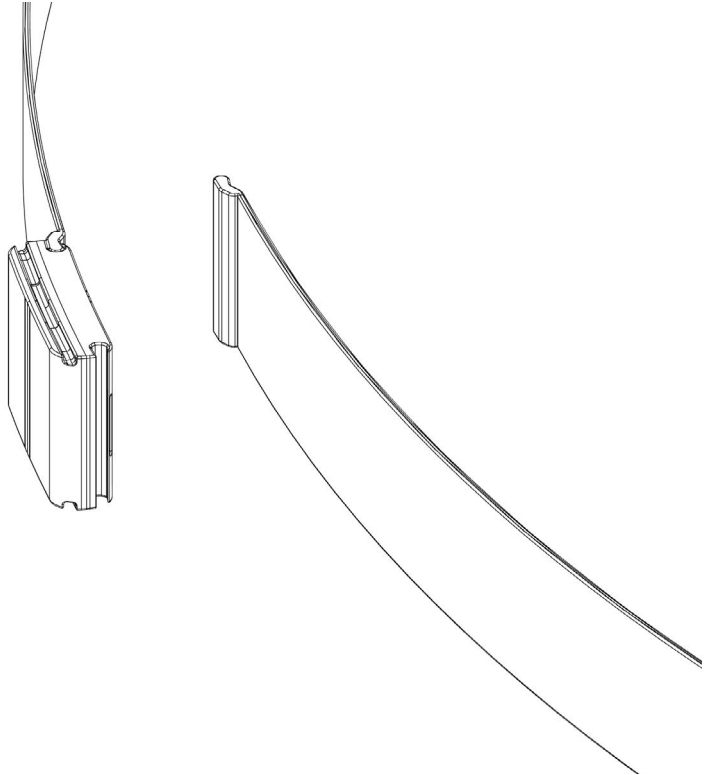


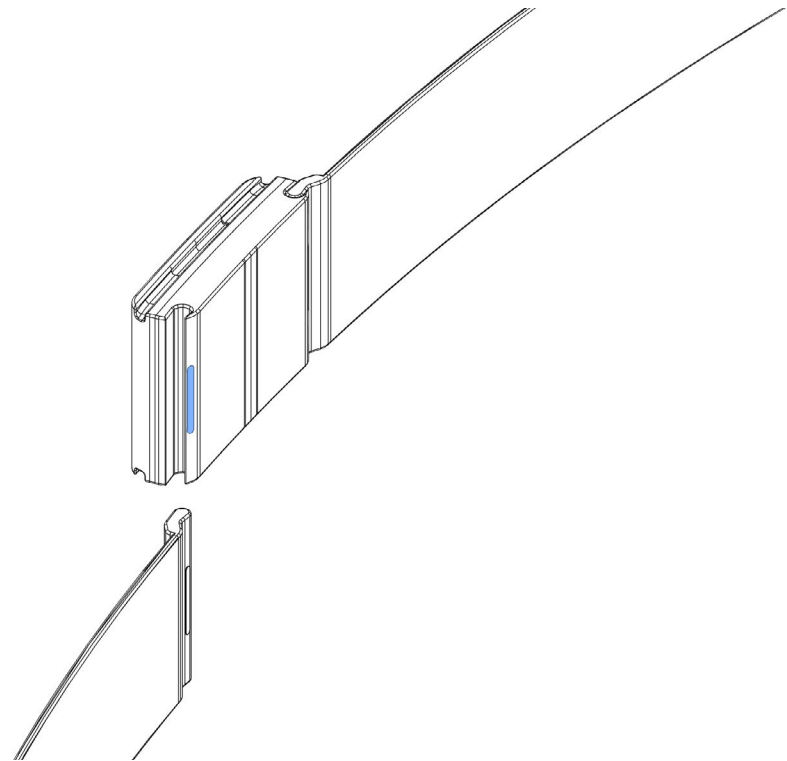
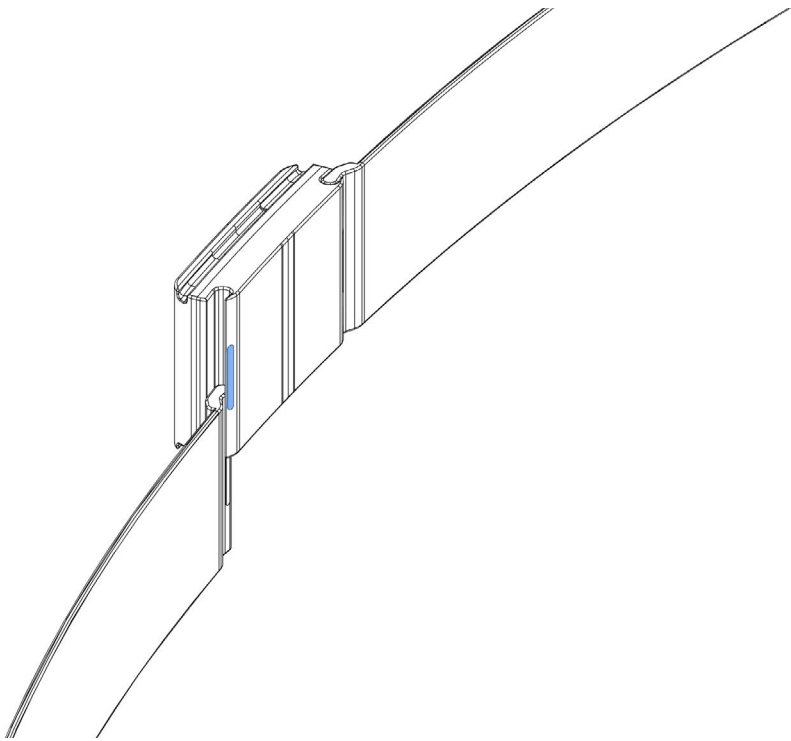
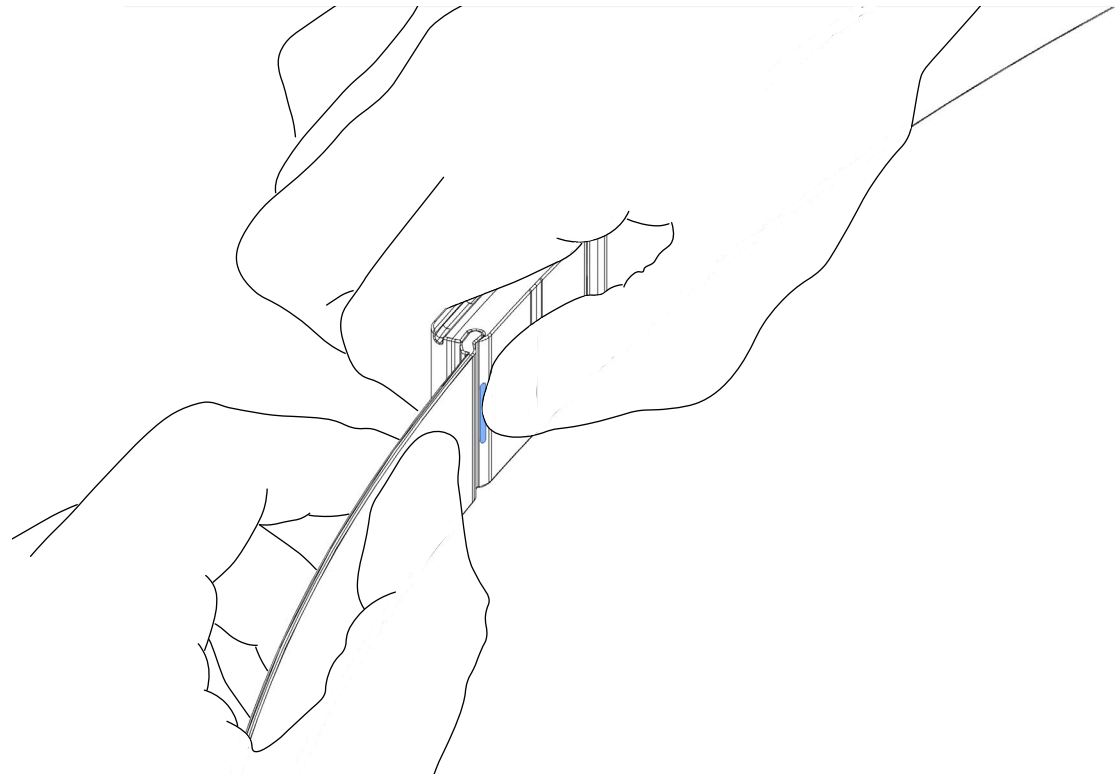
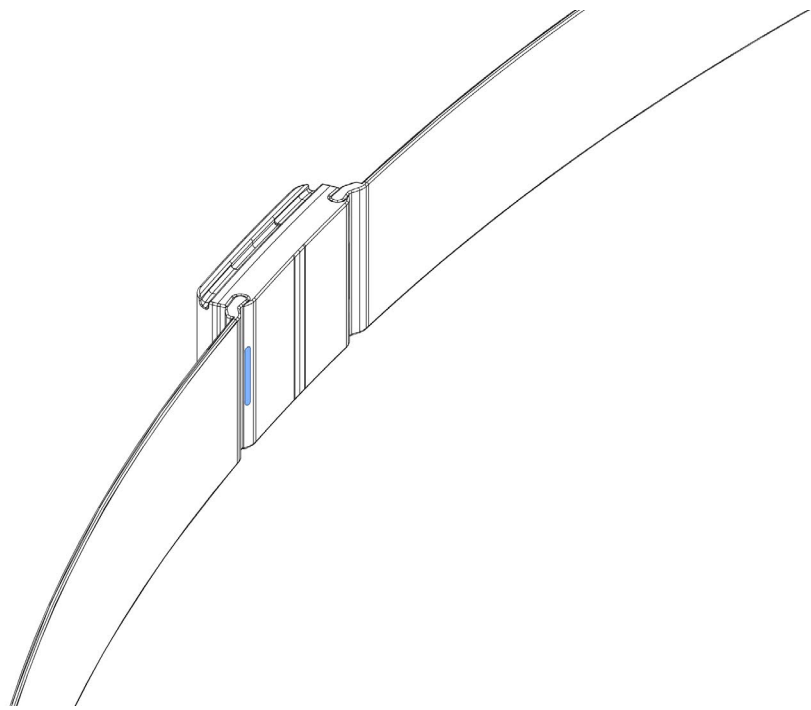


Release button for changing the strap and for the dressing and undressing functions.

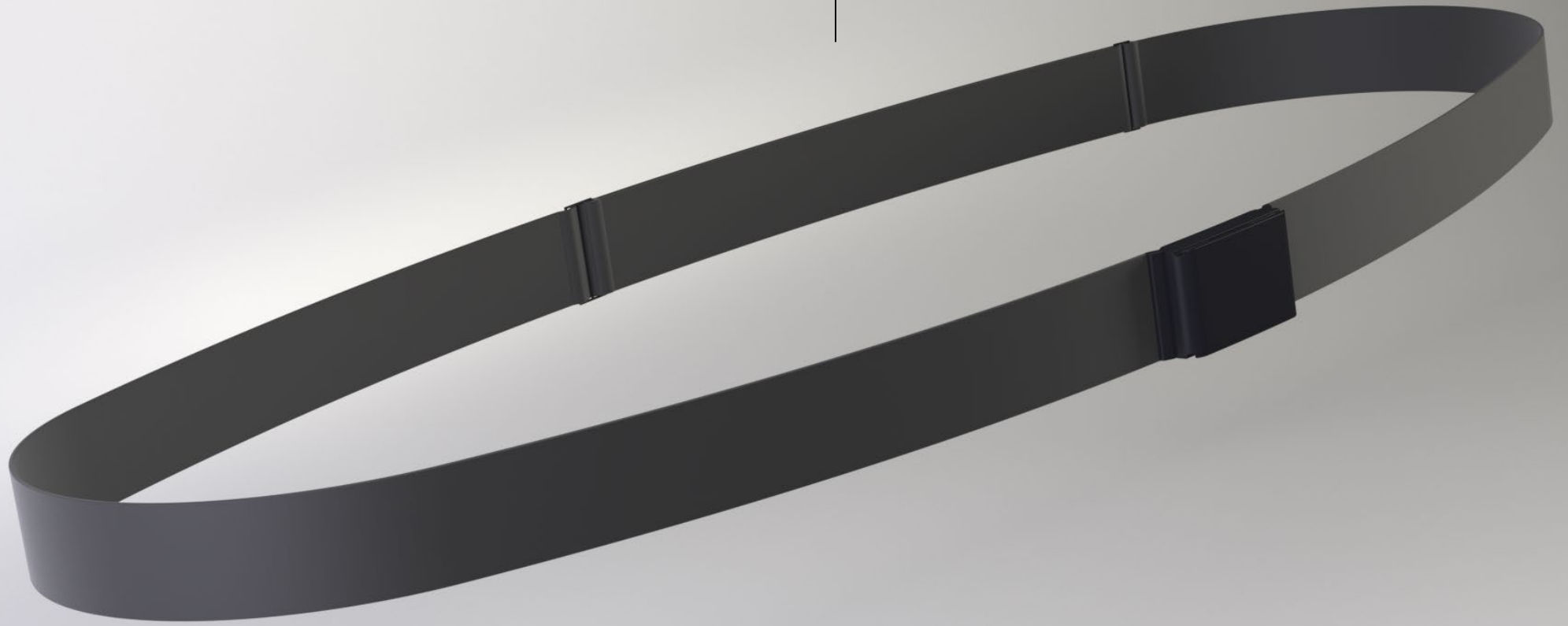
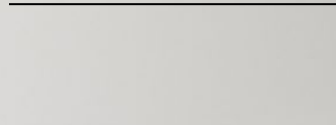
Spring lock systems are common in many products, from smartwatch bands to umbrellas. These systems are durable, simple, and secure.

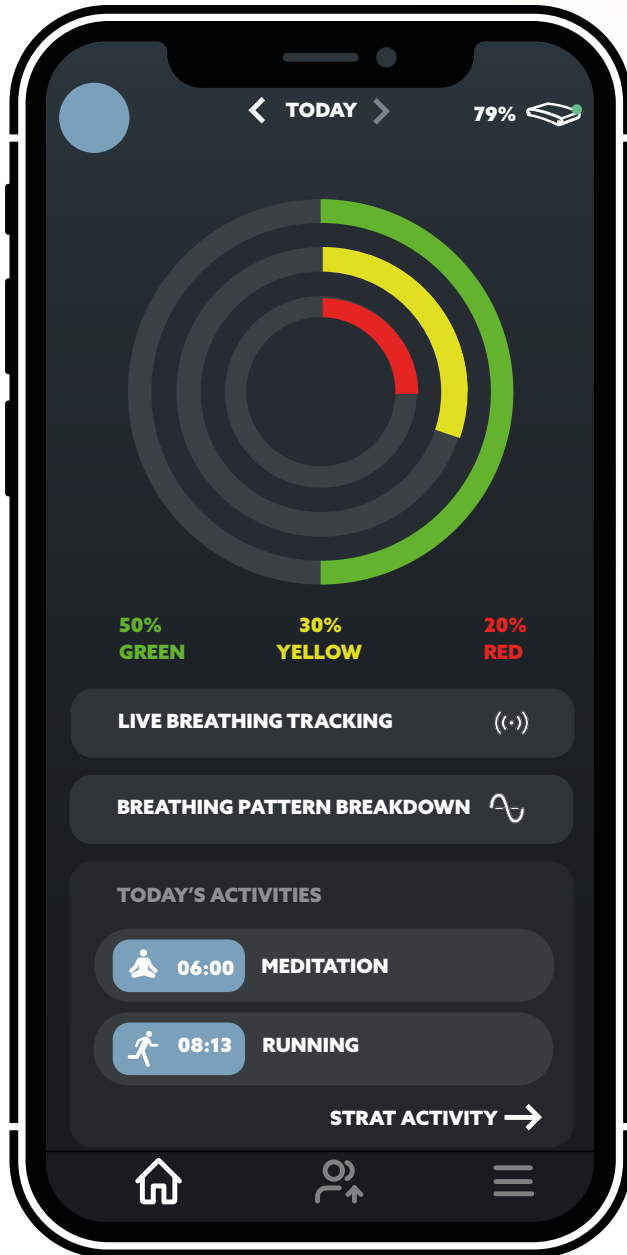






Adjustable length to fit all sizes





## Application Design

- **System:** AI generated algorithms separate and calculate the poor, normal and optimal breaths while giving slight vibration signal to the user through the device when the breathing pattern is poor. The device is connected to an app to collect data and give overview of the users situation. Simplifying the user experience and make the application user-friendly by giving the breaths an identity. Bad breaths are red, normal breaths are yellow and optimal breaths are green.
- **Realization:** The idea explain itself, The users learn about the breathing pattern metrix "Red, yellow and green" through the vibration signals and the information presented on the screen. Making the user feel smart and getting rewarded by more green and yellow breaths or punished by red breaths.
- **Reward system:** The APP-screen displays the current counted breaths for each group in Percent. For example green = 50%, yellow = 30% and red = 20%. Creating a reward system to encaourage optimal breathing by getting higher percentage of Green breaths. The user gets a full overview of information to reflect upon.
- **Live breathing tracking:** This function provides real-time breath tracking, which gives the user awareness of their breathing and also enhances mindful breathing for training purposes.
- **Breathing pattern breakdown:** is the place where the user gets full overview of their breathing pattern by day, week and month. The uer gets an average of weekly and monthly scores and results to reflcct on.
- **Activity bar:** is the place where the user ads their activities such as running or meditation to get the device calibrated to the current activity. An example is the breathing pattern for running, inhale for 2 secunds and exhaling for 2 seconds. The device help the user regulate their breathing with slight vibration signals

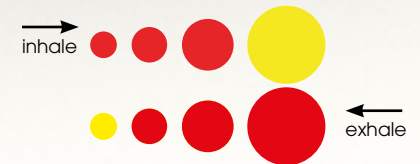


- **Live breath tracking function:** a Circle expands or decreases following the breathing movement. The Circle changes colors depending on what phase the user in green, yellow or red.

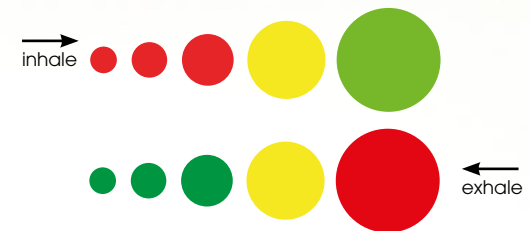
- **Red** inhale and red exhale the “short and fast shallow breath”



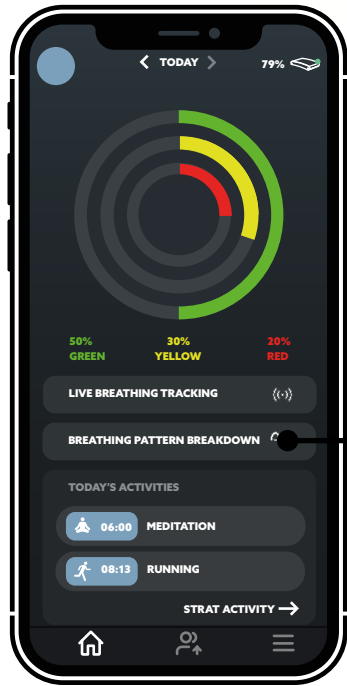
- **Yellow** inhale and yellow exhale is a bit longer and slower breath than red breaths.

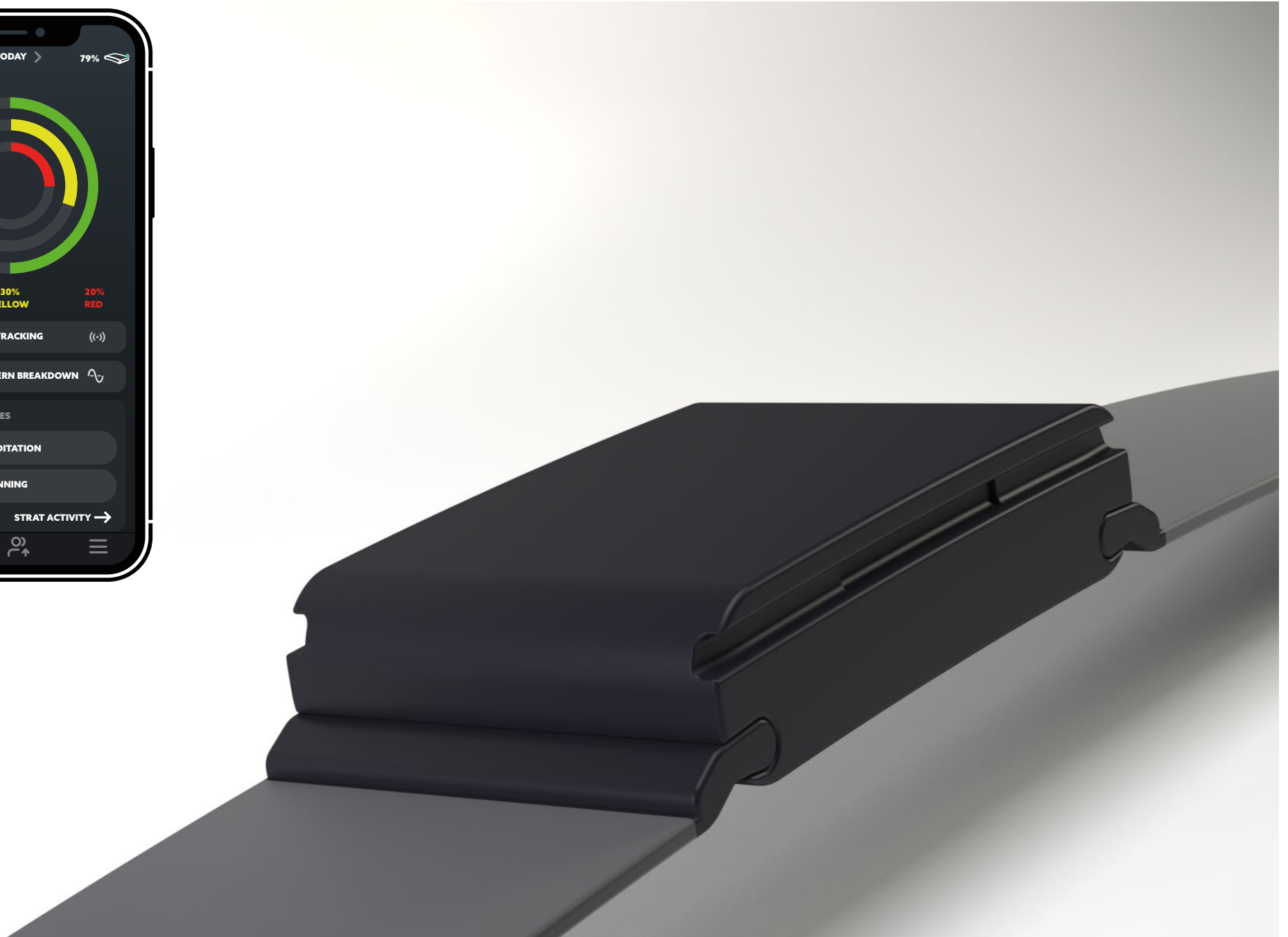
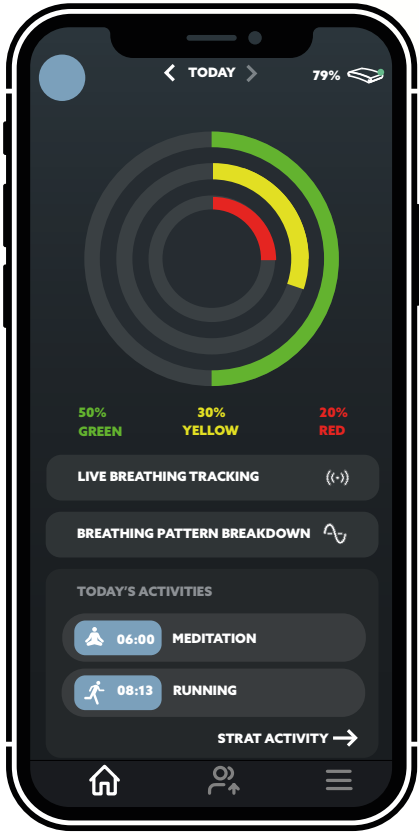


- **Green** inhale and green exhale is deep and slow breath.

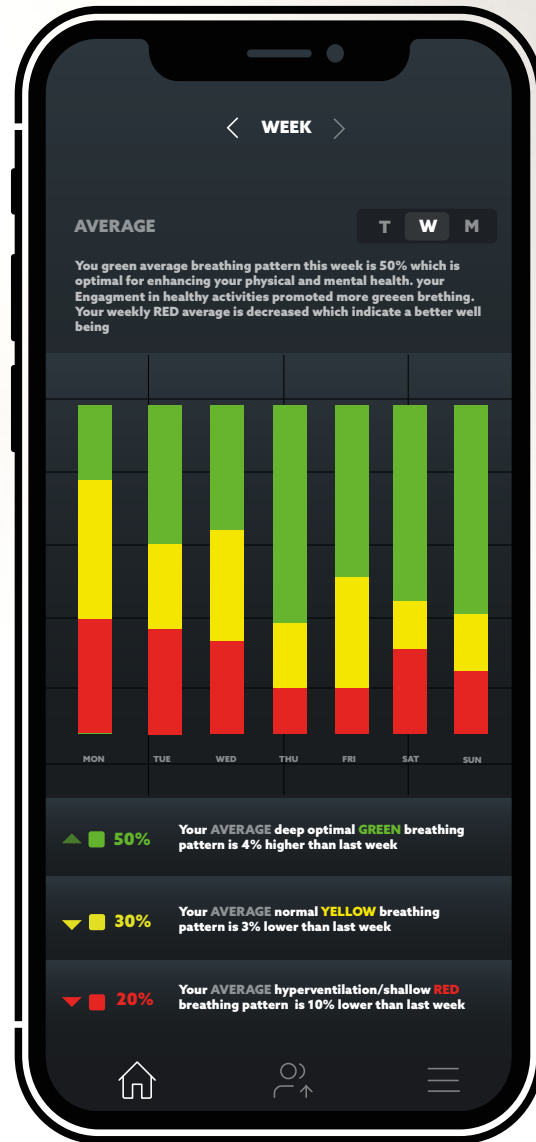


- **Counter:** Counts and separates breaths to provide an overview of the breathing pattern, alerting the user and offering insights to help guide them into the correct breathing pattern. A physical and visual signal gives the user an optimal overview of their breathing.









## A Story Scenario

Bob, 40, Airplane technician

Bob works as an airplane technician. He has a stressful job and needs to stay calm and focused during his work. He uses Breathe Right device and app to stay grounded and gain better control over his breathing pattern. He wears the device every day under his shirt and has gradually gained better control over his stress. By maintaining the right breathing pattern throughout the day, Bob feels more energetic and happy, helping him accomplish his daily goals. Over time, his average green breathing has increased, and he is pleased to have achieved better health and well-being with help of Breathe right.

## Evaluation And Future Improvement

As we use AI, like ChatGPT, to help with daily questions, we also need AI-driven wearable devices to help us maintain good health and habits. I believe the future of wearable devices is bright and will significantly enhance the virtual medical world. These devices will not only support human evolution but also help us reach higher levels of consciousness.

In this project, I have learned that design is not just about creating something visually appealing but also about understanding the connection between humans and design. Innovation and design serve as powerful tools for enhancing human lives. Through this project, I have gained insights into human physiology and recognized that as designers, we have the potential to make a significant impact across various fields.

I am satisfied with the final results of this project. As with any project, there are different versions such as V1, V2, etc. Improving things is an ongoing process. What could have been improved is the manufacturing of a functional model with an application, which would require a team to build, as well as making the device 24/7 wearable with multiple functions. However, looking at the big picture, I have accomplished and learned a lot, which is the main purpose.

## Sources

### Links, books and meeting

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2. Personal meeting 11 feb. 2020 with Per Wollmer Professor, Clinical Physiology and NuclearMedicine, Malmö.Profile area member, LTH Profile Area: Aerosols.
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3924606/>
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### Pictures

1. <https://portal.research.lu.se/sv/persons/per-wollmer>
2. [https://www.nobelprize.org/uploads/2019/11/Slideshow\\_All\\_NobelPrizes\\_2019\\_NobelPrizeLessons.pdf](https://www.nobelprize.org/uploads/2019/11/Slideshow_All_NobelPrizes_2019_NobelPrizeLessons.pdf)
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7. <https://www.centralcharts.com/en/10535-first-derivatives/news/4078834-pushing-boundaries-in-health-tech-3m-launches-new-medical-adhesive-offering-premium-wear-time-up-to-28-days>