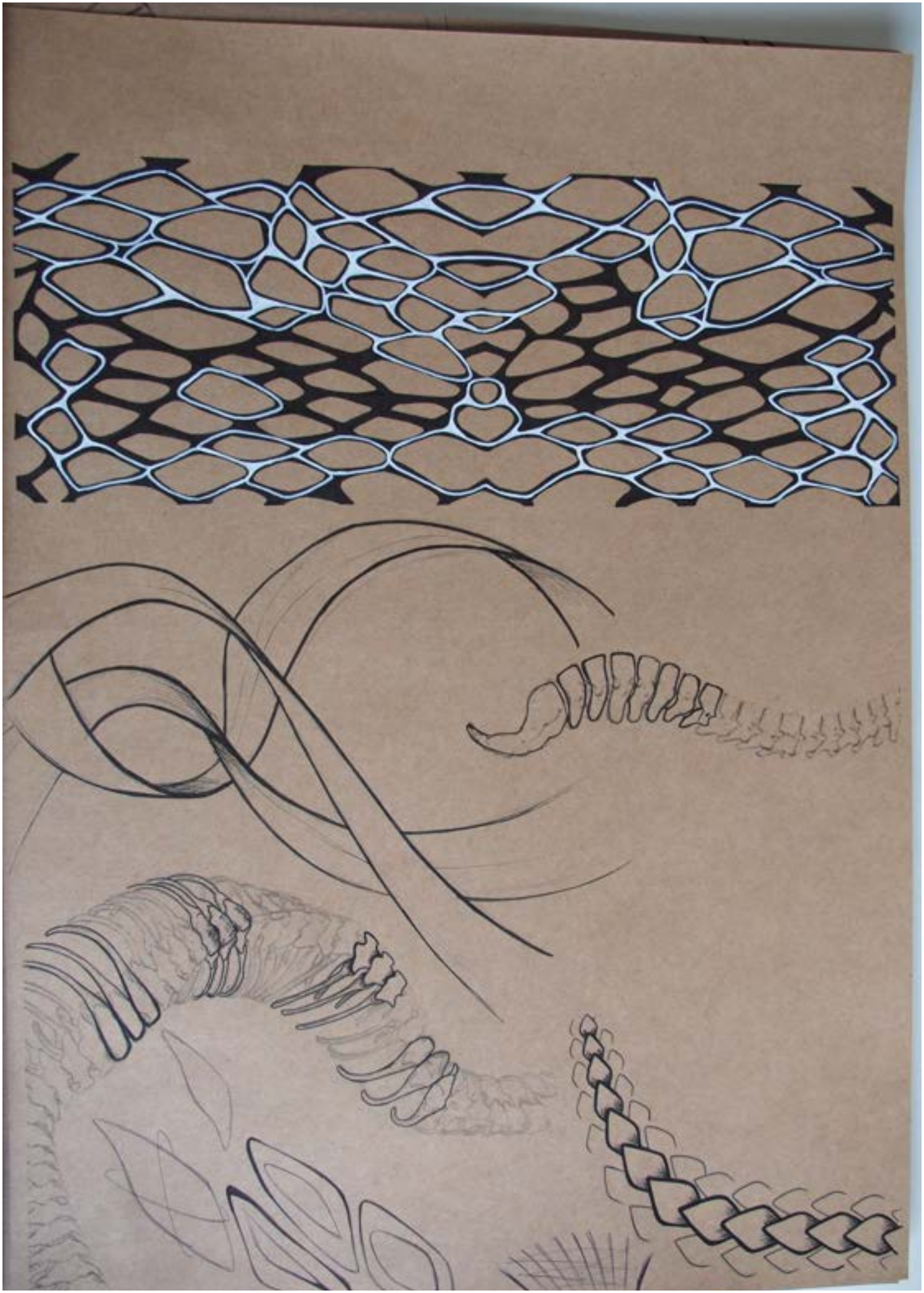
No part of the candidate evidence in this exemplar material may be presented in an external assessment for the purpose of gaining credits towards an NCEA qualification.

ORGANIC
GEOMETRIC
TRIANGULAR

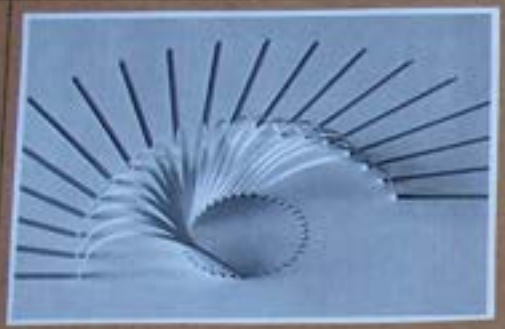
WRAP...
CURVES...
SHAPE SIMPLIFICATION
EYES...
MOUTH...
ROUND BODY...
SCALES...
MOUTH...
HEAD SHAPE
REPETITION
SCALE SKIN

FINE DETAIL

SHAPE EXPLORATION...



MODEL MAKING



MODEL MAKING

INITIAL IDEAS

INITIAL IDEAS

INITIAL BRIEF GUIDE

Design a product that is proactive towards solving current issues

Current Issues I'm interested in solving:

Transportation
-Traffic congestion is a huge issue in Auckland
-Potentially design high capacity, high speed transport
-Electric future to reduce carbon emissions and pollution

Health Care:
-Improve current prosthetics and medical disability equipment to reduce the stigma behind it
-Vehicles that encourage people to exercise more as obesity is still an issue
-Drugs

Final Statement:

Design an electric vehicle that enhances peoples' way of life such as conveniance and health, while being environmentally friendly.

New Brief to go before ideation concepts.

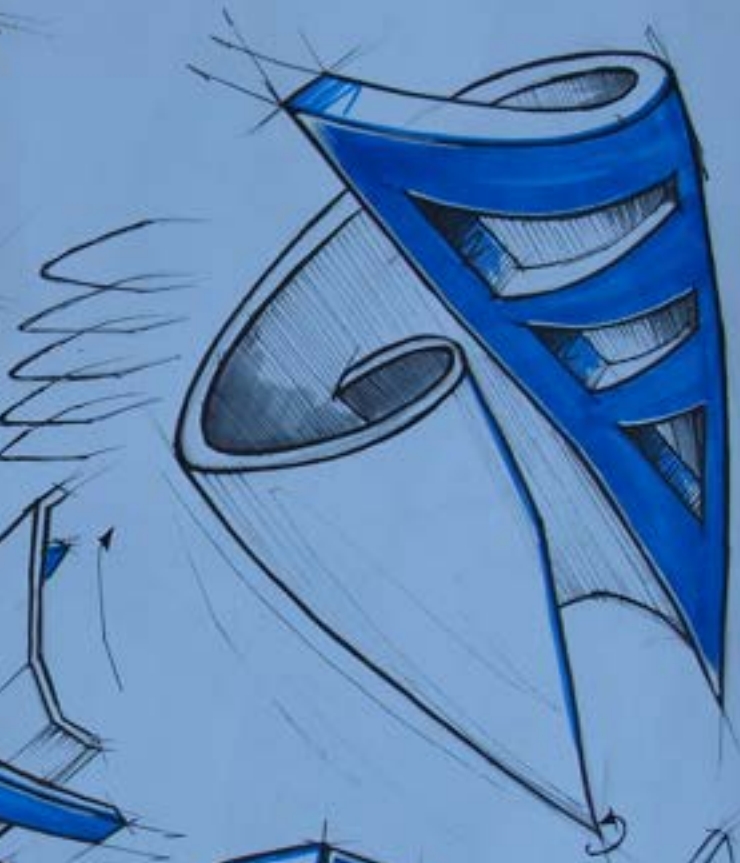
- After consideration I've decided to design a wheel chair, not just any wheel chair.....

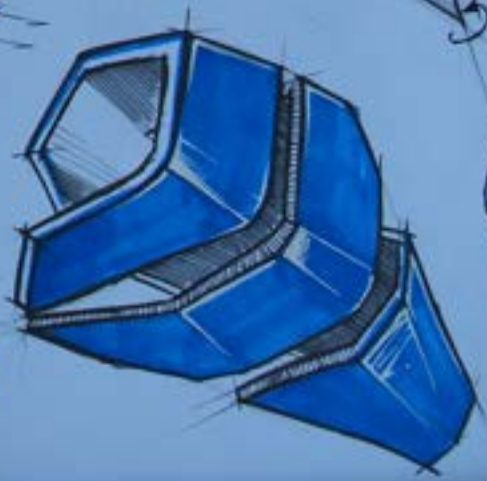
- Specifications - Must be.....

INITIAL IDEAS

WRAP...
INITIAL IDEAS

WRAP AND SKELETAL SHAPE EXPLORATION

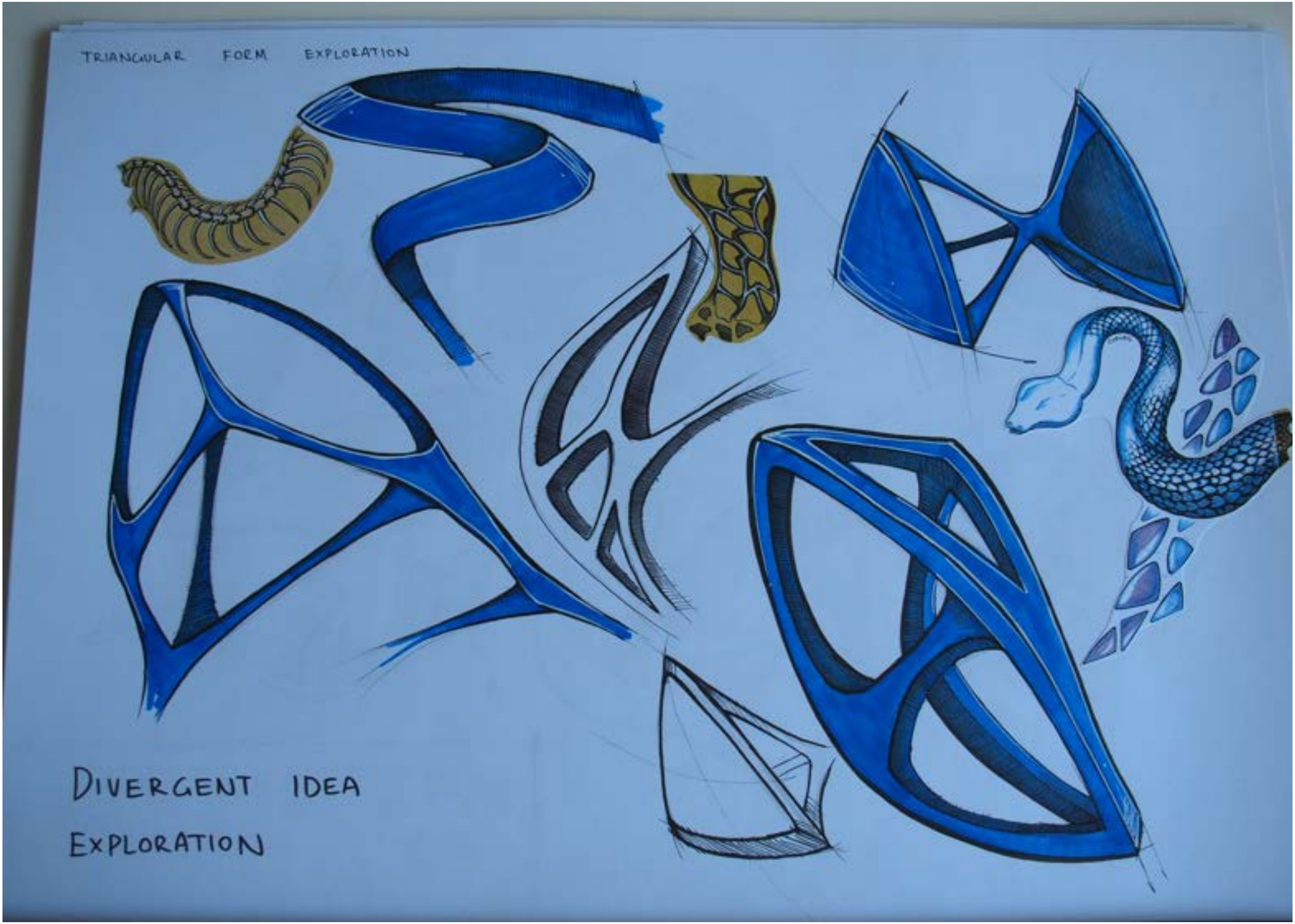




DIVEVERGENT IDEA

EXPLORATION

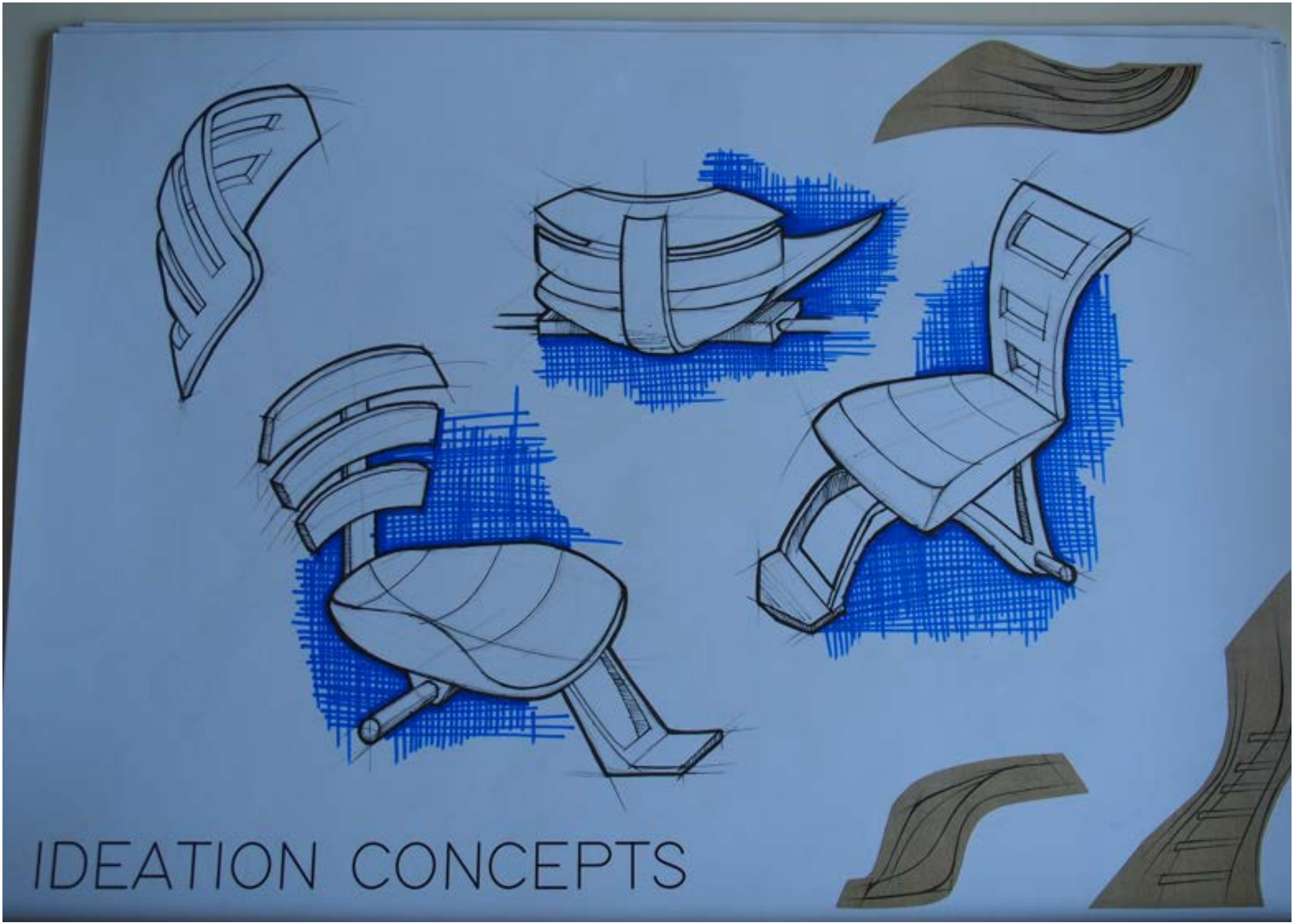
TRIANGULAR FORM EXPLORATION

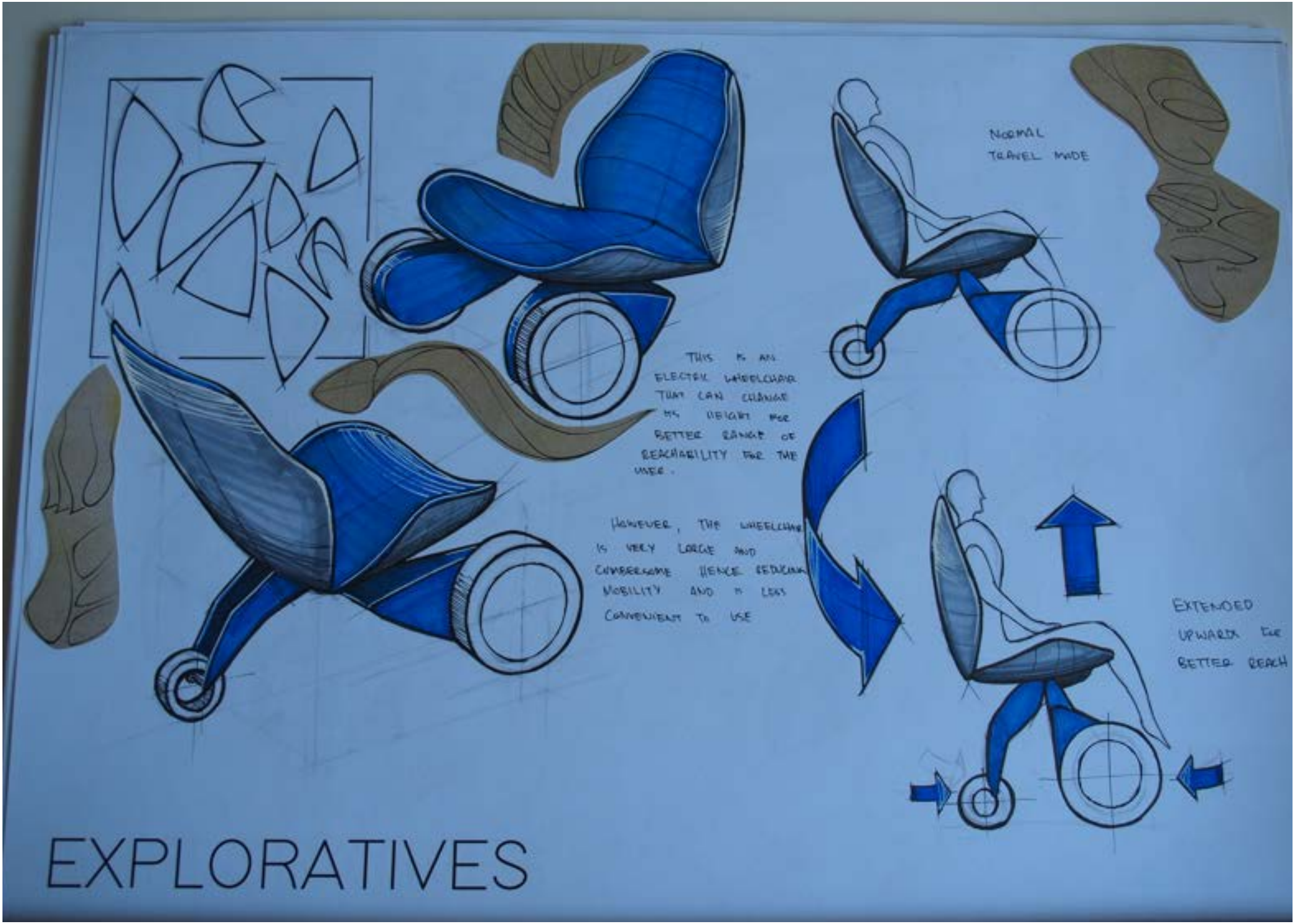


DIVERGENT IDEA EXPLORATION

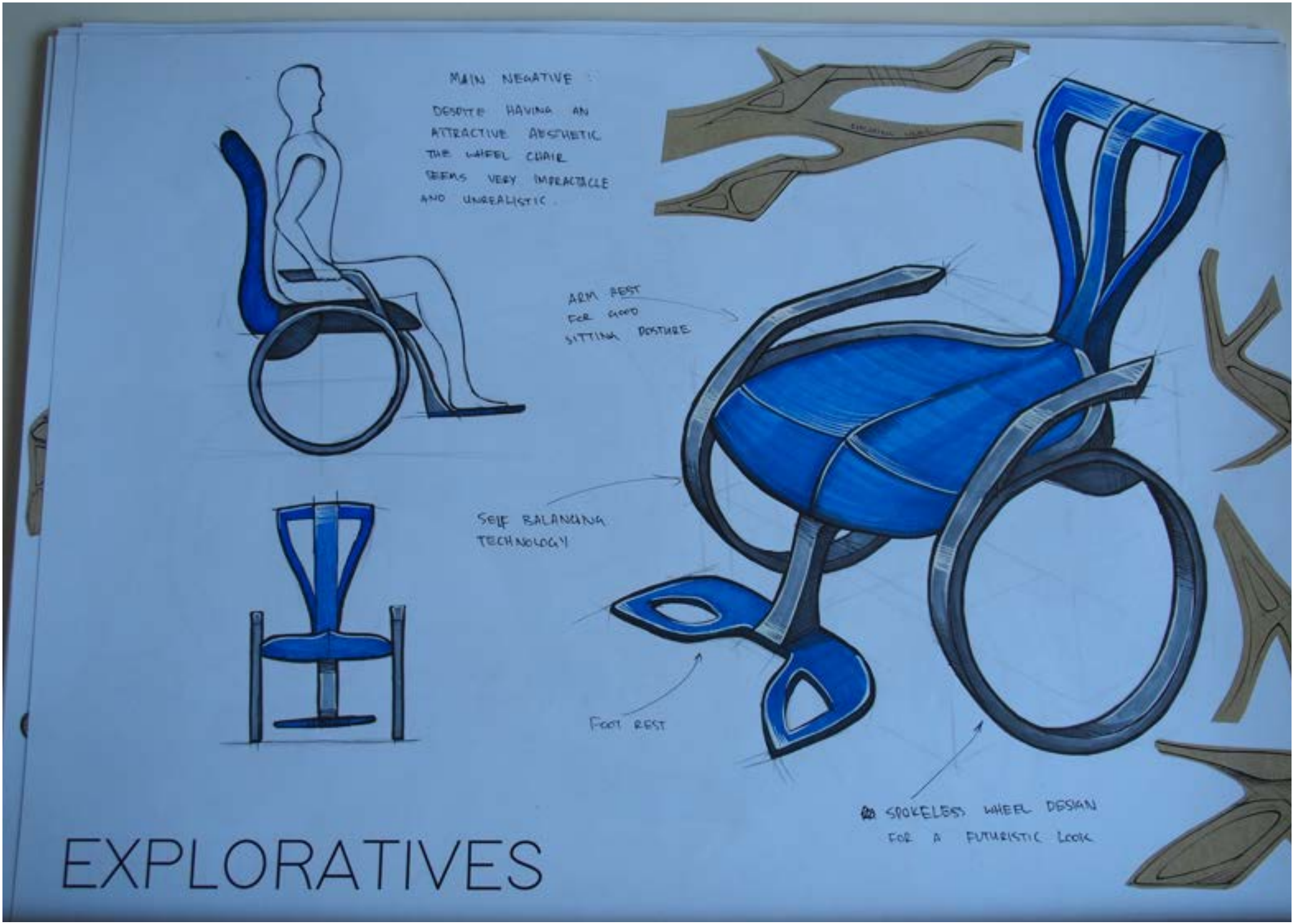
ORGANIC SHAPE EXPLORATION
DIVERGENT IDEA
GENERATION

IDEATION CONCEPTS


IDEATION CONCEPTS



EXPLORATIVES



EXPLORATIVES

EXPLORATIVES

OPPORTUNITIES :

- I WILL NEED TO FURTHER DEVELOP THE COMFORT OF THE WHEELCHAIR FOR A COMFORTABLE EXPERIENCE → ERGONOMICS DEVELOP
- I WILL NEED TO DEVELOP THE AESTHETICS INTO A CLEANER MORE MODERN LOOK → AESTHETIC DEVELOPMENT
- I WIL ALSO CHANGE THE WHEELS INTO SOMETHING MORE PRACTICLE AND REALISTIC, SO THAT THE WHEELCHAIR IS MORE DURABLE AND RELIABLE
- BATTERY AND ADDITIONAL COMPLEX ELECTRONICS MUST BE DEVELOPED AND EXPLORED

CONSTRAINTS :

- THE DESIGN MUST STILL BE MODERN AND HAVE AN ATTRACTIVE AESTHETIC.
- MUST STILL LINK BACK TO THE SNAKE ORIGIN.
- MUST BE COMFORTABLE WHILE BALANCING WITH THE ATTRACTIVE AESTHETIC.

CHOSEN CONCEPT

BRIEF & SPECIFICATIONS

After consideration of my current ideas, I have decided to design a wheelchair. Currently, wheelchairs are percieved to be unattractive while also being uncomfortable and inconvenient to use, fostering a stigma for wheelchair users. This gives potential for me to design a wheelchair that overcomes these issues, creating one that is aesthetically desirable whilst being functional and intuitive to use giving individuals with disabilities, whom already have a plethora of difficulties, confidence and ease of use.
To achieve this with my chosen wheelchair concept, numerous aspects must be carefully developed to fabricate a functional, ergonomic wheelchair for everyday use.

The wheelchair should:
-Be durable and reliable
-Have an attractive aesthetic
-Be intuitive
-Be comfortable
-Be functional - specifically for the urban environment
-Be safe - for the user and surroundings
-Have a relatively low environmental impact - constructed from sustainable materials

ALTERNATIVES

RESEARCH

ISSUES WITH WHEELCHAIRS

MOBILITY & OPERATION

PROBLEM:
It is rather combersome to constantly push and exert force to move the wheelchair, this leads to fatigue on the user's arms and palms while also making hands dirty from constant contact with the wheel which is unhygenic. Wheelchairs are also heavy, limiting portability while also being difficult to manoeuvre. With manual wheelchairs, it is difficult to move up an incline limiting its versatility in different places. Wheelchairs are also big and chunky which makes it diffcult to store and also fir into the daily environment.

SOLUTION:
These issues can be overcome by implementing electric motors for a hands-free, or power assisted operation. This reduces fatigue on arms, hands won't get dirty, while also allowing the user to move up inclines and travel at a faster speed. Portability can be improved by decreasing the wheelchair's weight through using strong light-weight materials. This is beneficial as it maximises the wheelchair's range as the electric motors use less energy to move a lighter weight. A focus on maximising the dimensions, keeping the wheelchair as compact as possible will lead to a more efficient design for daily use while still retaining useful features. This electric solution is more appropriate for living in the modern urban environment.

AESTHETICS

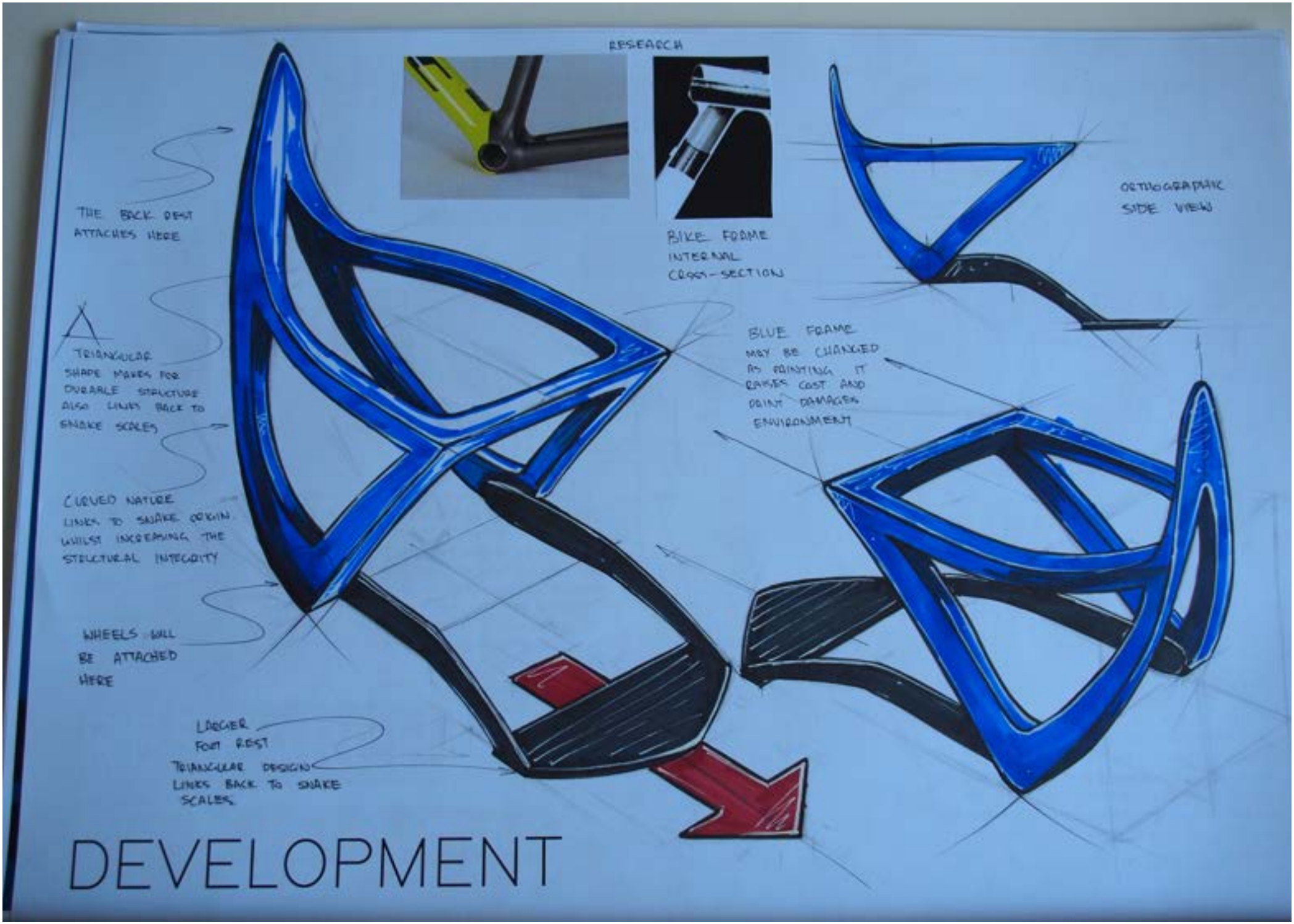
PROBLEM:
The majority of wheelchairs on the market currently, have unappealing, outdated, clinical designs which nobody finds desirable. This increases the stigma of using wheelchairs which is not healthy for the user's self-image.

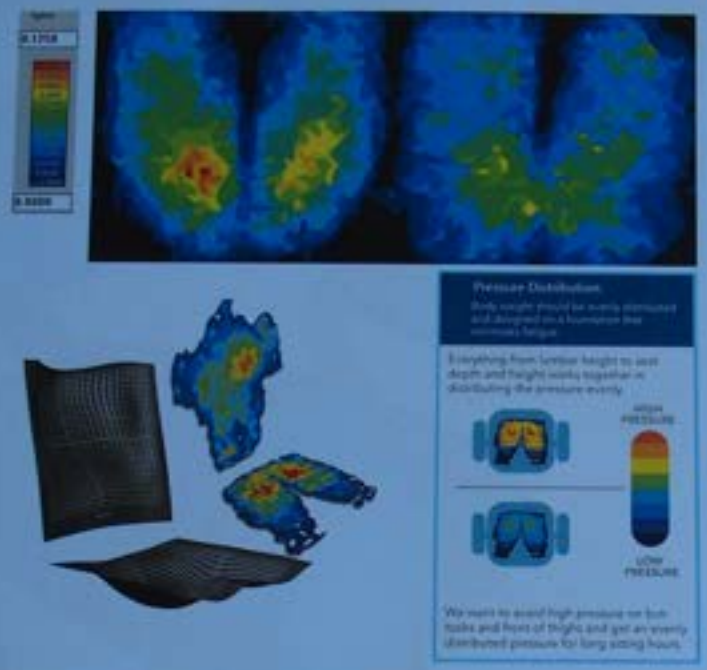
SOLUTION:
Design a wheelchair with an attractive aesthetic that is graceful, refined and futuristic so that people will want to use and admire. Much like a sports car, I would like to increase the confidence of the individual when using the wheelchair.

COMFORT

PROBLEM:
Wheelchair users commonly have back pains due to the poor ergonomics of the seat as it causes bad sitting posture leading to poor support that fatigues muscles causing pain. Another reason is there is an uneven pressure distribution of the individual's weight on the wheelchair seat, causing certain areas of the body such as the lower back and buttocks to be in pain due to higher pressure levels. The user's bottom becomes sweaty over an extended period of time sitting.

SOLUTION:
I will need to design my wheelchair seat so that it encourages correct sitting posture for good support hence more comfort. These issues can be also solved by selecting materials and a design that spreads body weight evenly onto the seat to reduce muscle fatigue, and a material that is breathable for better temperature regulation to reduce sweat and discomfort.


RESEARCH
THE BACK REST ATTACHES HERE
TRIANGULAR SHAPE MAKES FOR DURABLE STRUCTURE ALSO LINKS BACK TO SNAKE SCALES
CURVED NATURE LINKS TO SNAKE SKIN WHILST INCREASING THE STRUCTURAL INTEGRITY
WHEELS WILL BE ATTACHED HERE
LARGER FOOT REST
TRIANGULAR DESIGN LINKS BACK TO SNAKE SCALES
BIKE FRAME INTERNAL CROSS-SECTION
ORTHOGRAPHIC SIDE VIEW
BLUE FRAME MAY BE CHANGED AS PRINTING IT RAISES COST AND PRINT DAMAGES ENVIRONMENT
DEVELOPMENT



The above pressure distribution diagrams all show a similar reading where the buttock and the upper back regions have higher levels of pressure. This is not ideal as it causes greater fatigue on those areas of muscle, hence causing pain in the long term. Pressure needs to be spread out evenly by supporting a greater area, hence it is crucial to have good foot support to relieve buttock/thigh presusre, and supporting the lumbar region to reduce upper back pressure.

RESEARCH

HUMAN BODY ERGONOMICS

AVERAGE HUMAN DIMENSIONS

For maximum comfort, the individual should sit with correct posture to reduce back pain. For correct posture, the spine must remain neutral with correct support and the pelvis is perpendicular to the seat to reduce strain. My wheelchair seat must be shaped to encourage the user to naturally sit with correct posture.

SEAT ERGONOMICS

FLEXIBLE BACK REST

FLEXIBLE BACK SUPPORT FITS THE USER BETTER AS IT CAN BE SHAPED

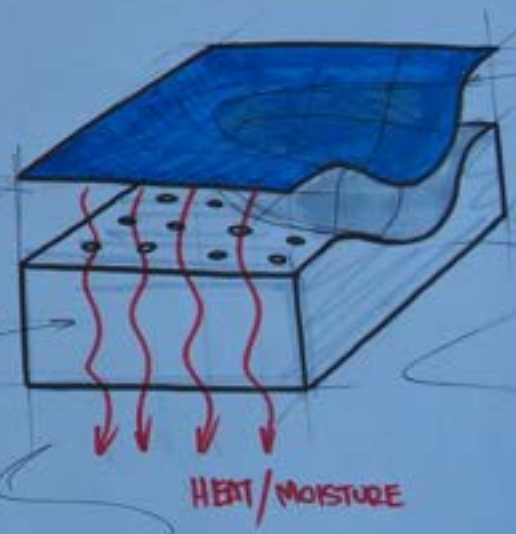
I HAVE ADDED AN ARM REST FOR BETTER COMFORT AND POSTURE

PROMOTES HEALTHY SITTING POSTURE

ARM REST 90°

FOOT REST TO SUPPORT BUTTOCK AND LEG MUSCLE

Office chair inspiration



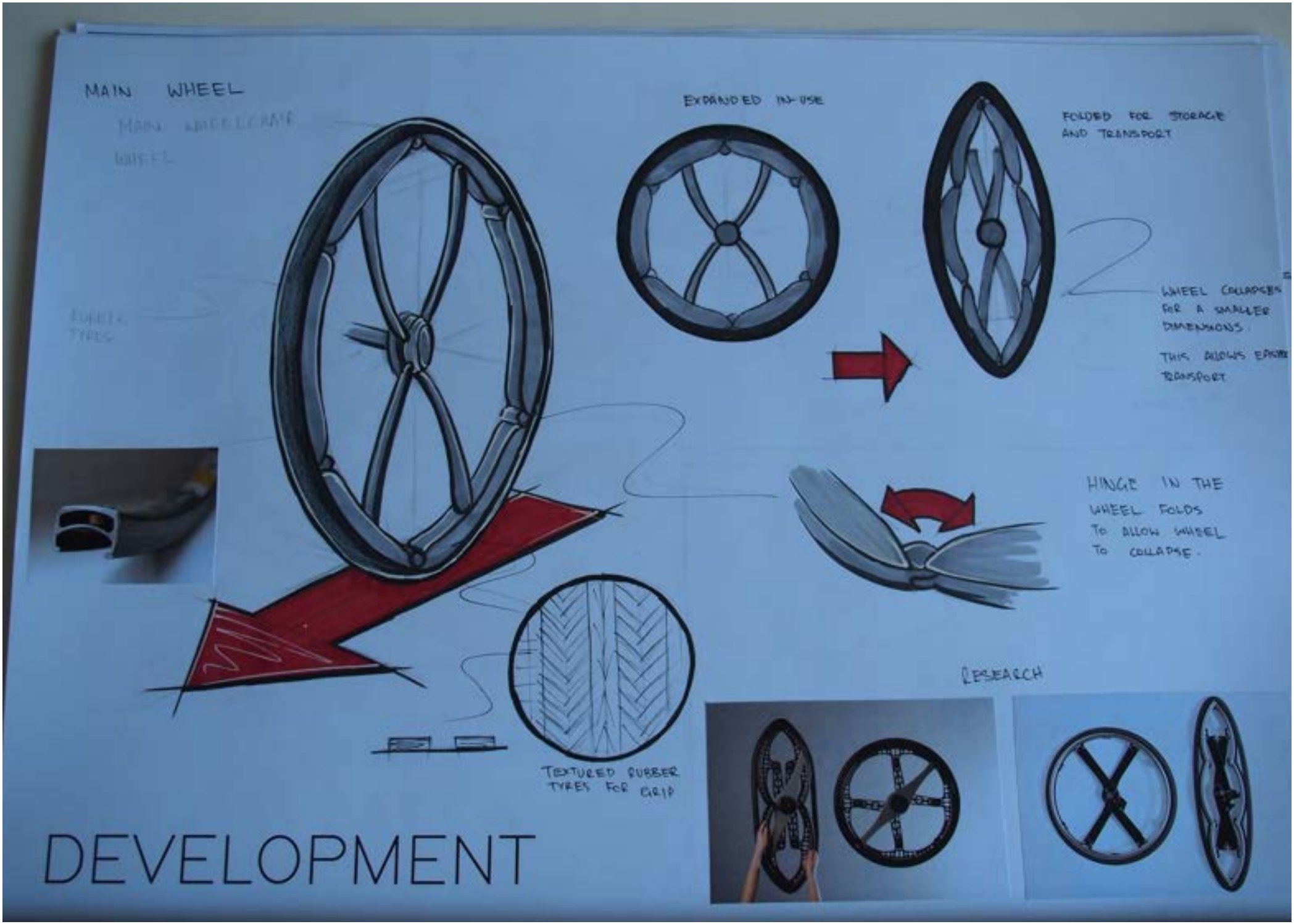
BREATHABLE MEMORY FOAM

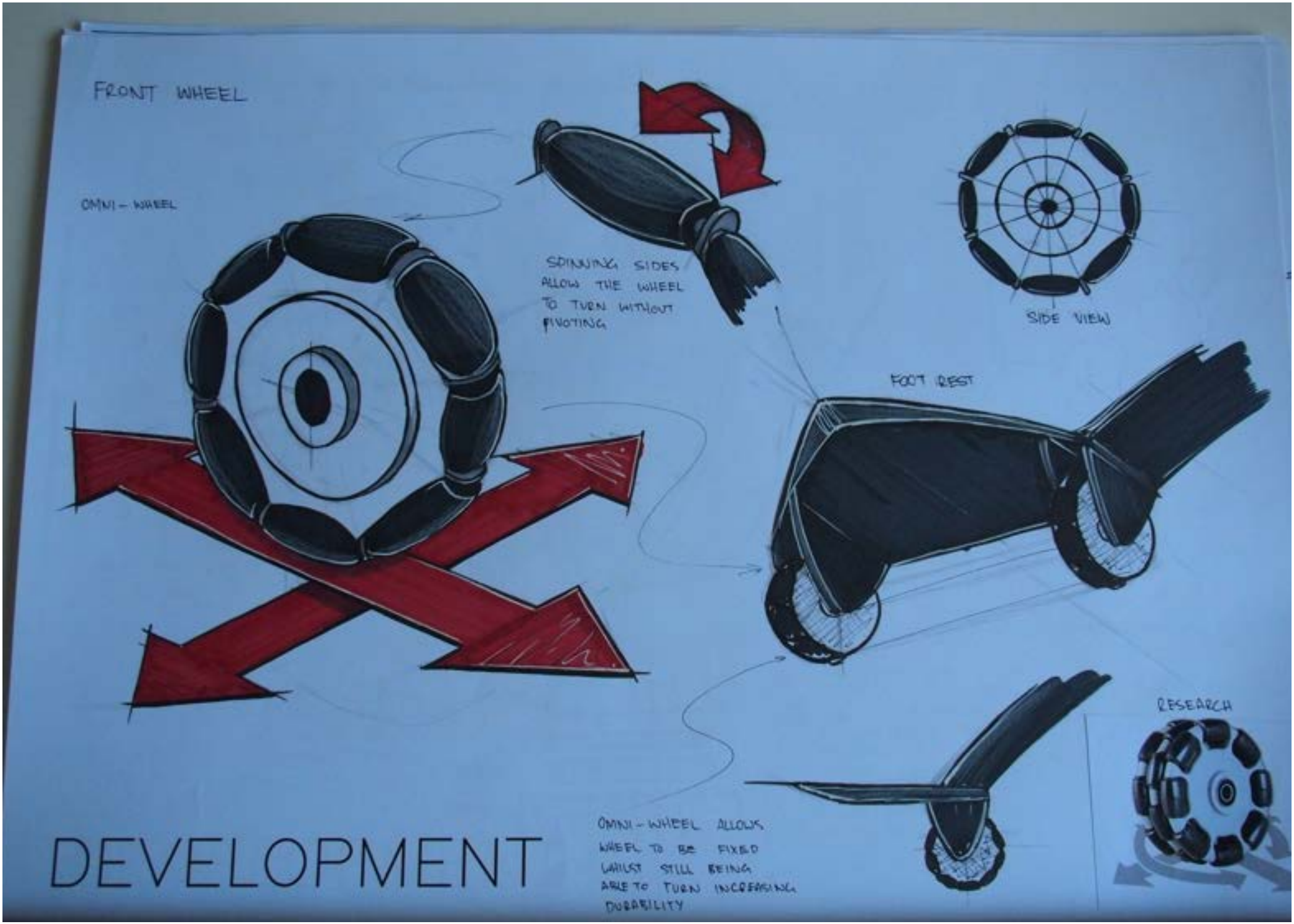
BREATHAB PROTECTIV MESH LAY

CONTOURS THE SHAPE OF THE U FOR BETTE COMFORT

HEAT / MOISTURE ESCAPES ALLOWING FOR BETTER TEMPERATURE REGULATION

DEVELOPMENT

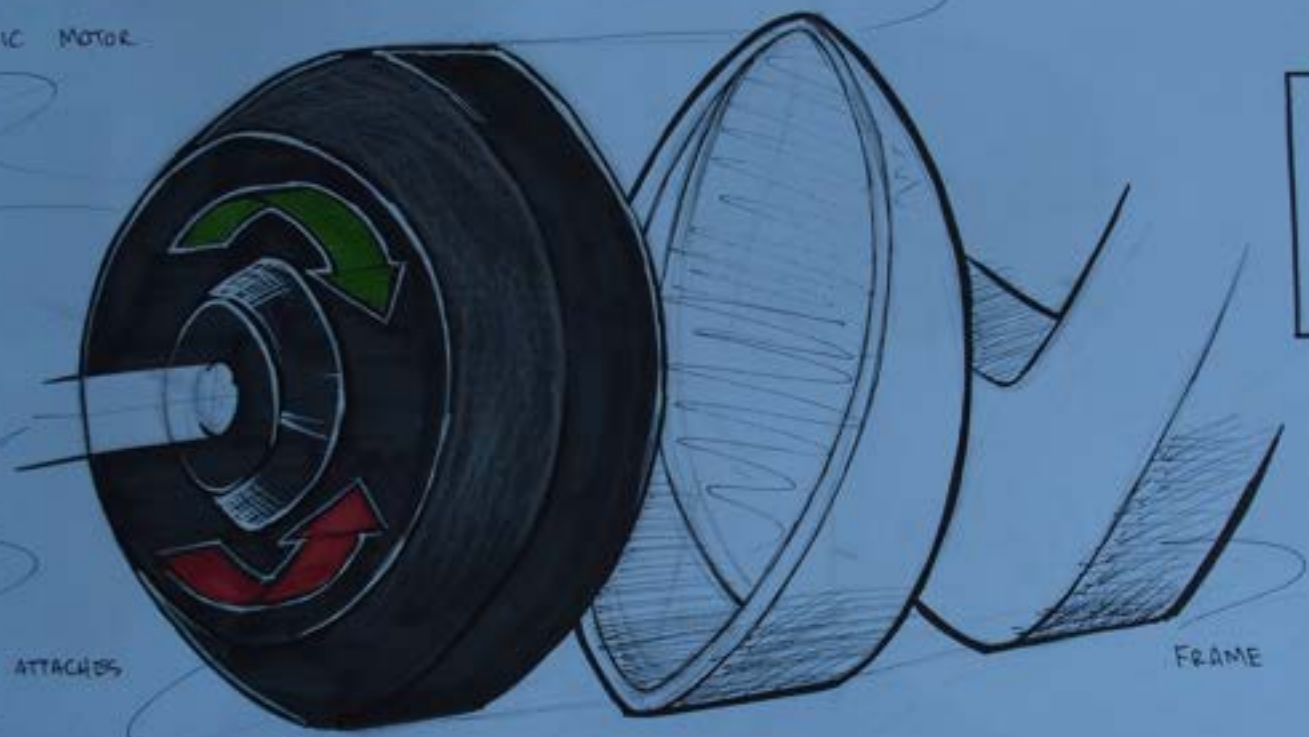

MAIN WHEEL
EXPANDED IN USE
FOLDED FOR STORAGE AND TRANSPORT
WHEEL COLLAPSES FOR A SMALLER DIMENSIONS.
THIS ALLOWS EASIER TRANSPORT
HINGE IN THE WHEEL FOLDS TO ALLOW WHEEL TO COLLAPSE.
TEXTURED RUBBER TYRES FOR GRIP
RESEARCH
DEVELOPMENT


FRONT WHEEL
OMNI - WHEEL
SPINNING SIDES ALLOW THE WHEEL TO TURN WITHOUT PIVOTING
SIDE VIEW
FOOT REST
RESEARCH
OMNI - WHEEL ALLOWS WHEEL TO BE FIXED WHILST STILL BEING ABLE TO TURN INCREASING DURABILITY
DEVELOPMENT

HOW WILL THE WHEELCHAIR MOVE?

MOUNTING BRACKET FOR MOTOR, ATTACHED WITH ROBUST HEX BOLTS.

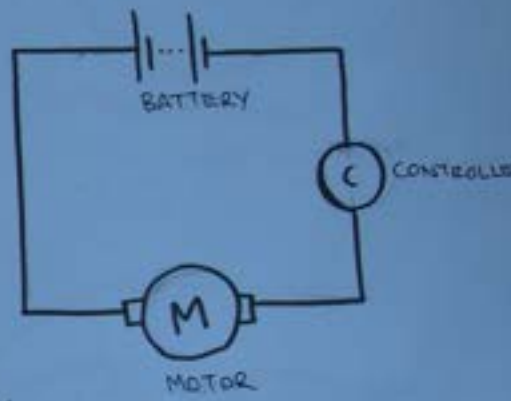
ELECTRIC MOTOR



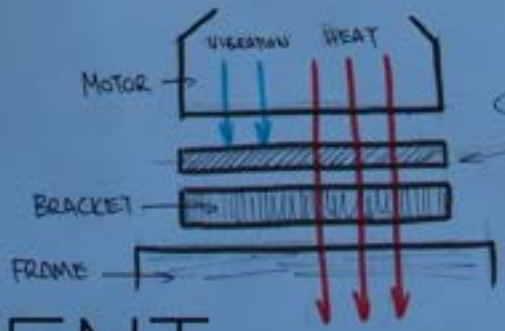
AXLE THAT ATTACHES TO WHEEL

FRAME

CIRCUIT DIAGRAM



REGENERATIVE BRAKING FOR DECELERATION. GENERATES ELECTRICITY TO CHARGE BATTERY



THERMAL CONDUCTIVE SILICONE PAD

① ALLOWS HEAT DISSIPATION TO METAL BRACKET & FRAME FOR COOLING

② FLEXIBLE, STRETCHABLE GOOD FOR VIBRATION SOUND DAMPENING FROM MOVING MOTOR PARTS

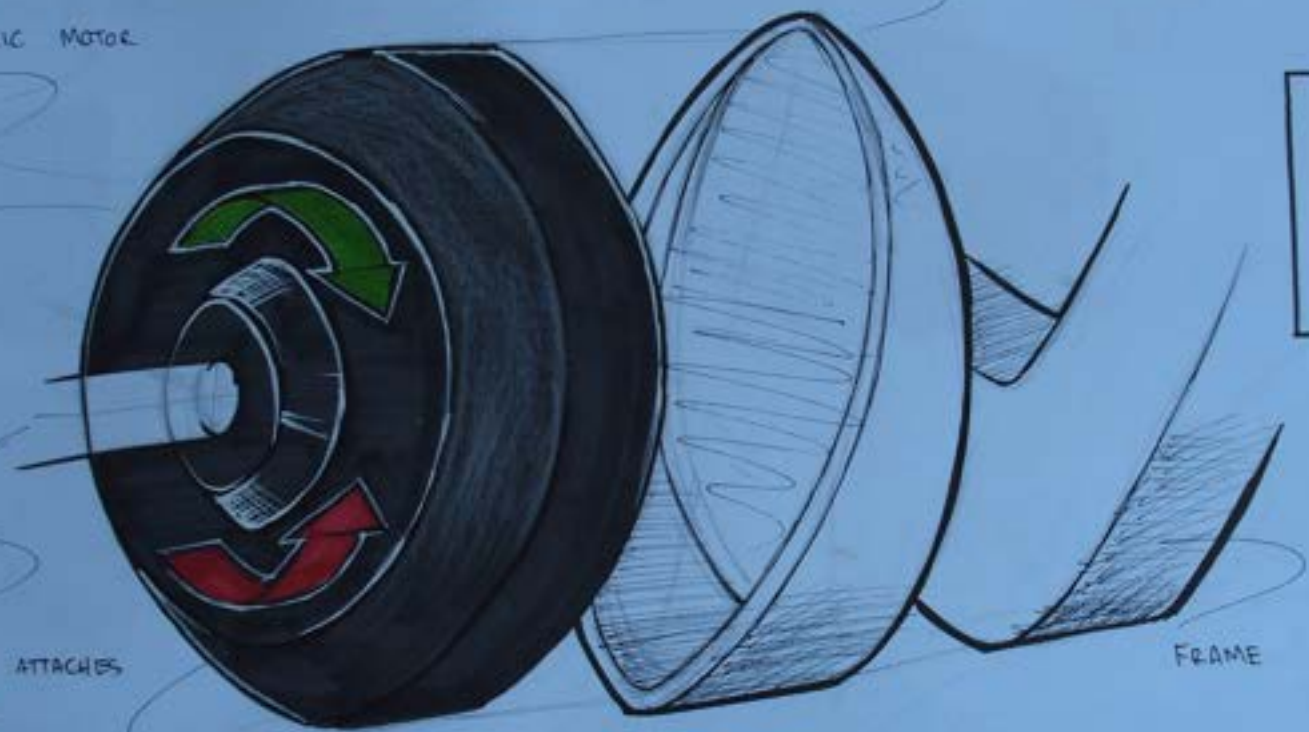
EXPLODED VIEW OF PERMANENT MAGNET MOTOR

DEVELOPMENT

HOW WILL THE WHEELCHAIR MOVE?

MOUNTING BRACKET FOR MOTOR, ATTACHED WITH ROBUST HEX BOLTS.

ELECTRIC MOTOR

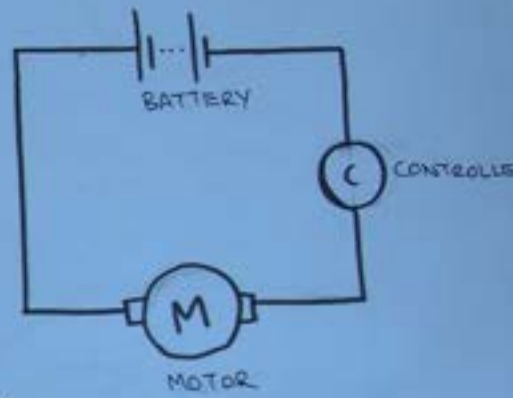


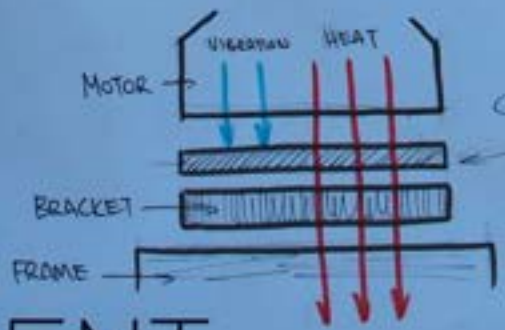
AXLE THAT ATTACHES TO WHEEL

FRAME

REGENERATIVE BRAKING FOR DECELERATION GENERATES ELECTRICITY TO CHARGE BATTERY

CIRCUIT DIAGRAM





THERMAL CONDUCTIVE SILICONE PAD

① ALLOWS HEAT DISSIPATION TO METAL BRACKET & FRAME FOR COOLING

② FLEXIBLE, STRETCHABLE GOOD FOR VIBRATION SOUND DAMPENING FROM MOVING MOTOR PARTS

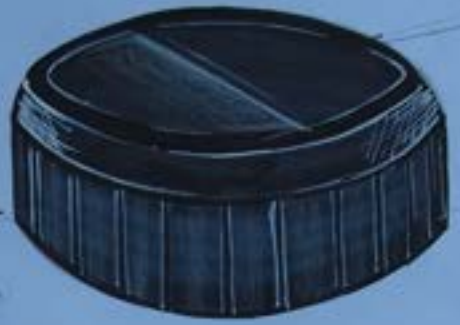
EXPLODED VIEW OF PERMANENT MAGNET MOTOR

DEVELOPMENT

HOW WILL IT BE CONTROLLED ?

RESEARCH / INSPIRATION

CAR INFO-TAINMENT CONTROLLER



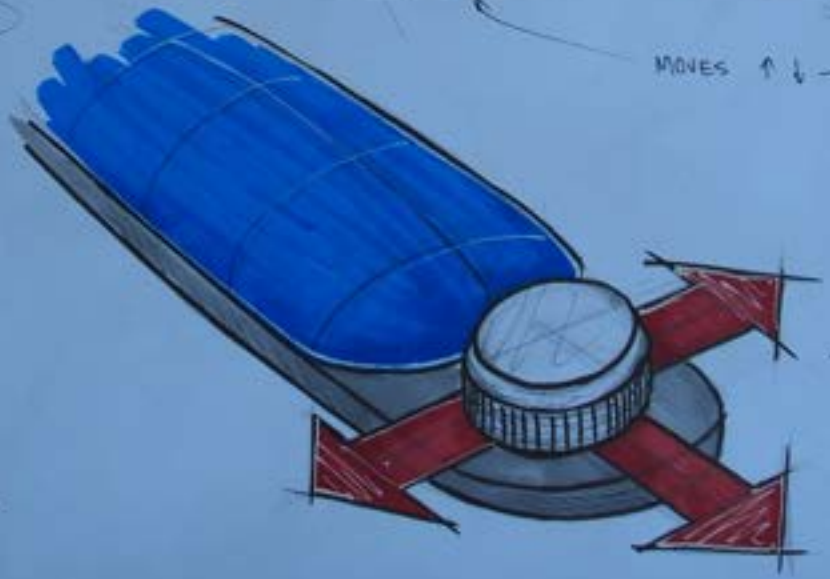
TEXTURED SIDES FOR GOOD GRIP

DIGITAL DISPLAY

SHOWS ELECTRONIC INFO OF THE WHEELCHAIR:
- BATTERY
- BLUETOOTH / GPS

SEAT ARM REST

MOVES ↑ ↓ → ←

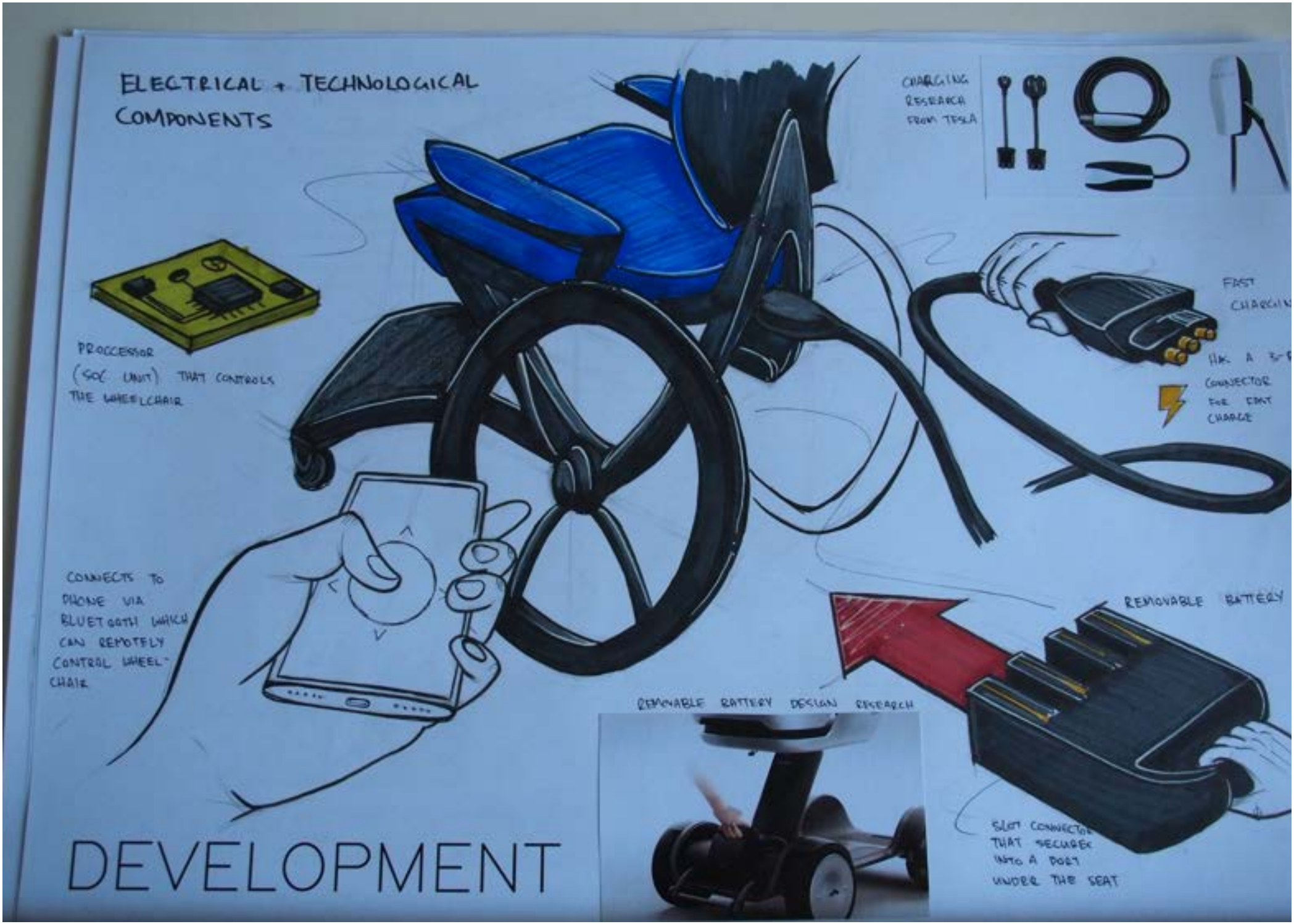


PUSH FOWARD
= ACCELERATE

PULL BACKWARD
= DECELERATE

SIDE
= TURN LEFT OR RIGH

DEVELOPMENT


ELECTRICAL + TECHNOLOGICAL COMPONENTS
CHARGING RESEARCH FROM TESLA
PROCESSOR (SOC UNIT) THAT CONTROLS THE WHEELCHAIR
FAST CHARGING
HAS A B-P CONNECTOR FOR FAST CHARGE
CONNECTS TO PHONE VIA BLUETOOTH WHICH CAN REMOTELY CONTROL WHEEL-CHAIR
REMOVABLE BATTERY
REMOVABLE BATTERY DESIGN RESEARCH
SLOT CONNECTOR THAT SECURES INTO A PORT UNDER THE SEAT
DEVELOPMENT

RESEARCH

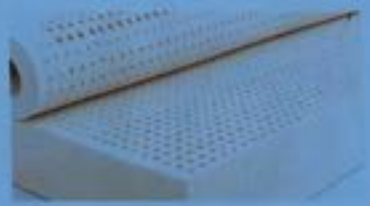
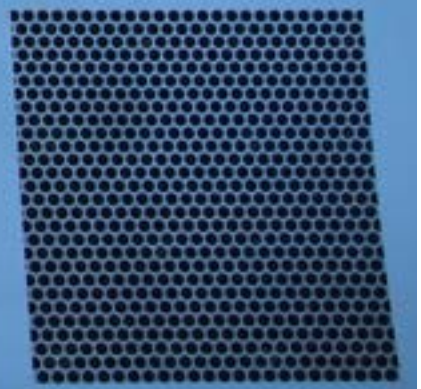
SEAT MATERIALS & DESIGN

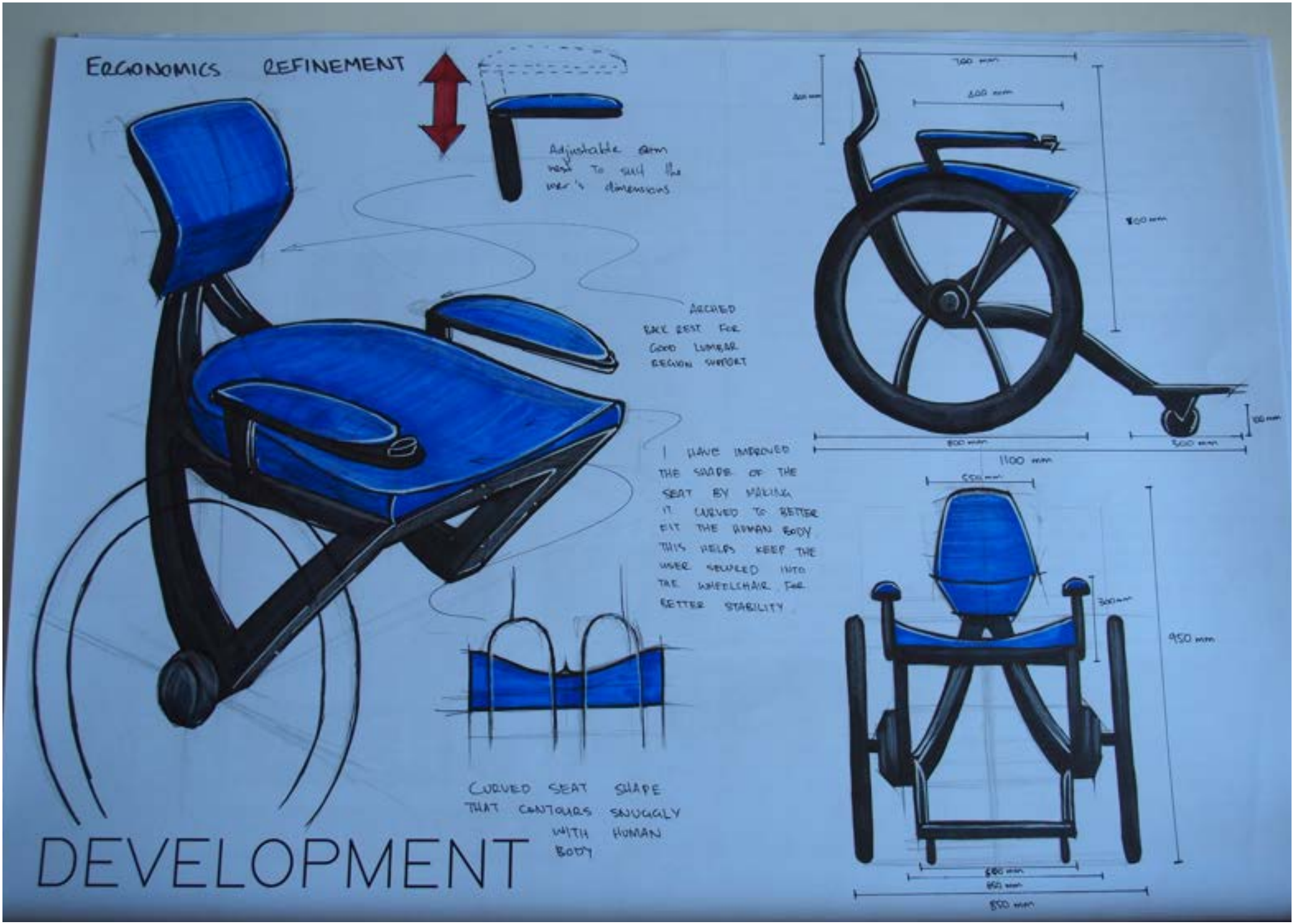
WHAT MAKES AN OFFICE CHAIR / CAR SEAT COMFORTABLE?

ADJUSTABILITY
The ability to adjust the different parts of the chair such as seat height, arm rest, head support allows the chair to fit the individual more precisely, hence offering better support.

SEAT DESIGN
A seat that has the appropriate dimensions, good lumbar support, good cushioning combine to fit the human body more ergonomically. It is essential that the seat encourages the user to sit with correct posture during extended periods of time to avoid back pain.

SEAT MATERIAL
A range of different seat materials are used in office chairs or car seats such as fabric, leather, mesh and plastic. Generally, a soft material that is breathable is ideal for a wheelchair as it regulates temperature better preventing the user's bottom from oversweating.

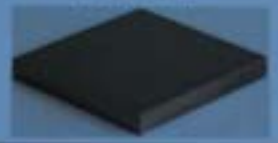




ERGONOMICS REFINEMENT
Adjustable arm rest to suit the user's dimensions
ARCHED BACK REST FOR GOOD LUMBAR REGION SUPPORT
I HAVE IMPROVED THE SHAPE OF THE SEAT BY MAKING IT CURVED TO BETTER FIT THE HUMAN BODY THIS HELPS KEEP THE USER SECURED INTO THE WHEELCHAIR FOR BETTER STABILITY
CURVED SEAT SHAPE THAT CONTOURS SNUGGLY WITH HUMAN BODY
1100 mm
950 mm
DEVELOPMENT

RESEARCH

MATERIAL ALTERNATIVES

Commonly in industry, all of these materials are always alloyed with other metals, resulting in many variations of the material, enhancing its properties like strength, weight and reducing cost.

	ADVANTAGES	DISADVANTAGES
STEEL 	-Dense material making it strong and sturdy. -Very durable material. -Low cost, cheapest material. -Recyclable, better for the environment. -Easy to manufacture, maximising efficiency and cost.	-Dense nature, it is heavy, not ideal for wheelchair portability and mobility. -As it is an alloy of iron, very susceptible to corrosion and rust making it is less durable which requires maintenance for repairs.
ALUMINIUM	-Lightweight material as it's low density. -Easy to work with which allows for a greater variety of structures. -Affordable -Recyclable, eco-friendly. -Aircraft grade aluminium is mostly used, which is resistant to corrosion.	-Due to its low density, metal is weaker compared to other metals hence more material is needed in the manufacturing process to yield the same strength. -Comparatively soft material which is prone to dents.
TITANIUM	-High strength-weight ratio allows for a lighter and stronger build. -Has dampening properties for good vibration absorption- smooth enjoyable ride quality. -Corrosion resistant -Very durable material that will last.	-Very expensive due to it's exceptional properties creating greater difficulties with construction and manufacturing.
CARBON FIBRE	-Extremely high strength-weight ratio making it extremely light weight. -Very strong -Corrosion resistant -Good vibration resistance. -Very durable can tolerate high levels of fatigue.	-Extremely expensive due to the complex manufacturing process. -Brittle, easily damaged during impact. -Expensive and difficult to repair, as if the structure is broken the whole piece must be replaced.

Comprehensively analysing and comparing these materials, I have concluded that it is advantageous to use a combination of these materials for the different parts of the wheelchair as each material has its benefits. Keeping costs to a minimum is ideal hence the expensive materials are only used on parts that absolutely require it. Keeping the wheelchair light weight is also a focus, which these materials will play a huge part in achieving, hence titanium and aluminium, cheaper than carbon fibre, will be mostly used. Many of these metals will be alloyed with other elements to enhance its properties and performance. I will be using titanium for the wheelchair frame as it strong and reduces vibration, while aluminium will be used for other parts such as arm rest and foot rest to keep cost low while keeping the wheelchair lightweight and strong.

MATERIALS

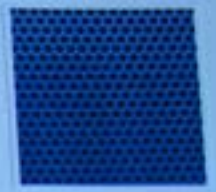
TYRES

TEXTURED RUBBER TIRES FOR GOOD GRIP MAKING WHEELCHAIR SAFER AND MORE CONFIDENT TO OPERATE

FRAMING

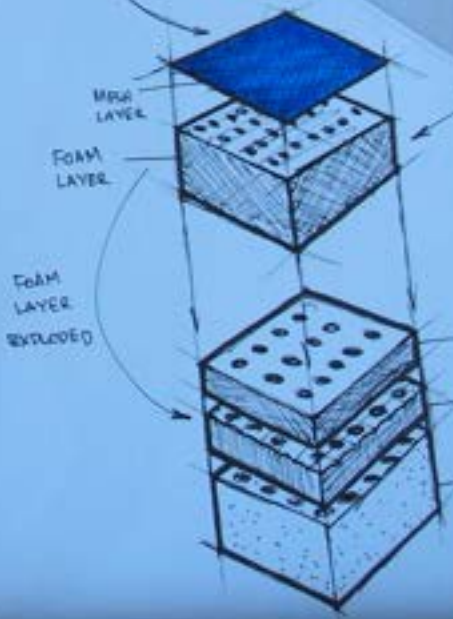
TITANIUM IS USED TO CONSTRUCT THE FRAME FOR A STURDY BUILD WHILE ALSO MAKING THE WHEELCHAIR LIGHTER WHILE BEING EQUALLY STRONG. TITANIUM ABSORBS VIBRATIONS VERY WELL MAKING THE RIDING EXPERIENCE MORE SMOOTH AND COMFORTABLE

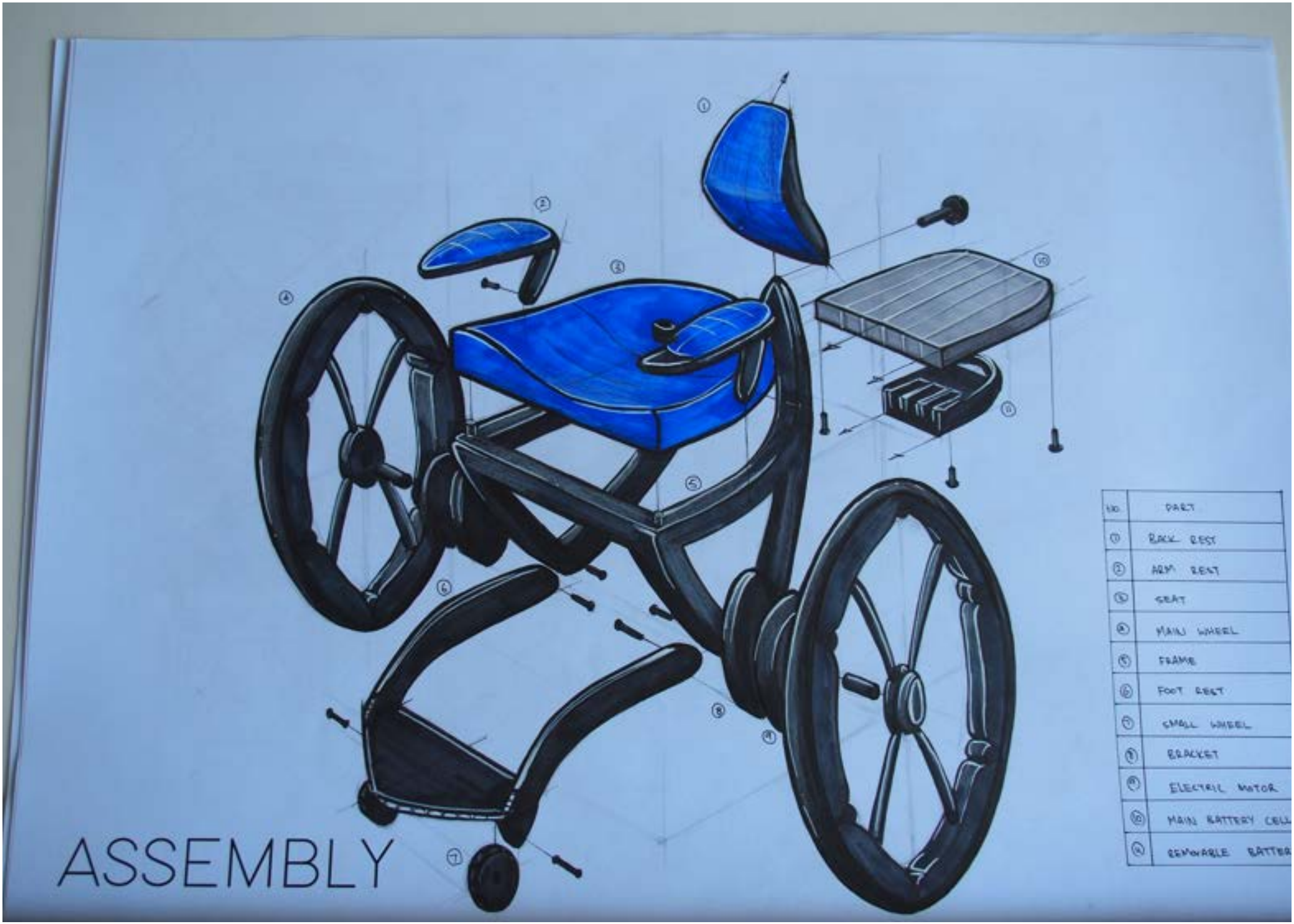
BACK REST



RUBBER MESH BACK REST FOR FLEXIBLE SUPPORT AND IS BREATHABLE FOR BETTER THERMOREGULATION.

SEAT




ASSEMBLY
NO.
PART
BACK REST
ARM REST
SEAT
MAIN WHEEL
FRAME
FOOT REST
SMALL WHEEL
BRACKET
ELECTRIC MOTOR
MAIN BATTERY CELL
REMOVABLE BATTER

FINAL DESIGN

DESIGN EVALUATION

My wheelchair is targeted to the average young adult. It has a modern minimalist design with an eye catching aesthetic with graceful curves and the blue elements of the wheelchair pop against the blacked out frame, giving the wheelchair a clean, stealthy, understated look. The original goal was to create a wheelchair that is different to what is on the current market, a wheelchair that has an attractive aesthetic along with advanced technology that will facilitate an incentive for people to use and enjoy, hence giving the user confidence and hopefully encouraging them to have a positive attitude towards their disabilities. I believe I have mostly achieved my goal as my wheelchair has an attractive modern aesthetic, along with numerous advanced technology such as Bluetooth connection to your smartphone for more information input while allowing the wheelchair to be controlled remotely from your phone. The electric motors allow the wheelchair to be operated with ease with a controller on the arm rest without physically pushing the wheel like conventional wheelchairs hence making my wheelchair good for everyday use while reducing stress and damage on the hands of the user.

In my ideation, I am glad I have thoroughly explored the forms, shapes and patterns of my origin idea of a snake which I have incorporated into my wheelchair design. The triangular scale shapes not only gives the wheelchair a sharp and modern design but also serves a functional purpose in making my frame very strong as the triangle shape is one of the sturdiest shapes for structural integrity, hence making my wheelchair more durable against accidents and everyday stress and tear. The curves of a snake also influenced my wheelchair design balancing the geometry of my wheelchair by creating flow in my wheelchair, fabricating a design that is streamline and asymmetrical to complement the geometric straight lines of the frame and many other components.

Looking at my Brief & Specifications I believe I have incorporated most of the specifications required.
That includes:
Durable and reliable
Attractive aesthetic
Intuitive to use
Comfortable
Functional
Safe
Low environmental impact

Further analysing whether I have satisfied my brief requirements, I would have liked to explore methods in reducing the environmental impact of my wheelchair towards the environment. I would liked to have developed more efficiency to save more energy along with exploring manufacturing methods and materials that reduce carbon emissions and use recycled material. This in turn would make my wheelchair more realistic in the real world, one that can be sustainable and have a positive impact not only to the user but also to the environment. Another aspect I would have liked to developed was the safety of my wheelchair, many safety features such as brake sensors, headlights, and braking were not throughly considered hence reducing the viability and logistics of my wheelchair in the real world. Overall I am very happy with my wheelchair design in the end. It has a clean, stealthy pleasing design with numerous technologies that help improve the user experience of a wheelchair making it more intuitive to use than a conventional wheelchair.

Assessment Schedule – 2019

Design and Visual Communication: Initiate design ideas through exploration (91627)

Achievement Criteria

Overall level of attainment for 91627	Achievement	Achievement with Merit	Achievement with Excellence
E	*Initiate design ideas through exploration.*	*Initiate design ideas through **insightful** exploration.*	*Initiate design ideas through **extensive** exploration.*

Evidence

Not Achieved	Achievement	Merit	Excellence
No source is material evident. Source material is not interpreted using visual communication strategies or taken into alternatives and variations. Design ideas are not derived from the alternatives and variations.	Use an **experience**(s) to generate **starting ideas**; using visual communication strategies to **interrogate and re-generate** ideas towards **design ideas**. Inspirational sources (**experiences**) are present. These could include mood / inspiration boards, compilation of images, collage, designer studies, modelling, observational drawing, photographs, etc. From inspirational sources, visual communication strategies are used to experiment, play and manipulate shape (2D) and form (3D), exploring **alternatives** and **variations** to generate **starting ideas** • **Alternatives** are distinct, different, contrasting or have divergent shapes / forms. • **Variations** are adaptations, alterations and modified versions of a shape / form. Alternatives and variations are visually **interrogated and re-generated** which lead towards **design ideas**. • **Interrogated and re-generated** refer to the thinking and visual communication of shapes / forms that are re-examined / critiqued, selected, and re-drawn. • **Design ideas** must have identifiable functional and aesthetic qualities.	Use visual communication strategies to analyse and identify an **emerging train of thought** and **re-interpret ideas** to form design ideas. Through the **reinterpretation** of design ideas an **emergent train of thought** is evident. • **Reinterpretation** of design ideas is applying thinking and visual communication that is purposeful and meaningful in its connection to its context. • **Emerging train of thought** is where a theme is developing with a perspective (viewpoint) and direction (intention) in either a functional / aesthetic / contextual or thematic way.	Use visual communication strategies to challenge thinking and **extend and transform ideas** to form design ideas. The train of thought of design thinking is **further extended / transformed**, which challenges and / or moves beyond the predictable design idea. • **Transform ideas** means the design idea has been seen in a new way.

Note: Visual communication strategies may include but are not limited to: abstraction, recombination, repetition, rotation, reflection, simplification, de-construction, truncation, exaggeration.

Excellence Exemplar 2019

Subject	Design and Visual Communication	Standard	91627	Overall grade	E

Annotation

Pages 1–9 contain the starting experience and explore forms and shapes from looking at snakes. Pages 10–21 introduce an initial brief and continue to re-examine shapes and forms and re-generate these into an identifiable design idea. Pages 22–41 shows a detailed brief and has a focused train of thought that has connection to context, human user, function, aesthetics. The design thinking and contextual research is purposeful and meaningful in relation to the design idea. Re-interpretation and transformation of the idea occur in this section. This submission is an Excellence. The visual communication details the design thinking in a coherent manner. The final end pages make the idea understandable. It is useful to note that the end evaluation does not add anything to the submission and does not benefit the visual communication of the design idea. Large quantities of writing, in this case the evaluation, defeats what the intention of this external standard is about. The evaluation has come from the work being generated as part of the internal standards.