

Progress Report

CERN IdeaSquare Summer School 2023

Team Peak Balance



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The Peak Balance Team

For the entire duration of this Summer School, Team 4, also known as Team Peak Balance, was composed of four ambitious and eager to learn students.

Simon Ilić



Simon is an Artificial Intelligence master student from the University of Amsterdam. He is a bit of a madcap, but he gets the job done. With his positive spirit he truly believes anything is possible, even the impossible: Where there's a will, there's a way. This chaotic magical realist gets the team started, however he needs a planner to balance him out.

Valentin Marchon



Valentin is a Strategic Entrepreneurship master's student from Erasmus University Rotterdam. He was born and raised in Switzerland until 2018 when he moved to Rotterdam to start his International Business Administration bachelor at RSM. After his bachelor's degree, he completed a master in Management of Innovation and a master in Strategic Entrepreneurship.

Being enterprising and dynamic, Valentin seizes every opportunity that arises. He is passionate about his work and can comfortably share his enthusiasm with others. He always relies on his work experience and skills to overcome complicated and stressful situations. Being well organised, efficient, and open-minded, it is easy for him to adapt to any working conditions.

Valentin has always been passionate about technology and innovation, which is also why he decided to apply for the CERN Summer School. Indeed, this program represented a perfect opportunity for him to apply the knowledge he gained during his degrees to a concrete scenario.

Greta Skorupska-Ruiz



Greta is an Aerospace Engineering Bachelor's student from TU Delft. She is originally from Poland and moved to the Netherlands to pursue her studies. She is looking to continue her Master's studies in Delft and expand her knowledge of public policy and economics.

As an engineer, Greta likes being organised and keeps the group on track, providing a realistic outlook on the challenges ahead. She relies on her energy and enthusiasm to keep the team spirits up and likes to ‘think outside of the box’. She likes to explore different perspectives and reach out to others to get a holistic overview of a project.

Greta enjoys exploring and applied to CERN IdeaSquare to gain experience in innovation, marketing and design thinking. She believes that the skills she gained during the programme will be very valuable in her future work.

Viktor Gilin



Viktor is a Nanobiology student from TU Delft/Erasmus MC. Born in Bulgaria he travelled to the Netherlands to pursue his passion for studying interdisciplinary science particularly to explore the subjectively most interesting phenomena of our world, that being life itself. After finishing his Bachelor’s he plans to follow a scientific career in academia, wishing to study the complex physics of cell biology.

In a team dynamic, he tends to be the more chaotic person who is always questioning everyone’s ideas and actions, while at the same time contributing with his own crazy ambitious ideas often out of touch with the practically conceivable. As an interdisciplinary scientist, however, he has a good intuition to look at complex problems from multiple lenses giving him a clear realistic view.

Recognizing the importance of innovation, exponential thinking, and high tech in the modern scientific realm, Viktor chose to embrace the CERN IdeaSquare Summer School challenge. His goal was to expand his range of experiences and enhance his abilities in multidisciplinary teamwork. Following this programme was truly a unique opportunity that definitely developed his work mindset and view of the world.

Breaking the ice

While the program started with a general kick-off at TU Delft on the 24th of May, our first team meeting took place one week later, on the 1st of June. To lay the groundwork for our collective experience, we had to individually complete an MBTI personality test before our first official lecture.

During our first team meeting, we then used these test results as a starting point for getting to know one another better, and also to initiate the discussion around our unique personality traits. This exercise served as an icebreaker, breaking down initial barriers and fostering camaraderie. Building upon this, we delved into identifying our individual "Superpowers" and "Dragons" – symbolic of the attributes that could elevate or hinder our team's dynamics. This introspective journey allowed us to collectively grasp the strengths that would significantly impact our collaborative efforts.

Through deep reflection and open dialogue, we came to deeply appreciate the harmonious blend of diverse attributes and academic backgrounds that define our team. This realization culminated in the birth of our team's name, "Peak Balance," a representation of our aspiration to attain equilibrium in skills, perspectives, and camaraderie. The process not only brought us closer together but also solidified our commitment to leveraging our varied strengths to achieve remarkable outcomes.

Team values

Team values are important as they are usually responsible for setting up the foundations of successful teamwork. As a team, we agreed on the following three values:

Expressiveness

We cherish expressiveness as a cornerstone of our team culture. We believe that every voice matters and that diverse perspectives fuel innovation. We actively cultivate an atmosphere where each team member feels empowered to articulate their thoughts, ideas, and concerns openly. By embracing expressiveness, we foster an environment of rich collaboration, where creativity thrives, and solutions emerge through meaningful dialogue.

Freedom

Within our team, we recognise that true innovation flourishes when individuals are free to explore uncharted territories. We value the creation of a nurturing space where each team member is not only encouraged but also expected to exercise their autonomy responsibly. This freedom extends to the exploration of ideas, the pursuit of novel approaches, and the courage to take calculated risks. We understand that with freedom comes great responsibility, and we value the conscientious choices that contribute to our collective success.

Accountability

We are a team of ambitious students who have come together with a common interest in this project. As such, we take ownership of our actions and outcomes. We hold ourselves to the highest standards, acknowledging that our contributions ultimately shape the trajectory of our journey. With a commitment to transparency and integrity, we recognise the significance of our roles and the impact we collectively make. In upholding accountability, we not only honour our team but also ensure the realisation of our shared vision.

1. INNOVATION PROCESS, CHOICES AND MILESTONES

1.1. Initiation

Technology choice

On the 1st of June, we were introduced to five cutting-edge technologies, all part of the ATTRACT program. This marked the beginning of a process where each team had to score the technologies before ultimately being assigned one. Each team had 25 points to share among the technologies, and we had to give at least 1 point to each technology. Interestingly enough, after some discussion within the team, we quickly realised that we all had the same interest – we all liked the MEGAMORPH technology the most.

Therefore, over the following week, we strategically pooled our points to secure the MEGAMORPH technology. Our hope was to invest as many points as possible in our favourite technology, increasing our chances of obtaining it. On the 7th of June, we finally received our technology attribution, and we were happy to be assigned to our number one choice - MEGAMORPH.

During the following lecture on the 8th of June, we learned more about the general approach of the program. While we anticipated that a thorough understanding of the fundamental principles and mechanisms of the MEGAMORPH technology was crucial, it turned out that the focus during this program would actually revolve around comprehending its transformative capabilities instead. As such, our challenge was to distil the essence of the technology and adeptly communicate its potential for innovative applications. Ultimately, we were tasked with crafting a distinctive "With this technology, we know how to..." statement, encapsulating the very essence of MEGAMORPH's capabilities.

Understanding the technology

To better understand the technology, we were first given a “tech card” which provided a brief overview of the technology. However, since we all agreed on MEGAMORPH as our first choice, we all had a strong interest in the technology itself and as such, we really wanted to genuinely understand it. Therefore, in order to do so, we got in touch with our ATTRACT ambassador, Santiago Cartamil. Prior to our first meeting, Santiago gave us a paper to read about GIMOD,

which is the main idea behind MEGAMORPH. This paper was from the first phase of ATTRACT. Overall, this paper helped us to better understand the MEGAMORPH technology, as well as build a strong knowledge foundation that served us for the rest of our innovative journey.

1.2. Interview with an expert

On the 6th of July, we had the opportunity to interview Santiago via a video call. During our conversation, we delved into a range of topics related to the technology, seeking insights into its mechanics, applications, sustainability and feasibility, but also some more personal curiosities.

Our dialogue commenced with a fundamental query: How would Santiago complete the statement "With this technology, we know how to...?" His responses were enlightening:

With this technology, we know how to...

- *Alter the colour of any surface using graphene modulator technology.*
- *Generate vibrant images with a multitude of colours.*
- *Transform virtually any surface into a display, given certain lighting conditions.*
- *Digitally paint or modify the pigments of diverse surfaces.*

Santiago's journey began with a serendipitous discovery of graphene crystals' reflective properties, which paved the way for the development of GIMOD technology. This laid a logical path toward display technology. GIMOD boasts benefits such as low power consumption and efficient bandwidth utilisation, differentiating it from traditional LED screens. However, incorporating the relatively expensive graphene into consumer products presents challenges that require further planning.

Santiago highlighted that the most promising application for GIMOD technology presently lies within the healthcare sector, offering improved imaging capabilities in virtual reality. Despite this, he underlined that the exact industry focus for GIMOD and MEGAMORPH remains undecided. A notable trade-off of GIMOD is its reliance on external light sources. He also emphasised the positive environmental impact of the technology due to its minimal power consumption and the non-toxic nature of graphene.

When probed about the technology's trajectory, Santiago projected the possibility of establishing a 50-person company within the next 5 years, envisioning market dominance within a decade. He speculated that the virtual and augmented reality sector could become early adopters of the technology.

“We know how to...” statement

Building on the insights gained from both the GIMOD paper as well as our discussion with Santiago, we distilled our collective understanding into one concise "We know how to..." statement for the MEGAMORPH technology:

“With this technology we know how to precisely and dynamically colour on any surface in a sustainable way, using just carbon and a light source.”

1.3. Domains exploration

Start of ideation sprint

From the 10th until the 12th of July, we had our 3-day ideation sprint in Delft and Amsterdam. Our first technology video and “We know how to...” statement was presented and we received our first technology drawings done by Jelle. We received feedback from Dap on all the above and had an opportunity to reflect on the drawing and discuss if it accurately represents our vision. We also discussed how to improve our we know how to statement and after some slight changes our final statement was the following:

“With this technology, we know how to precisely and dynamically colour any surface with a low environmental footprint”

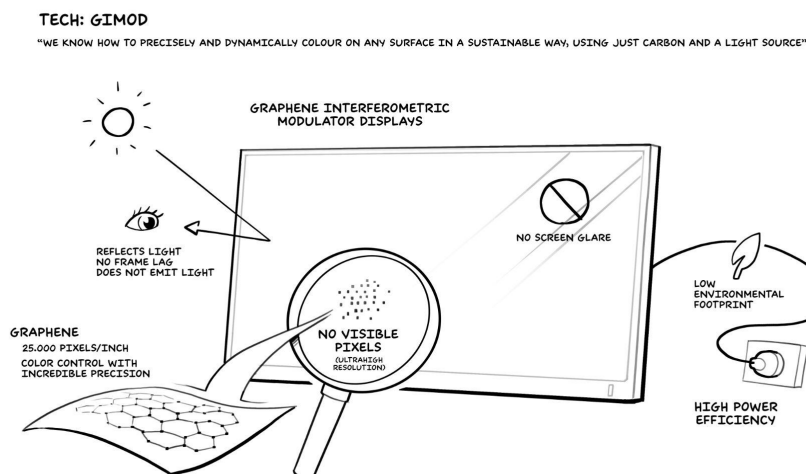


Figure 1: Jelle's visual on the MEGAMORPH/GIMOD technology

Brainstorming industries

Throughout the lecture days, as we were progressively learning more about our technology we were brainstorming some of our personal ideas for possible applications of the MEGAMORPH technology.

Before the beginning of the 3-day ideation sprint, we were expected to have 100 industries/applications for our technology. To assist our ideation process we used the help of chatgpt. We processed the output of chatgpt and carefully made our final 100, combining our own ideas with chatgpt's output.

During the first day of the 3-day ideation sprint, we then organised our industries into different categories on the mural.

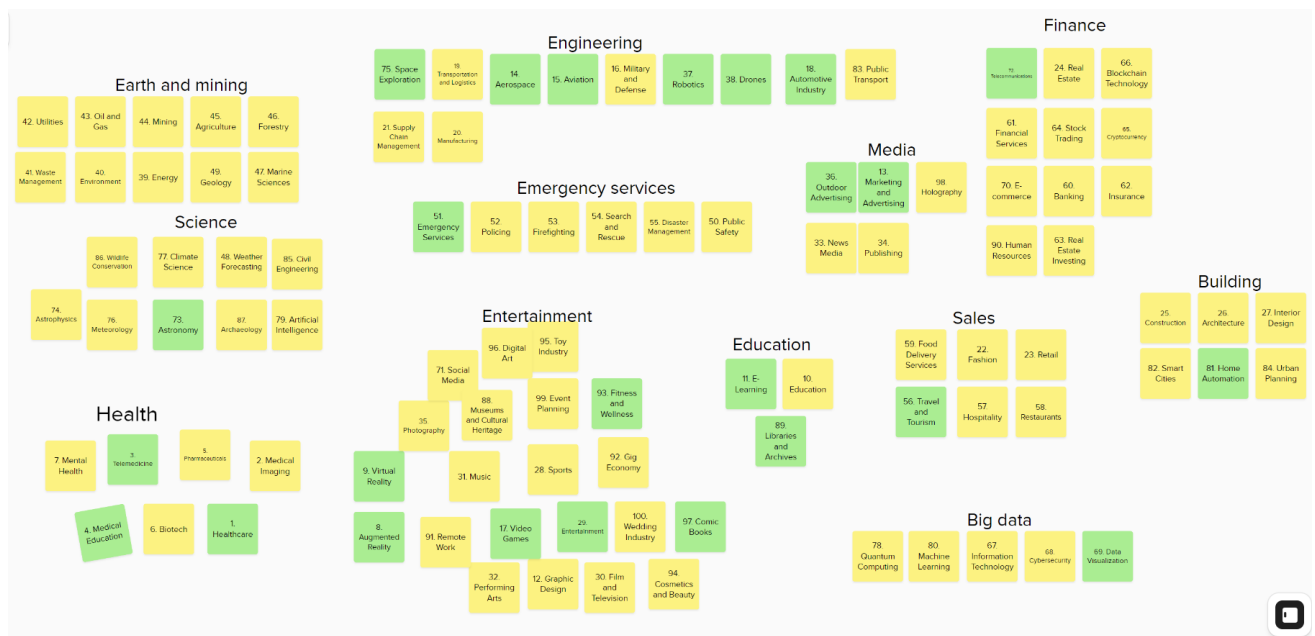


Figure 2: Distribution of our 100 industries into categories

Industry research

On the second day of our ideation sprint, we began our more focused idea research for the span of industries we had. This was done in a sprint research session. In a very short time span, we obtained some major findings for each different industry, extracted insights from them and got an appropriate visualisation.

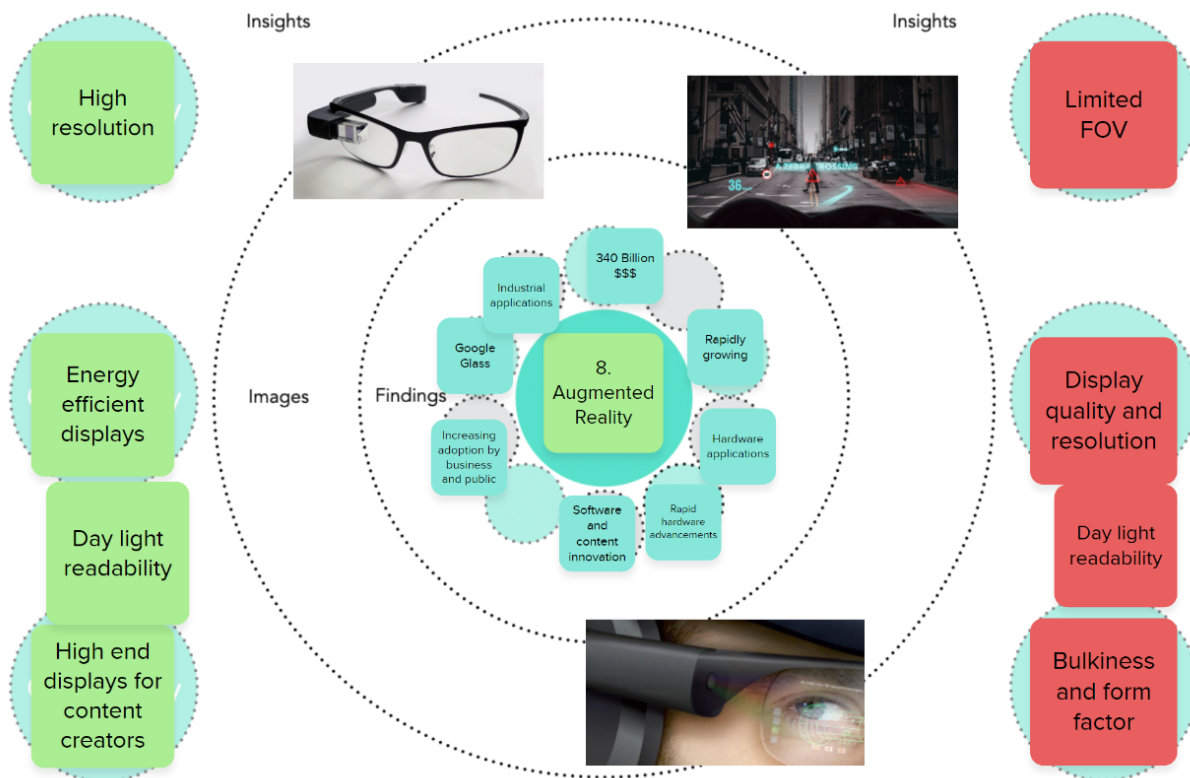


Figure 3: Example of one of the filled industry research canvases. In cyan/blue, the different findings of the industry are presented, on the right in red the pains in this industry and on the left in green the opportunities MEGAMORPH has in solving those pains.

Subdomain exploration and sustainable development goals

On the last day of the ideation sprint, we filled the Ideation Wheel canvas through which the different subdomain applications and insights were obtained for the already established industries for our technology.

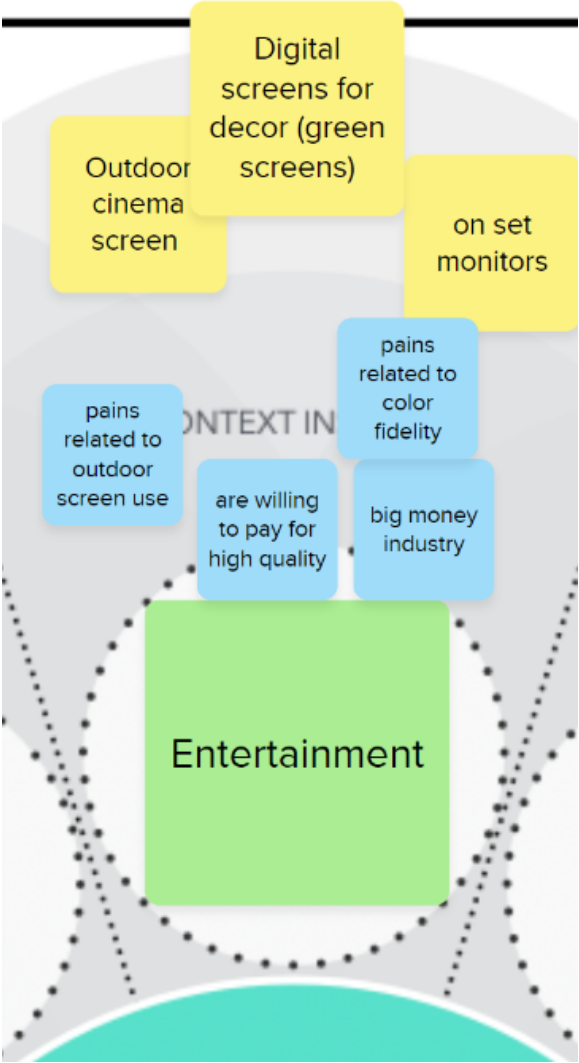


Figure 4: Example section of our Ideation wheel. The entertainment industry is explored with the blue squares denoting certain contextual characteristics of the industry while in yellow possible applications are exemplified.

In addition, we filled an additional analogous canvas with the 17 sustainable development goals of the UN. Filling this canvas truly provided us with insight into the societal impact our technology can have.

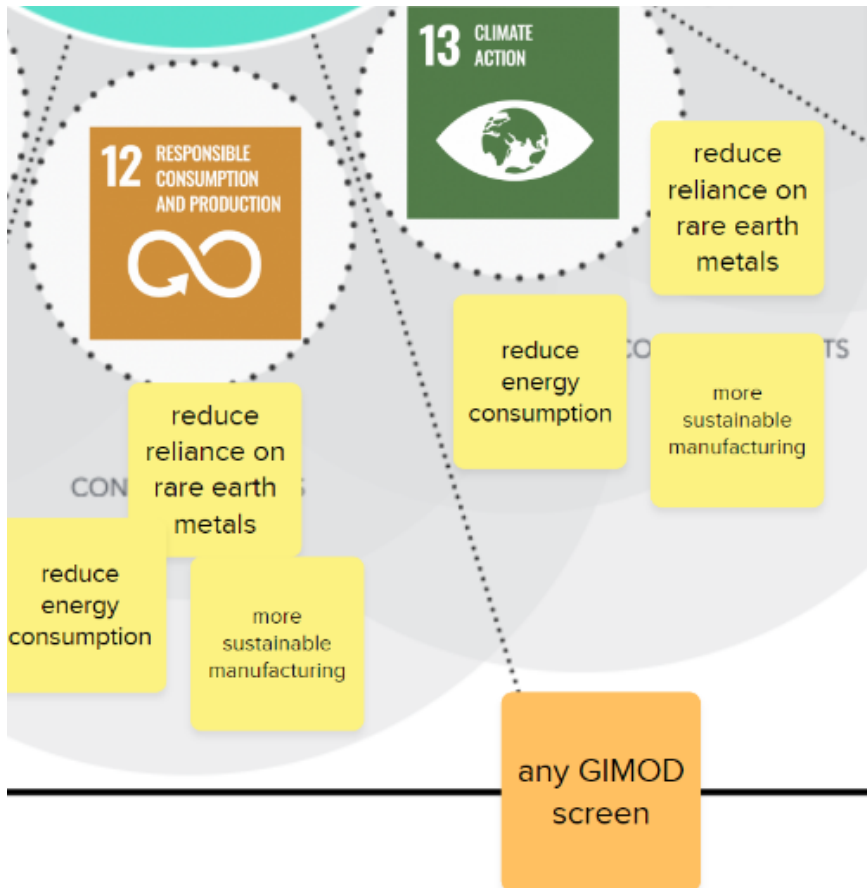


Figure 5: Example section of the Sustainable Development Goals Ideation wheel. In yellow the respective context is given for each Sustainable Development goal while in orange the respective application is given which can benefit those Sustainable Development Goals

Tech-applications fit comparison

We filled the “tech-applications fit” comparison, recognising who needs the technology in the different explored domains, what is their pain, and how our technology can provide significant benefit for them. Afterwards, we discussed our applications with other teams to gain more insight into which are the most promising technologies.

Preliminary prototyping

At the end of the 3-day ideation sprint, we made individually 5 simple prototypes of our applications in the working area of the Architecture building of TU Delft:

VR Headset (Greta)

The concept of integrating the GIMOD technology into a VR headset emerged as a prominent idea during our design sprint. We recognized that the exceptional attributes of GIMOD – including its high resolution, elevated refresh rate, and non-intrusive blue light – made it an ideal candidate for utilisation within the realm of virtual reality (VR). The possibilities were enticing, driving our exploration of this innovative combination.

Our team embarked on the creation of a prototype that mirrored the conventional form of a VR headset, constructed primarily from foam and paper materials. However, it's important to note that the prototype's development was far from straightforward, a consequence of the intricate design involved. The challenge lay in capturing the essence of GIMOD's capabilities through a tangible model, with the GIMOD screen itself represented using a newspaper image, providing a preliminary glimpse into its potential.

Through the prototyping process, our observations unveiled a promising prospect: the incorporation of GIMOD technology in the realm of VR was indeed feasible. However, it became evident that the complexity of the VR headset design required modifications to fully integrate GIMOD's potential. Additionally, a notable challenge emerged – ensuring optimal display visibility necessitated the incorporation of a frontlight (or potentially a backlight). Intriguingly, the traditional VR headset design posed limitations in accommodating this essential feature. This realisation sparked the exploration of alternative avenues for harnessing GIMOD's capabilities, including the contemplation of VR spectacles or even pioneering concepts like VR contact lenses.

In essence, the VR headset application concept, born during our design sprint, unlocked a wealth of potential for GIMOD technology. The prototype's creation, though intricate, served as an initial stepping stone towards this fusion of innovation. The path ahead, as illuminated by the complexities uncovered, encourages us to seek inventive pathways to fully harness GIMOD's attributes within the realm of immersive virtual experiences.

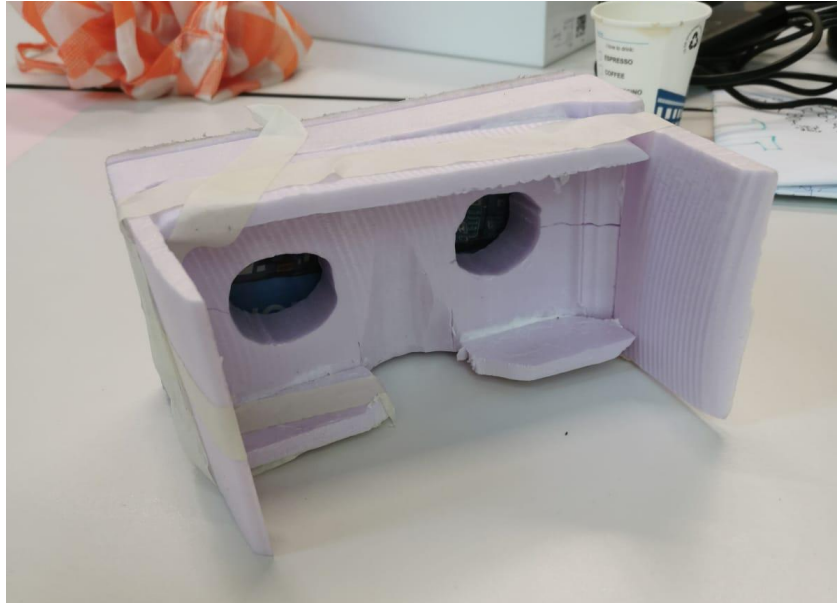


Figure 6: VR Headset Prototype

Changing Road Sign (Valentin)

Another remarkably promising avenue that captured our collective imagination was the potential application of GIMOD technology in the domain of traffic control. The exploration initially encompassed the notion of incorporating GIMOD-equipped signs at the rear of vehicles to facilitate seamless communication between automobiles. However, the true spark of ingenuity emanated from the concept of dynamic and changeable road signs – an idea that rapidly ignited our curiosity and enthusiasm.

The notion of dynamic road signs is imbued with an array of compelling advantages. Foremost, it holds the potential to revolutionise traffic management, ushering in a new era of safer and more fluid roadways. The dynamic adjustment of speed limits in response to varying traffic densities or the transformation of lane configurations on congested or blocked highways are just a couple of examples of how this concept could enhance traffic flow. Furthermore, during incidents such as accidents or roadworks, these adaptable signs could serve as invaluable guides for detours, streamlining navigation for drivers. Notably, the application of changeable road signs takes on paramount significance in fluctuating weather conditions, particularly during harsh winter periods.

GIMOD technology seamlessly dovetails with this innovative application. The passive nature of GIMOD displays translates into minimal energy consumption, a virtue that aligns harmoniously with the concept of dynamic road signs. Energy expenditure would only be requisite when changes to the signage are executed, rendering the utilisation of this technology remarkably sustainable in contrast to traditional LED screens.

The prototype embodying this concept elegantly encapsulates its essence. Crafted from plywood and accompanied by a paper display, the prototype comprises an arrangement of multiple paper sheets, each showcasing distinct road signs. These sheets can be seamlessly flipped to transition from one sign to another, mirroring the adaptability envisioned in the dynamic road sign idea. While the prototype's representation is straightforward, it effectively conveys the core concept that holds immense potential to reshape the landscape of traffic control.

In sum, the envisaged fusion of GIMOD technology and dynamic road signs presents an innovative leap in traffic management. The profound impact on road safety, congestion alleviation, and navigation precision underscores the transformative potential of this idea, aligning perfectly with the ethos of GIMOD's sustainable and adaptive capabilities.



Figure 7: Changing Road Sign Prototype



Figure 8: Changing Road Sign Prototype

GIMOD Watch (Viktor)

The initial concept for the GIMOD application centred around integrating it into a smartwatch, which is an ideal fit due to its energy-efficient passive display, making it a sustainable alternative to LED smartwatches. Unlike traditional e-paper used in some smartwatches, GIMOD offers several key advantages: it features a coloured display, higher resolution, and a high refresh rate, addressing the limitations of most e-paper technologies. Additionally, GIMOD does not emit blue light, making it a suitable choice for health-monitoring smart bands.

To create a prototype of the GIMOD smartwatch, we used copper wire and styrofoam. We shaped the clock's circular form using a foam wire cutter, allowing for rotation of the clock section. To mimic the reflective nature of GIMOD, we covered one side of the watch with a newspaper map and the other with a blue-white pattern from a magazine. This paper screen design aims to resemble pigmented paper while the circular watch section's rotation enables quick screen changes, providing a seamless user experience.

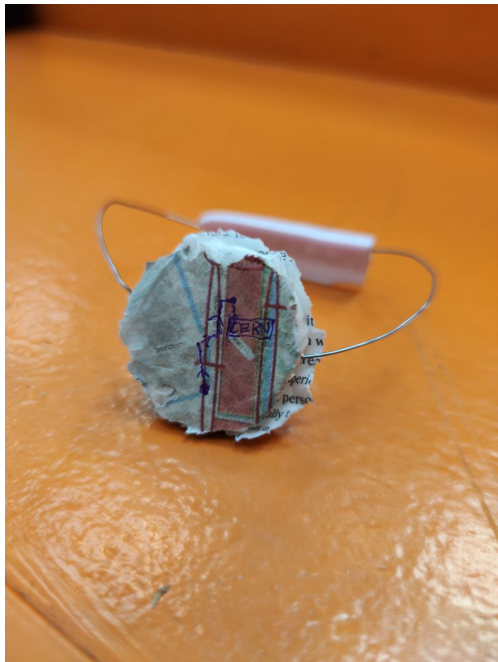


Figure 9: GIMOD Watch Prototype



Figure 10: GIMOD Watch Prototype

1.4. Domain selection

Opportunity fields exploration and initial selection

First workday in CERN. We established our new working space and began filtering the most significant applications for our technology. To do this we took a more holistic view and grouped our industries further into even bigger categories (for example we combined art with entertainment as both of these sectors have similar aspects in the context of our technology) for which we filled the provided Opportunity Fields Exploration canvases to get a better idea of the potential of those applications.

Industry visualisation and final selection

We chose to visualise- the five most significant applications from each bigger group on a drawing sketch. Those were: camouflage, display eye lenses, shirts with dynamic pigment, house roofs with dynamic light absorption and dynamic signage.

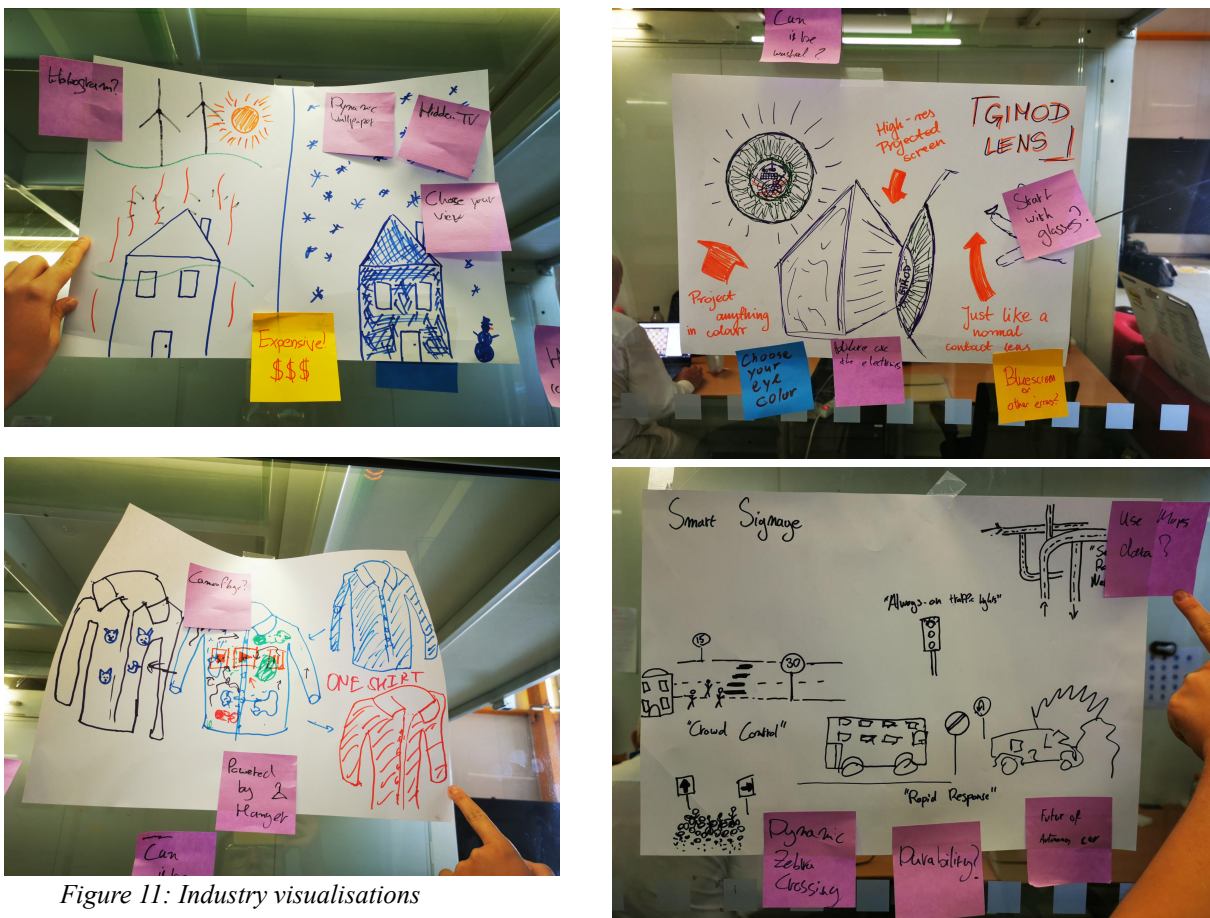


Figure 11: Industry visualisations

A discussion session began where we provided input to other teams and received such from the others for our current technology ideas.

Concept Design of final industry selection

After we reconsidered all the final technologies and all the provided input from the other teams and all the people from IdeaSquare we decided that the fashion applications seemed to be the most promising as despite not having the importance of the medical VR/AR that Santiago is working on, it is our most original direction with still great significance and societal impact. However, we did a concept design for three applications, exploring the concept from multiple angles through the Concept Canvas. Our final three concepts were in fashion (InfiniWear), camouflage (MegaCamorph) and wall TV-display screens (InfiniCanvas).

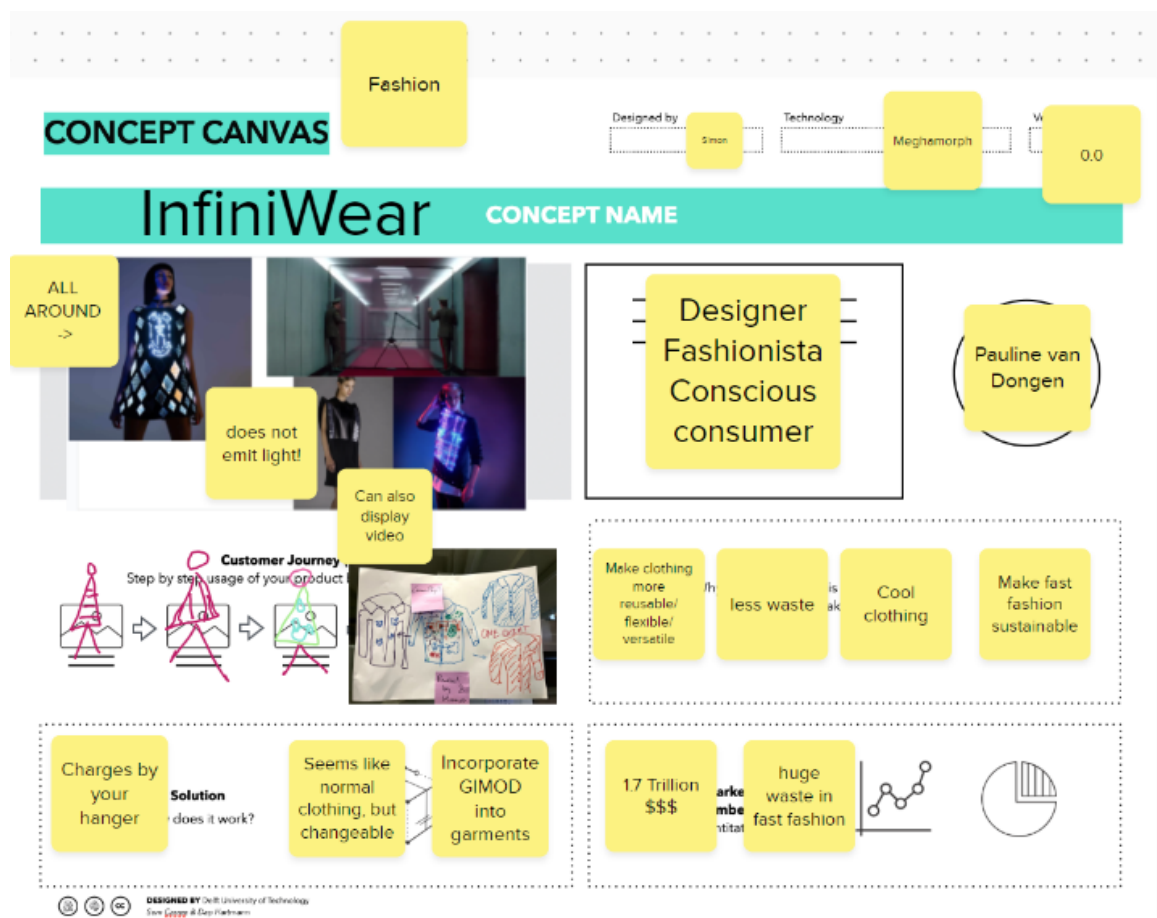


Figure 12: Concept Canvas of InfiniWear

Later, based on those canvases, Jelle made another professional visualisation showing clearly the concept of our applications.

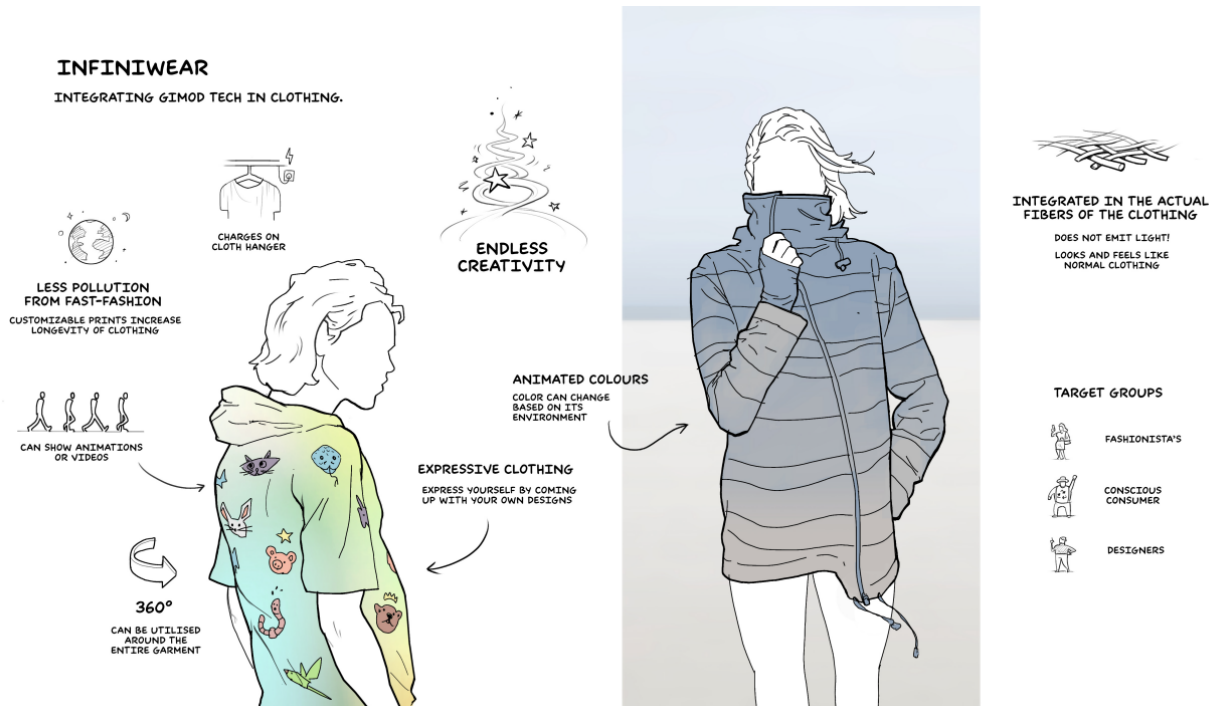


Figure 13: Jelle's InfiniWear visual.

2. DEFINED PROBLEM

After selecting the fashion industry to develop our new application of the MEGAMORPH technology, we focused on clearly defining the problem that the fashion industry faces and how this problem actually has global societal implications.

The rapid rise of fast fashion has exacted a devastating toll on our natural resources, boosting the proliferation of textile waste. This reality can be illustrated by the example of the iconic white T-shirt—a wardrobe staple whose annual global sales top a staggering 2 billion units, solidifying its status as one of the most common articles of clothing across the globe. Crafting a single cotton T-shirt requires an astounding 2700 litres of water, equivalent to the capacity of over 30 bathtubs. Meanwhile cotton uses more insecticides and pesticides than any other crop in the world, which ultimately end up negatively and significantly impacting the environment.

The process of transforming raw cotton involves the use of both heat and chemicals. During that process, the fabric is dipped into commercial bleaches and azo dyes which make up the vivid colouring in about 70% of textiles. Unfortunately, some of these contain cancer-causing compounds, such as cadmium, lead, chromium, and mercury. On top of that, when poorly managed, other harmful compounds and chemicals can cause widespread contamination when released as toxic wastewater in rivers and oceans.

Finally, once manufactured, these T-shirts embark on a journey across seas, railways, and roads to reach affluent markets. The cumulative carbon emissions stemming from apparel production make a significant contribution, accounting for around 10% of global emissions. Fueled by a growing demand for cost-effective garments and consumers' insatiable desire for newness, global apparel production surged by an astounding 400% between 1994 and 2014, resulting in an annual output close to 80 billion garments.

In essence, the rise of fast fashion has triggered a crisis that deeply impacts our environment. This phenomenon, exemplified by the journey of the classic white T-shirt, comes at an immense cost to natural resources. The extensive water usage, heavy reliance on chemicals, and significant carbon emissions have collectively propelled the fashion industry to a pivotal point. Urgent action is thus imperative to address these unsustainable practices. By addressing this problem, one can foster a more responsible approach to clothing production and consumption.

3. SOLUTION

To tackle the aforementioned issue, we came up with an innovative solution: InfiniWear. Leveraging the power of MEGAMORPH reflective-type display technology, InfiniWear revolutionises the concept of clothing by instantly changing the colour and visual design of any garment, all while consuming minimal power. This breakthrough not only addresses the environmental impact of fast fashion, but also how individuals approach their clothing choices.

InfiniWear embodies the "ultimate all-in-one shirt" approach, aiming to replace an entire wardrobe with a single, versatile garment. Often, people buy new clothes not out of necessity, but rather to stay in line with fashion trends, explore new colours, or embrace fresh designs. InfiniWear directly tackles this concern, offering a sustainable perspective on fast fashion. With this innovative technology, consumers only need to purchase one item of clothing. They can then conveniently access an array of colours and designs from our online marketplace, ultimately reducing the need for multiple clothing items and curbing unnecessary consumption.

By simply tapping their phone on the garment's integrated NFC tag and utilising reverse wireless charging, consumers can instantly transform their shirt into an entirely different look. This fusion of technology and fashion not only empowers individuals to express themselves through clothing but also promotes responsible consumption. InfiniWear envisions a future where personal style can be redefined without compromising our planet's resources. By embracing sustainable innovation, we are reshaping the fashion landscape—one garment, countless possibilities.

In order to visualise our solution, we designed three different prototypes



Figure 14: Closet prototype

The first prototype was a small box containing two miniature scale closets. The first miniature closet with the implementation of InfiniWear and the other one without the implementation of InfiniWear. This allowed us to showcase the impact of InfiniWear on closet space, and how it would actually change the whole room environment.

The second prototype was a multi purpose piece of fabric. We made it possible to insert different types of material in a fabric pocket to change the rigidity of the fabric. This was used to present people with different texture and rigidity of fabric and ultimately explore what “feel” people would be willing to wear on themselves. It allowed us to envision what a high-tech fabric should feel like to be adopted by the public.



Figure 15: Fabric prototype



Figure 16: Tote bag prototype

The final prototype was a more “concrete” version of our solution where we implemented a screen in a tote bag. This allowed us to showcase how InfiniWear would look like on a different fashion accessory and it also allowed people to play around with it. That way they could experience the implementation of InfiniWear by themselves.

Overall, these prototypes allowed us to really showcase the potential of InfiniWear, both in practice, but also in context. Ultimately, this allowed us to get a better understanding of what people were looking for and what they were willing to accept regarding high-tech fashion.

Customer journey

The customer journey for InfiniWear is as follows:

Step 1: Introduction Through High Fashion Market The journey begins with InfiniWear making its debut in the high fashion market. The concept catches the eye of fashion enthusiasts looking for uniqueness and versatility in their clothing. With its promise of transformation and style, InfiniWear sets the stage for an exciting customer journey.

Step 2: The Customer Experience Prospective customers encounter InfiniWear as an appealing and upscale product. Its allure lies not just in its aesthetics, but also in its innovative nature. The promise of a garment that can change its appearance at will intrigues and captivates fashion-conscious individuals seeking distinctive attire.

Step 3: Durability, Cool Factor, and Innovation As customers delve deeper, they discover that InfiniWear not only offers visual novelty but also boasts durability and coolness. The technology behind InfiniWear is truly innovative, sparking interest among those who value both style and functionality in their clothing.

Step 4: Making the Purchase Motivated by the allure of the product, customers decide to make the purchase. The decision is underpinned by the product's uniqueness and its promise to revolutionise the way they interact with fashion.

Step 5: Exploring Design Marketplace Upon acquiring InfiniWear, customers are introduced to a vibrant marketplace where they can select and purchase various designs for their changeable clothing. This aspect adds an exciting layer of customization, enabling customers to curate their own fashion statements.

Step 6: Driving Repeat Purchases With the initial positive experience, customers find themselves motivated to explore more InfiniWear garments. The dynamic possibilities of creating different looks from a single item inspire repeat purchases, as the customers recognize the long-term value and adaptability of their wardrobe.

Step 7: Expansion to Targeted Audiences Initially, InfiniWear predominantly targets men due to the simplicity of male garments and the potential for integrating the technology in ties, t-shirts, and other wardrobe essentials. This strategic focus enables the product to gain a foothold in the market while paving the way for future expansion.

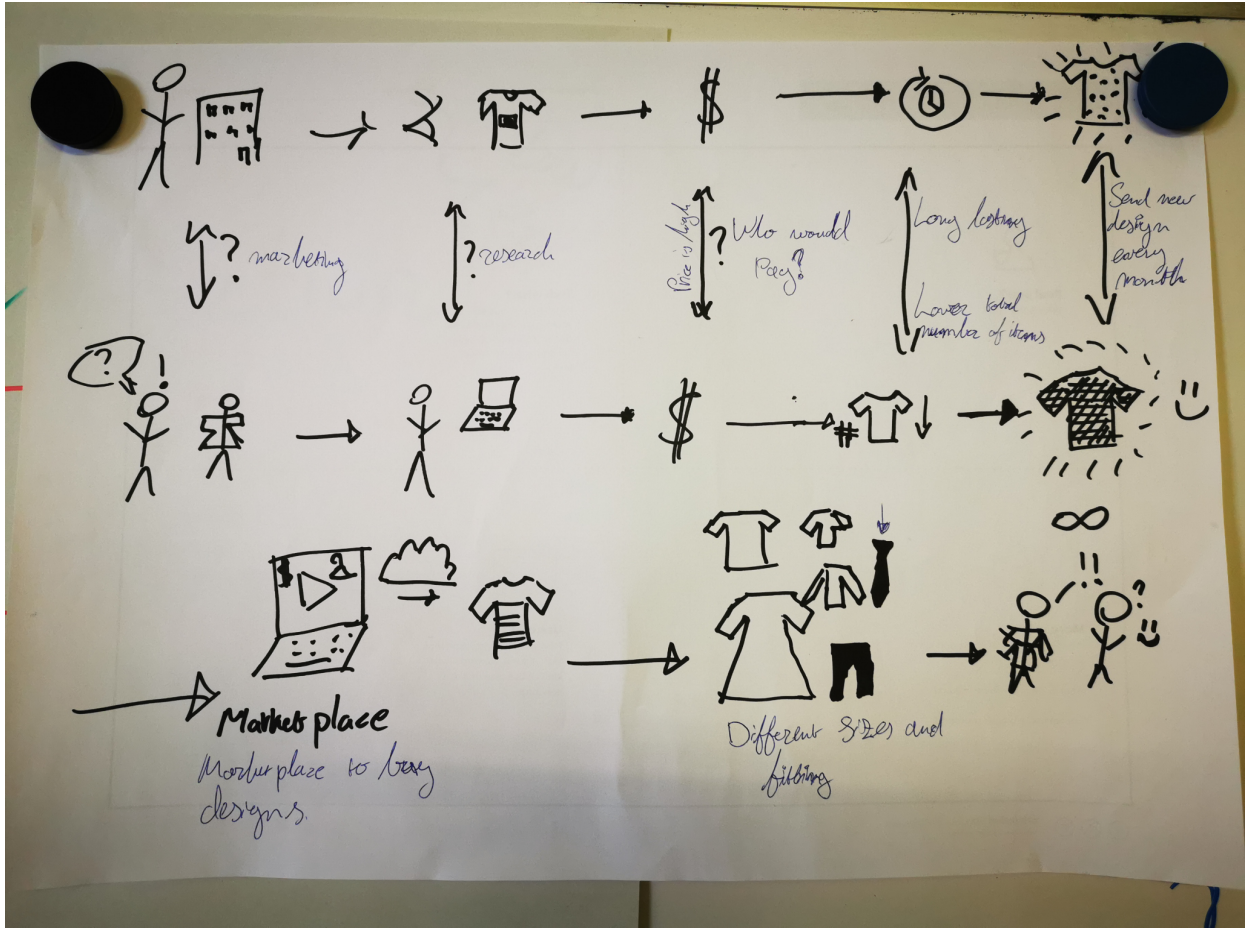


Figure 17: Customer Journey

InfiniWear's customer journey is marked by innovation, style, and adaptability. From its introduction in the high fashion scene to its promise of transforming clothing, it offers customers a fresh perspective on what clothing can be – a canvas for self-expression that seamlessly combines technology and fashion.

4. IMPACT OF INFINIWEAR

The introduction of InfiniWear holds a simple yet powerful goal – to tackle the wastefulness prevalent in the fast fashion culture. This innovative idea revolves around the concept that a single garment, such as a shirt, tie, or bag, can replace the need for owning multiple pieces. This shift toward thoughtful consumption directly addresses the alarming waste generated by the fashion industry.

At its heart, InfiniWear aims to make a dent in the environmental toll of clothing production. The harmful effects of pollution, carbon emissions, and excessive water usage tied to the conventional fashion cycle are issues that can no longer be ignored. By encouraging less frequent purchases and prolonged use, InfiniWear sets out to contribute to a greener planet. Moreover, the ethical production practices adhered to in creating InfiniWear garments reflect a genuine concern for the well-being of those involved in the fashion supply chain.

To support the claim that an InfiniWear shirt will indeed be more sustainable than a person's full set of shirts, an approximate number of the carbon footprint of an InfiniWear shirt was calculated. Considering the carbon footprint to produce one cotton t-shirt is around 10.75 kg CO₂ eq, and assuming that a MEGAMORPH display has the carbon footprint of an HP 14s Laptop PC ENERGY STAR screen, we can estimate that a t-shirt covered in MEGAMORPH display has the carbon footprint of approximately 35 t-shirts. This means that for an InfiniWear shirt to be as sustainable as a normal cotton t-shirt it has to be able to substitute around 35 cotton t-shirts.

However, GIMOD technology plays a pivotal role in this venture, mainly due to its energy efficiency. GIMOD's passive display requires minimal energy, using power only when changing garment designs. This contrasts sharply with traditional LED technology, which consumes more energy throughout its lifecycle. In addition, with the future progress of nanofabrication techniques and the significantly simpler and nontoxic materials of GIMOD, the production of one GIMOD screen is expected to be substantially more environmentally friendly than that of LEDs.

Thus 35 t-shirts is very much an upper estimate. In reality, an InfiniWear shirt could have a carbon footprint of around 10 cotton t-shirts, a number similar to the lower bound of the number of t-shirts a person owns, while providing an infinite number of fashion designs.

The decision to incorporate GIMOD aligns seamlessly with InfiniWear's eco-conscious approach. Crafted from environmentally friendly materials, GIMOD serves as a testament to the brand's commitment to avoiding environmental harm.

In essence, InfiniWear is a practical response to a complex problem. By encouraging a shift toward purposeful consumption, embracing eco-friendly technology, and prioritising ethical practices, InfiniWear offers a simple yet impactful solution in the fight against fashion waste. It's not just about reimagining clothing; it's about redefining our relationship with fashion and the planet.

5. INDIVIDUAL REFLECTIONS

Simon Ilić

Simon enjoyed taking part in the program.

Valentin Marchon

“I thoroughly enjoyed participating in this program as it provided a perfect platform for me to integrate the knowledge I acquired during my studies in international business administration, management of innovation and strategic entrepreneurship. This opportunity allowed me to put theoretical concepts and techniques, accumulated over my years of study, into practice. Furthermore, I found the program's blend of technological innovation and business extremely compelling. Engaging with a new technology and exploring novel applications to optimise its potential for positive societal impact aligned closely with what I envision doing in my future career. Having the possibility to participate in such a program has been extremely enriching.

On top of that, in my opinion, collaborating with a diverse team of individuals from various backgrounds was definitely a strength of the program. Joining forces, sharing ideas, and merging perspectives in a university context, where engineers and business students typically operate separately, was a refreshing and unique experience. Additionally, the program's culmination was undoubtedly the opportunity to visit CERN. Immersing myself in an environment that actively promotes innovation and change added an extraordinary dimension to the overall experience.

Reflecting on this journey, I am proud of what I managed to accomplish on the individual level, but also of what our team managed to do over the course of this program. We put a lot of effort into coming up with a new innovative application for our technology, and in the end I think we were definitely successful in doing so. Our team's ability to dive into a project and work harmoniously with team members possessing diverse experiences, all while striving towards a shared objective, has also been incredibly enriching. Overall, embracing this experience has been immensely gratifying, and as such, I am truly grateful for the opportunity.

As I move forward, I am excited to carry the lessons and insights gained from this program into my future endeavours. The hands-on application of knowledge, the collaboration with diverse peers, and the exposure to cutting-edge innovation have instilled in me a deeper appreciation for

the potential of interdisciplinary collaboration. I am confident that the skills and perspectives I have gained will serve as valuable assets as I navigate the challenges that lie ahead. This program has not only expanded my horizons, but also solidified my passion for merging technology and business to drive meaningful change in our ever-evolving world.”

Greta Skorupska-Ruiz

“Participating in the CERN program in Switzerland was an absolute highlight of my time as an engineering student. Looking back on the experience, I can't help but feel grateful for the opportunity to learn, grow, and have a lot of fun along the way.

One of the aspects that truly stood out to me was the introduction to design thinking. Exploring this problem-solving approach was like discovering a new toolkit for tackling challenges. And working within a team during the program was a real eye-opener – witnessing diverse perspectives melding into creative solutions was both rewarding and educational.

Of all the activities, I found the discussions about marketing particularly engaging. With a personal interest in marketing and economics, it was enlightening to see how these fields intersect with engineering. Engaging with individuals outside of our program to bounce off our ideas provided a whole new dimension to our thinking process.

The program was a masterclass in teamwork and collaboration. Navigating the dynamics of group work, sharing ideas, and achieving common goals was a valuable lesson that I'll carry forward. Moreover, the experience of collaborating with fellow participants, who were equally enthusiastic about innovation, made the whole experience even more memorable.

Being immersed in the environment of CERN was an incredible privilege. The backdrop of groundbreaking scientific research added an extra layer of inspiration to our endeavours. As someone with an inclination towards marketing and economics, being at CERN reinforced my belief in the power of interdisciplinary collaboration and thinking beyond a single field.

In retrospect, this program wasn't just about learning concepts; it was about embracing a mindset that celebrates collaboration, innovation, and seeing the bigger picture. I'm excited to take these learnings with me and apply them to my future endeavours, knowing that the CERN program has left an indelible mark on my academic and personal journey.”

Viktor Gilin

“Participating in the CERN IdeaSquare Summer School proved to be an immensely enriching experience. With a background in Nanobiology, my education had primarily focused on interdisciplinarity only within the academic sphere. However, this program opened my eyes to the often-overlooked aspects of STEM, such as grasping market dynamics, embracing design thinking, and harnessing the power of prototyping for effective idea communication. These skills, not commonly emphasised in academia, are undeniably crucial.

Perhaps the most vital element of this program was our multidisciplinary and diverse team. Collaborating in such an environment necessitated distinct teamwork dynamics, effective communication, and seamless collaboration. We quickly learned that we should not confine ourselves based on our individual backgrounds, but instead, maintain open minds and articulate our ideas clearly for everyone's understanding. Confronting global challenges demands interdisciplinary teamwork, and this experience proved immensely valuable in that regard.

Additionally, the program offered a unique opportunity to interact with a wide range of individuals, each with their own expertise. From the IdeaSquare team, fellow students from TU Delft, EUR, and UvA, to CERN scientists, business professors from Almo University, robotics engineers, cinematographers, and many others, their diverse perspectives consistently surprised us with insightful contributions, significantly advancing our concept development.

One of the most enlightening moments for me occurred when I felt the most out of my comfort zone, that being during the prototyping stage. Due to my limited experience with prototyping, my idea seemed practically unworkable. However, what I initially perceived as a "failure" during the process ultimately taught me the significant importance of meticulous prototype planning and resource awareness. Above all, it underscored the necessity of maintaining composure in stressful situations, as stress can severely restrict creativity and workflow. Luckily, my struggles did not hinder our collective effort. Teamwise, we made some impressive prototypes. Despite my significantly lower productivity, I gained valuable lessons from this experience, and in the process enjoyed acquiring new skills, such as sawing.

Reflecting on this entire journey, I firmly believe that our team successfully embraced the challenges presented by the CERN IdeaSquare Summer School, fostering an exponential

thinking mindset. I am immensely grateful for the opportunity to be part of this program, especially for the incredible team I had the privilege to work with and the positive environment created by fellow students and the IdeaSquare Summer School staff. I am confident that the skill set I developed throughout this journey will have a profoundly positive impact on my scientific career.”