About the company

vivekamberkar
product design

The studio situated at Dadar, Mumbai consists of a team of designers as well as engineers. Their current spread of work ranges across multiple domains like medical, consumer, automobile and transportations products as well as industrial products, mechanical systems and special purpose machines.

One of their designs was given an honorable mention at the Red Dot Award 2012. The company strives to deliver user centric, user driven solutions which offer rich experience.

The Team

The team consists of designers as well as engineers.

Vivek Amberkar is the head of the company and also the senior designer who is an alumni of NID, Ahmedabad. He guided me through the internship and also participated in brainstorming sessions.

Pranav Patil is a core member of the team who works on design engineering and CAD.

Aswin Save is an engineer who has also recently started a startup called NotStark, which is 3D printing online platform.

Project Overview

Cranial electrotherapy stimulation (CES) is a form of non-invasive brain stimulation that applies a small, pulsed electric current across a person's head to treat anxiety, depression, insomnia and chronic pain. Electrodes are placed on the ear lobes, maxilla-occipital junction, mastoid processes or temples. CES has been widely used by dental surgeons in western countries which help the patient to relax so that the surgeon can perform dental operations. In the United States, CES technology is classified by the Food and Drug Administration as a Class III medical device and must be dispensed by or on the order of licensed healthcare practitioners. The FDA indicates that there are 11 CES devices cleared for marketing in the United States.

One such device is made by Nucalm technologies, a company based in USA that produces and sells CES devices. Their existing product is sold as a package of separate devices which must be used by the patient. They want the new product to be an integral device which houses all the separate components into a single unit and looks appealing to the user. Since it will now be marketed to a wider audience, the redesigned product should also look stylish and must have the feel of a premium product.

Project Brief

"To redesign the product which packages all the components into one design which need to work in tandem and stylize it as a lifestyle product for a larger audience"

The current product has a lot of shortcomings, which are listed below;

- The product is visually unappealing
- It is not seen as a lifestyle product
- The key components are all separate devices
- Currently, it is only used by dental surgeons and doctors
- The overall package is bulky

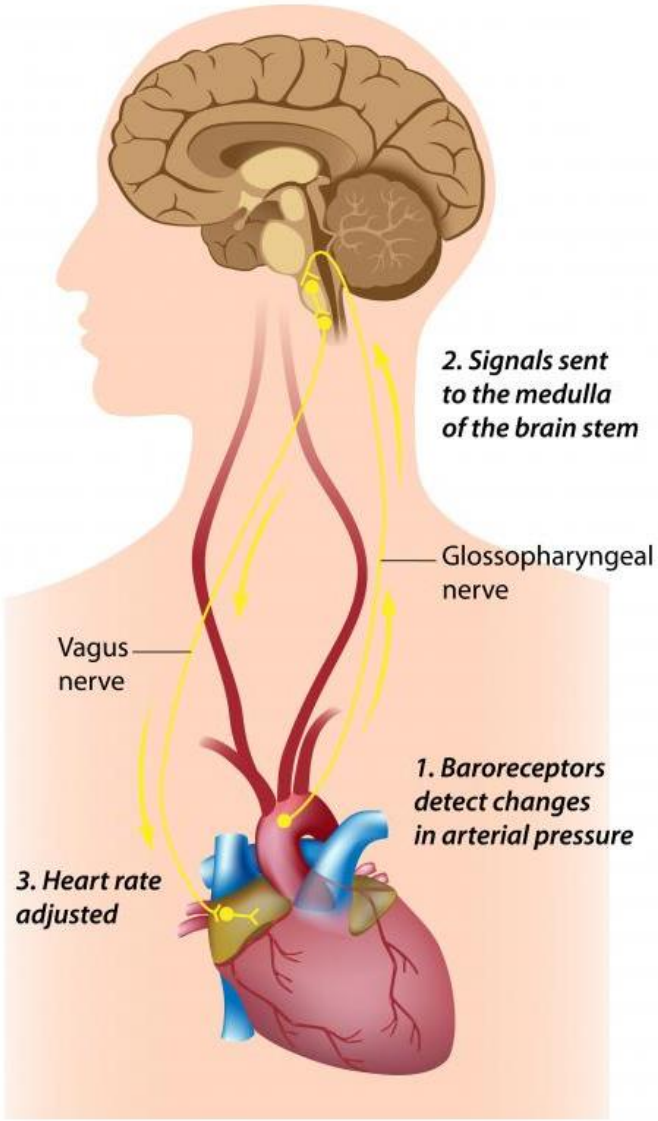
1.
WORKING OF THE PRODUCT

The Vagus Nerve

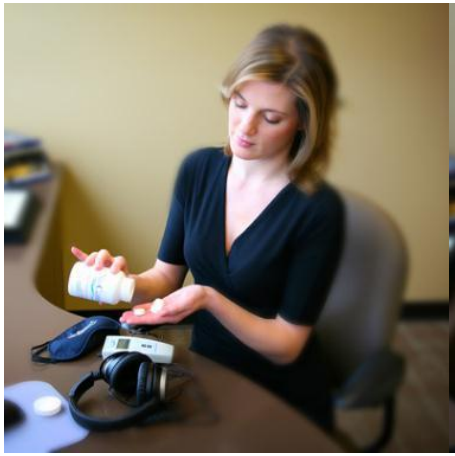
The vagus nerve historically cited as the pneumogastric nerve, is the tenth cranial nerve or CN X, and interfaces with parasympathetic control of the heart, lungs and digestive tract. The vagus nerves are paired; however, they are normally referred to in the singular. It is the longest nerve of the autonomic nervous system in the human body.

CES works by sending electrical impulses to the vagus nerve which stimulates it, thereby helping to prevent sudden rise in heart rate or palpitations and also reducing anxiety. The vagus nerve originates from the medula oblongata, which is in the centre of the brain and extends downwards through the body. The vagus nerve can be stimulated by placing electrical patches either on the neck, in front of the ear on the temples, or directly behind the ear on the area known as the mastoid process.

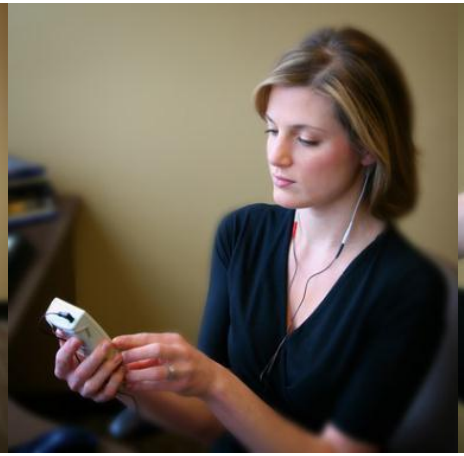
The nucalm design works by applying the patches on the mastoid process or on the temples, depending on the user's comfort.



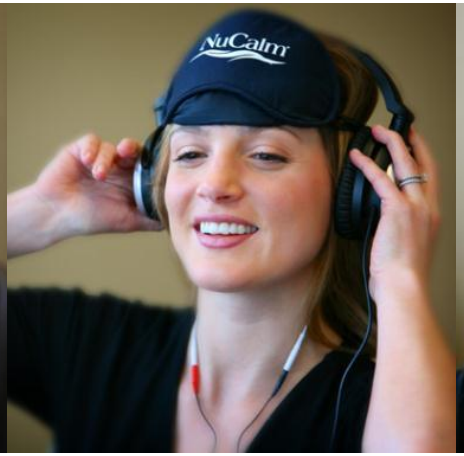
Nucalm Components



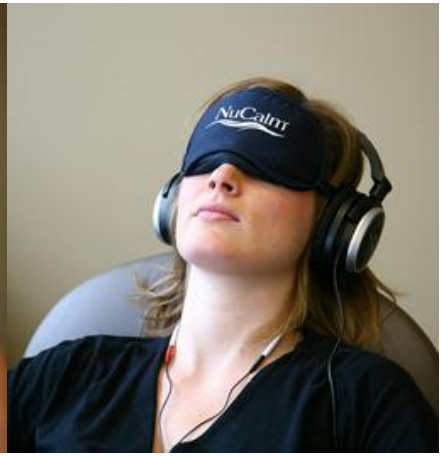
Apply NuCalm topical cream



Microcurrent stimulation patches are placed behind each ear



Put on noise cancelling headphones



Light-blocking eye masks are used to negate visual stimuli and help maintain the relaxation state.

For the system to work, the user has to apply a topical cream on the skin where the CES patches have to be applied. The cream helps in improving the conductivity and also the adhesion of the patches to the skin. Next, the patches are applied on the skin, it can be on the temples or behind the ears. Another important step is to put on noise cancelling headphones, which help to cancel out ambient noise and instead a soothing music is played. After that, eye masks are put on which remove visual stimuli.

Depending on this condition of the user, specific frequencies of electric impulses are applied to the head through the patches, which in turn stimulate the vagus nerves. These vagus nerves which control involuntary muscle movements like the heart and gastro-intestinal organs, resonate to the applied frequency of the impulse and likewise, help to reduce the anxiety and stress levels of the patient. Over a large user survey conducted, 95% of the users said that it helped them feel relaxed and reduce anxiety within a matter of minutes.

2.
STUDYING THE PRODUCT

Peripheral Units

Eye Mask

Reduction of visual disturbance is most important for one to relax through the process of Nucalm making this accessory and important part/component.

A variety if eye masks have been used including 70% amber tinted glasses and Neoprene cushioned sleeping masks.

Headphones

One important element of the therapy is the music which helps you calm down. These noise cancellation headphones ensure you are acoustically isolated to concentrate on the music making the therapy more efficient and effective.

MP3 Player

The player plays specially designed music tracks for the therapy. The player holds 4 tracks as of now.

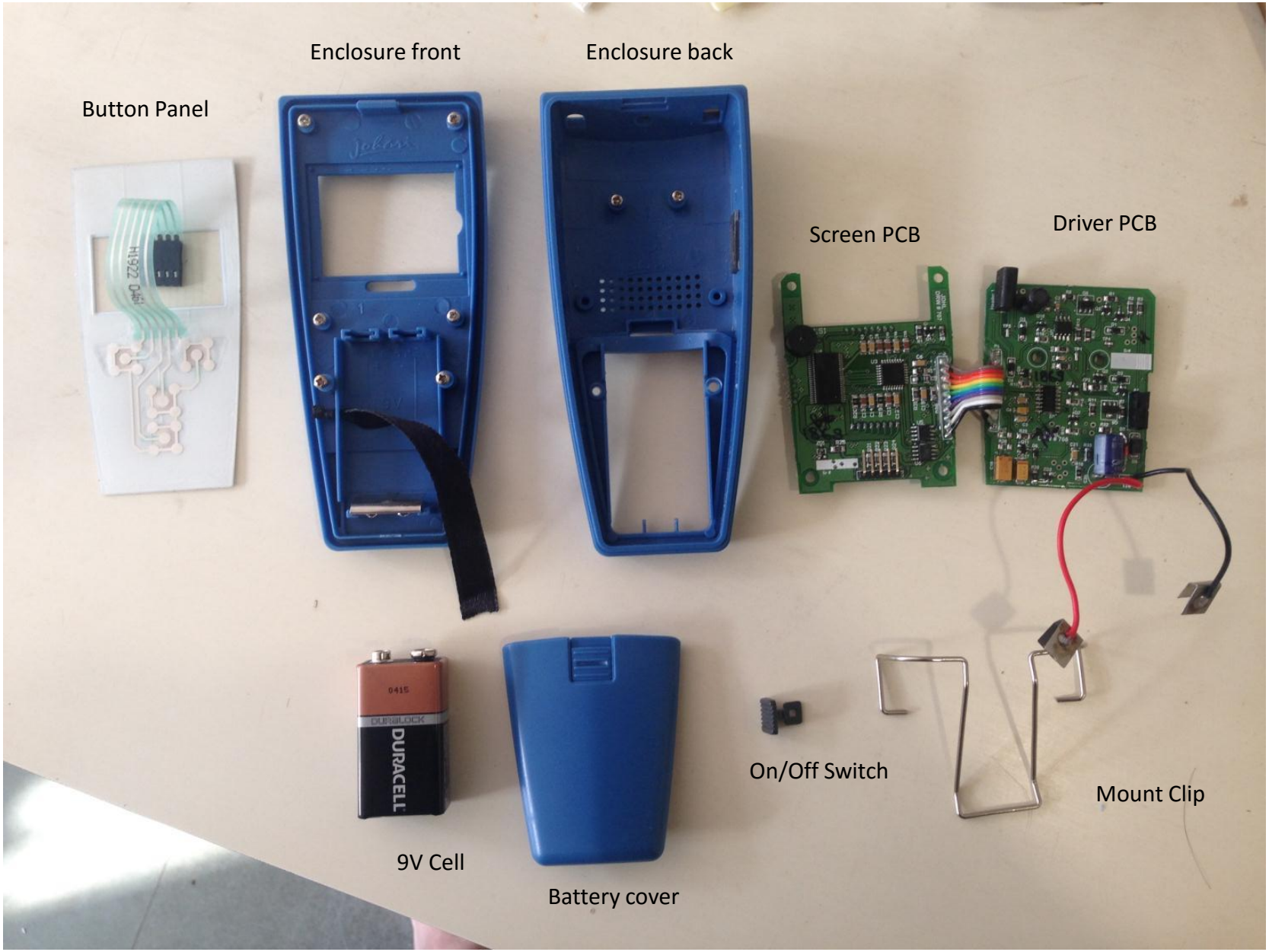
Key Units

CES unit and electrode patches

This is the key driving unit of the therapy which generated pulses and transmit via the electrode patches usually stuck underneath the ear.

The unit also has controls for the intensity and duration of the therapy. The unit is powered by a 9V cell and sports a clip for mounting the unit on a belt.

It is necessary to understand the circuitry of the pulse generator, since it is a key component which has to be integrated into the new form. Hence the generator device was dismantled to understand the footprint size of the circuitry. The battery which is used in this device is an alkaline battery. The new device will use lithium ion batteries which are much smaller and lighter than conventional batteries.


Enclosure front
Enclosure back
Button Panel
Screen PCB
Driver PCB
DURACELL
On/Off Switch
Mount Clip
9V Cell
Battery cover

3.
HISTORY OF WEARABLES

The first wearable

The original Walkman actually introduced a change in music listening habits by allowing people to carry recorded music with them and listen to music through lightweight headphones. Owners of the Walkman were able to take back their "lost" time, commuting for example, and turn it into a pleasurable experience, or add a soundtrack to their urban surroundings. It was the privatization and personalization offered by the Walkman that lead to its success.

The Walkman also created a problem by blurring the lines of public and private spheres. The Walkman allowed individuals to “privately” consume music in “public.” This led some to accuse the Walkman of being anti-social, a problem that Sony would try to remedy.

Present day - Google Glass

Google Glass is a headset, or optical head-mounted display, that is worn like a pair of eyeglasses. It was developed with the mission of producing a ubiquitous computer. Google Glass displayed information in a smart phone-like hands-free format. Wearers communicated with the Internet via natural language voice commands.

The headset has received massive criticism and legislative action due to privacy and safety concerns. Google co-founder, Sergey Brin, claims that Glass could be seen as a way to become even more isolated in public, but the intent was quite the opposite: Brin views checking social media as a constant "nervous tic," which is why Glass can notify the user of important notifications and updates and does not obstruct the line of sight.

Yet again there were issues in social acceptance. ‘Late-night’ host Conan O'Brien couldn't resist making a crack at Google Glass with a hilarious spoof called "Google Ass," which shows what it would be like if the glasses were worn elsewhere, also saying that Google was getting a little greedy because this is just coming out now and they are already releasing a new device to be worn on a different part of your body.

Fitbit

In May 2013, Fitbit released the Fitbit Flex, which is a device that one wears on the wrist. It tracks movement 24 hours a day, including sleep patterns. It has a simple display of 5 LED lights which indicate the number of steps taken in a day, and it vibrates to indicate that your goal has been reached.

What Fitbit did well, was to conceal the device making it unobvious for others to notice the worn device.

Thync

Thync uses neurosignaling to activate specific cranial and peripheral nerves to influence this balance and shift you to a state of calm or give you a boost of energy in minutes. One evaluator compared it drinking an espresso accompanied by a tingle of prickly heat behind the ear.

The wearable is too prominent and is bound to gather attention if you are wearing it, creating a alienating feeling.

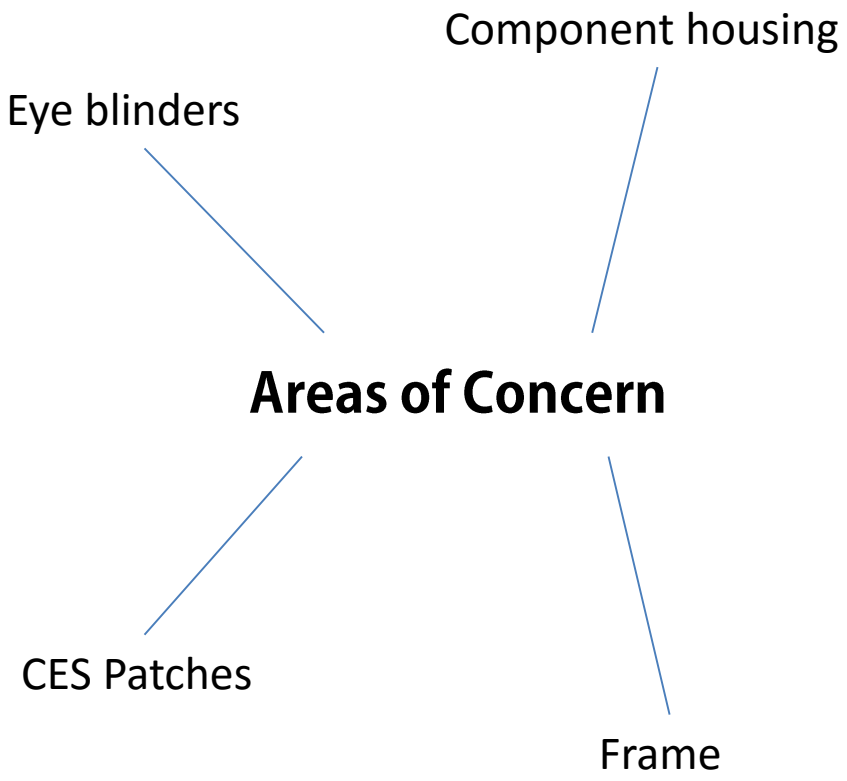
4.
BRAINSTORMING

User Profiling

Currently the product is used only by dentists and dental surgeons. The redesigned product needs to appeal to a wider user audience, primarily people who work in high stress environments. Hence it is important to conduct user profiling so as to understand the kind of people who will be using this kind of a product and also their taste in lifestyle devices.

- Businessmen -High stress job with constant travel. Characterized by luxurious and glossy looking products
- Corporate leaders -Another high stress job where managing employees can be mentally taxing
- Sports team managers -Need to constantly micro manage the team
- Surgeons -Work for long hours, many times over 24 hours at a stretch.
- Patients -Have to undergo surgery, which can cause high levels of anxiety



The component housing would have to encase the lithium ion battery as well as the circuitry. In the current product, an alkaline battery is used along with the driver PCB. The area of the PCB is important as it dictates the footprint of the housing. The housing can either be placed behind the neck, suspended like a pendant or even be incorporated into a spectacle type frame similar to google glass.

CES patches are the second key component in the device. They need to adhere to the surface of the skin all the time when the device is being used for effective delivery of electrical impulses. Also, there has to be a little adjustability to the position of the patch depending on the user's head shape. For different users, the position needs to be adjusted for the optimum effect.

The eye blinders, also called visors are helpful in negating visual stimuli. Since the product will be marketed towards people who also need to work while using it, the visors need to be detachable. Similar to the magnetic smart case of the iPad, the visors will also attach to the frame with the help of magnets placed on the frame.

Lastly, the frame is responsible for holding all the components together. The frame should be comfortable to wear for long durations and must not look heavy.

5.
CONCEPTUALIZATION

Approach towards ideas

Two approaches had already been generated, however it was decided that a totally different approach should be followed as well. The first two approaches focus on a design that looks more comfortable but is bulky. Hence, taking inspiration from several modern day luxury products, a sleeker and more sporty looking form was generated to appeal to a larger set of users.

The first approach places all the components inside the blinder. It looks like a pair of goggles where all the components are placed inside the frame itself behind the cushioning. However, it posed a problem that the user will be blinded at all times when the device has to be used. A removable blinder was needed hence the components have to be mounted on a separate frame. The second approach is a sort of a neck pillow with an external encasement that houses all the components. This design, although it prevents the problem of the user having to cover their eyes while using the device, looks very bulky and also the patches are not at the optimum position near the ears, but rather they are on the neck.

The third approach was based on futuristic gadgets like the Google glass and other wearable technologies like the Fitbit. This approach focused on making the device look clean and simple, while at the same time being sporty and look like a premium product.

Approach 1

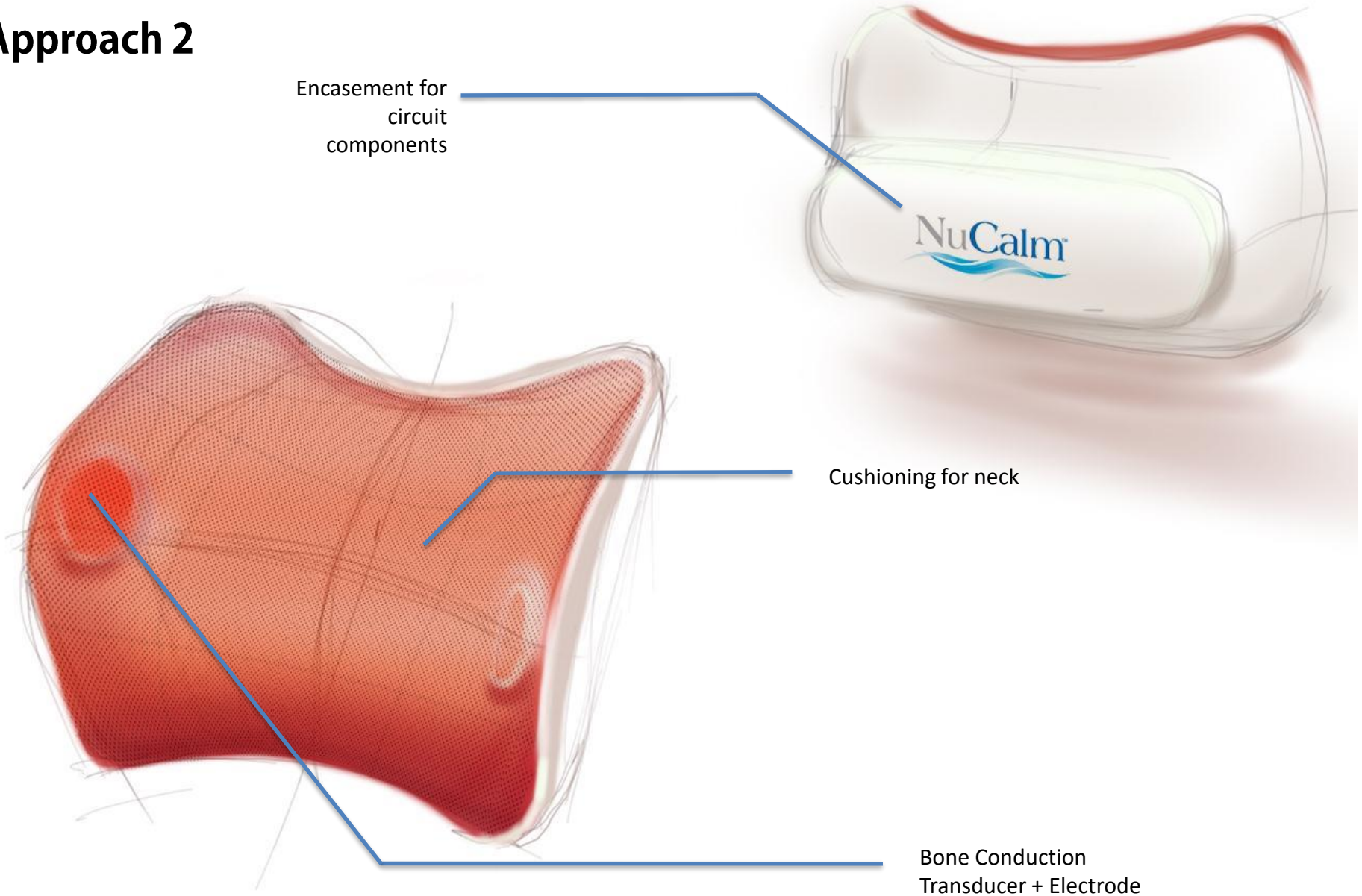
Cushioning on inside

Bone Conduction
Transducer + Electrode

View Blinder

Status lights

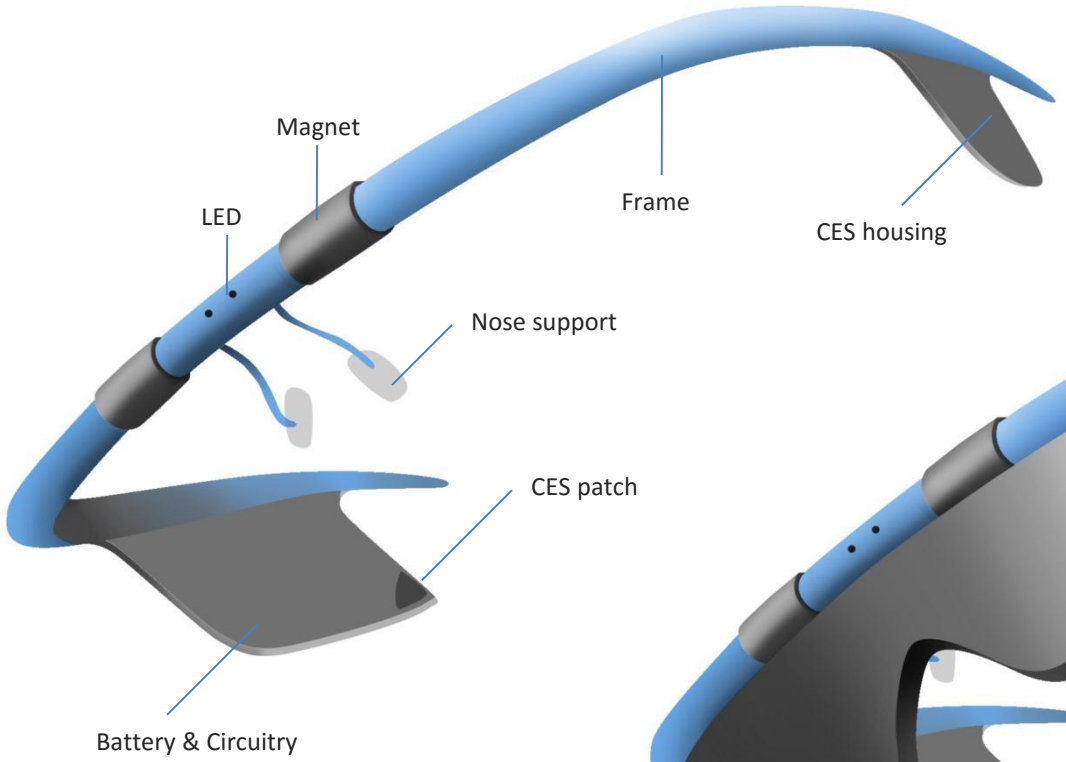
Approach 2

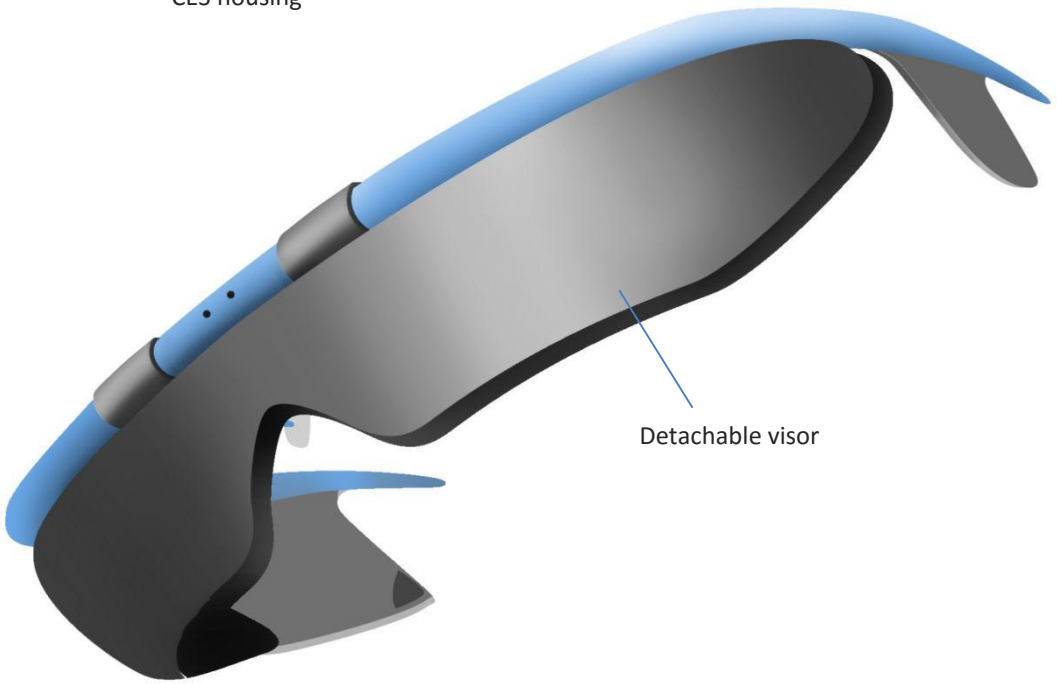

Encasement for circuit components
NuCalm
Cushioning for neck
Bone Conduction Transducer + Electrode

Approach 3

Products like B&O earphones, magnetic clamp on spectacles and high-brow visor designs were taken as an inspiration for the third approach. Simplicity of form was the factor while going for the new approach. It started with a bare bone frame on which components were added later.

A very minimal frame which is offset from the forehead to accommodate the visor. The visor snaps onto the frame with the help of magnets mounted on the frame itself. Two indicators lights are located on the middle. The entire form is asymmetric to give it a dynamic visual appeal with the circuitry and the battery mounted on the right side. The CES patches are placed in front the ear on the temples.





After a thorough discussion over the design and technical aspects, it was decided that the visor would be made of a harder plastic frame which covers the outer shell while the inside of the shell would have a soft cushion lining which would sit comfortably over the face. The method of clamping would be through the use of magnets that are situated on the frame and the edge of the visor; they would simply snap into place just like the Apple iPad's smart cover.

It was concluded that designing a frame that goes around the neck is counter intuitive and also difficult for the user to access buttons on it. Hence, a frame that goes over the forehead has to be designed. Also, the circuitry and battery would be placed only on one side of the frame to make it look asymmetric and also make the component packaging easier.

Styling

The current product is only used by experts in the medical field. However, the company now wishes to expand their user base beyond the niche. After studying the user profiles, it was concluded that the new product needs to resemble a high end lifestyle product, similar to something like a pair of luxury headphones. The form should feel premium and the user must feel comfortable while wearing it outdoors. The styling has to be sleek and minimal. A mood board has been created keeping the styling brief in mind. High end products from Bang & Olufsen, Mark Newson and Philippe Stark have been chosen for the mood board as their design language communicates well with what we want to achieve in terms of form and styling. The products shown in the mood board are designs that are derived from simple elementary shapes.

Six different styling concepts have been proposed, which resonate with the lifestyle products of today and would appeal to working professionals as well as tech enthusiasts.

Mood Board

Styling Concept 1

Styling Concept 2

Styling Concept 3

Styling Concept 4

Styling Concept 5

Styling Concept 6

Conclusion

Towards the end of the internship, I had successfully worked on the brief by providing a new approach and generating a variety of styling concepts.

I am fortunate to have been a part of the design team and develop skills relevant to the design industry. It was a rewarding experience and has enriched my views on user centric design.

References

Vagus nerve image
http://heatherdane.com/wp-content/uploads/vagus-nerve.jpg

Information on vagus nerve
https://en.wikipedia.org/wiki/Vagus_nerve

Stock photo reference
Google.com

Nucalm reference images
http://www.nucalm.com/

Reference images for moodboard
http://www.bang-olufsen.com/en

Glossary

B&O (Bang & Olufsen) - A high end audio solutions brand

Bone Conduction Transducer - Technology that transmits sound through bones of the skull rather than directly into the ear

CES – Cranial Electrotherapy Stimulation

CN X - 10th Cranial Nerve

iPad - A touchscreen tablet designed by Apple.

Mark Newson - A very well known designer

PCB - Printed Circuit Board, a board used to mount electrical components in devices.

Philippe Starck - A very well known product designer