TIC PROTECTION

Project Deliverable C: Conceptual Design and Project Plan

Intro. to Product Dev. and Mgmt. for Engineers

GNG 2101 A02

Group A6

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C.1 Conceptual Design.

1. Based on customer needs, clarify core functionality by breaking down required product functions (functional decomposition) into smaller basic sub-functions, identifying external sub-system boundaries.

Core Function 1: Prevention of Injury

- Cut resistant for palm
- Padding for knuckles to prevent dislocation
- Burn resistant for palm
- Extra protection for middle knuckle

Core Function 2: Feel as if user is not wearing our gloves

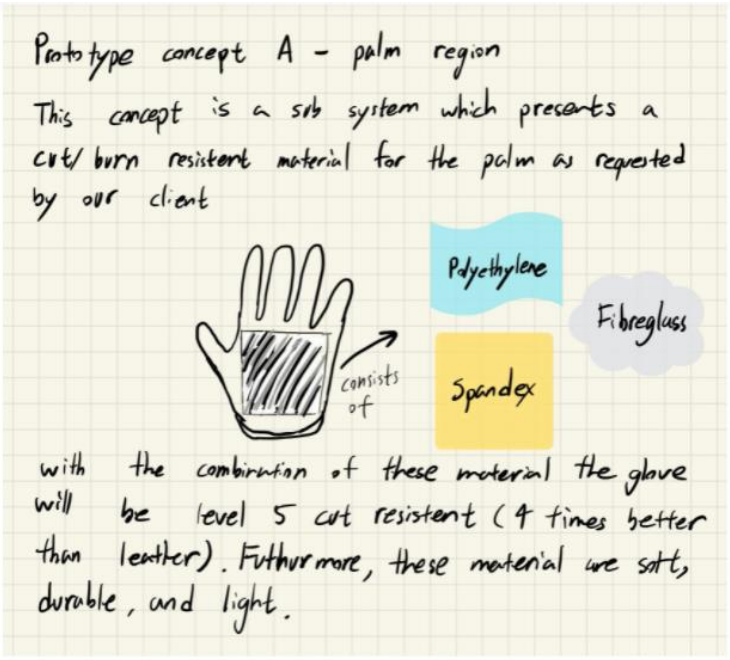
- Exposed fingertip
- Fingers free to move
- Can be worn to sleep
- Lightweight
- Breathable
- Fashionable

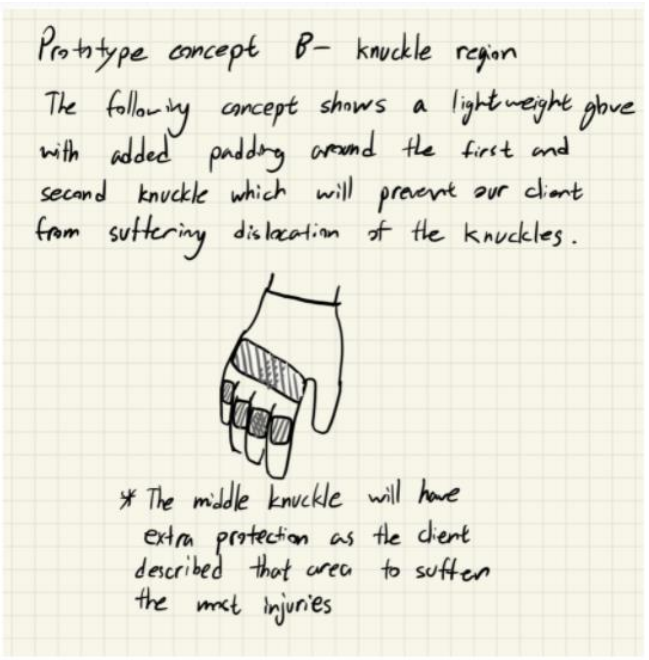
Core Function 3: Durability

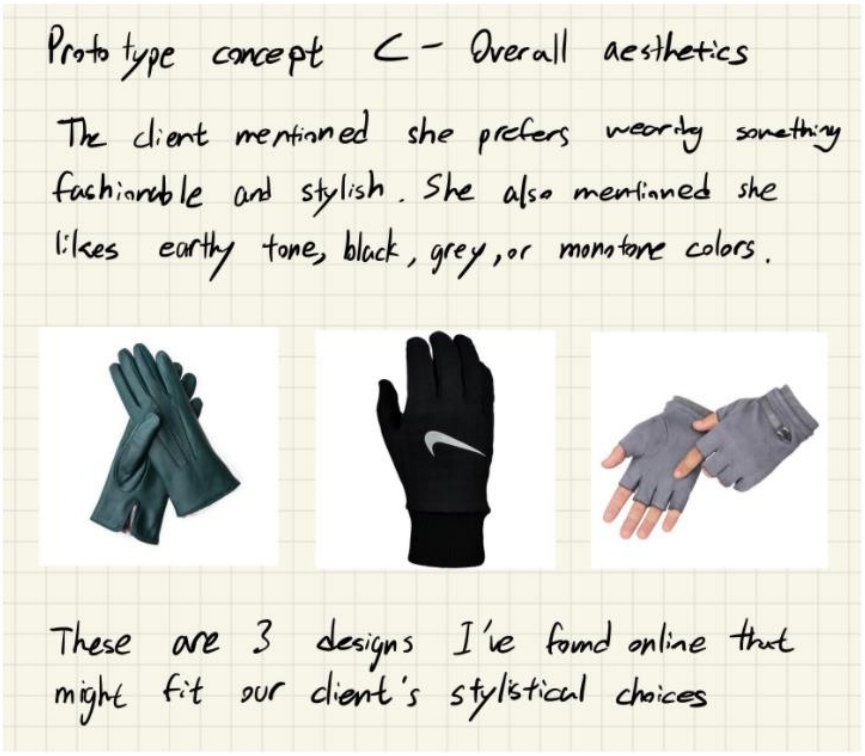
- Easy to be cleaned
- Can be washed
- Can be worn all day
- Doesn't get dirty easily

2. Provide a minimum of 3 product concepts per team member (clearly identify each concept's creator). A concept may be for a subsystem or a global concept. Start from your functional decomposition/use case diagram, provide product concepts for a sub system or the entire system.

Eric







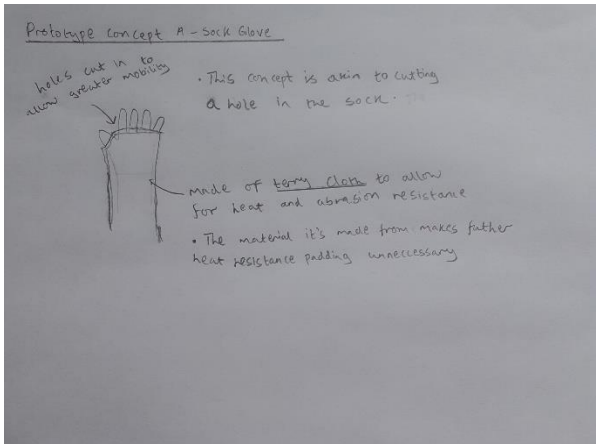
Ethan

A) Silicone palms for heat resistance, but with small holes for breathability. Slightly raised surface around the holes to keep hand safe (similar to a rubber oven mitt)
Similar to above but with holes inside each little circle.

B) Hard knuckle caps covered in a layer of some sort of foam to protect both the hands and the body. Motocross gloves would work as a good base for this idea since they would be easy to modify to accommodate other protective aspects as well.

C) A fabric cover for aesthetic purposes, should be replaceable in case of damage. Either a sleeve that goes over the glove or a sheet that velcro's to the back of the hand. Either we or the client could make more designs than the one requested if desired.

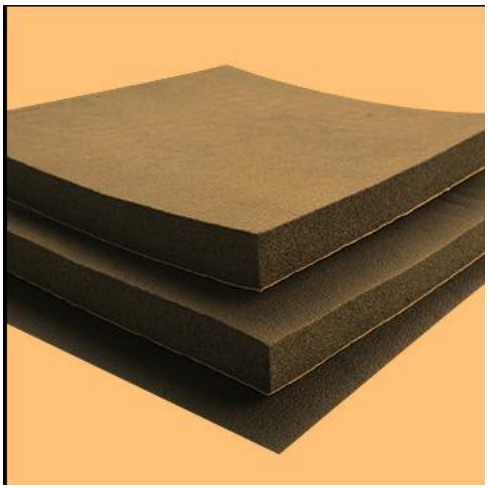
Etinosa



A) "Terry cloth autoclave gloves provide durability and long wear with heat and abrasion resistance". concept a involves cutting finger holes into these gloves to allow for greater mobility.

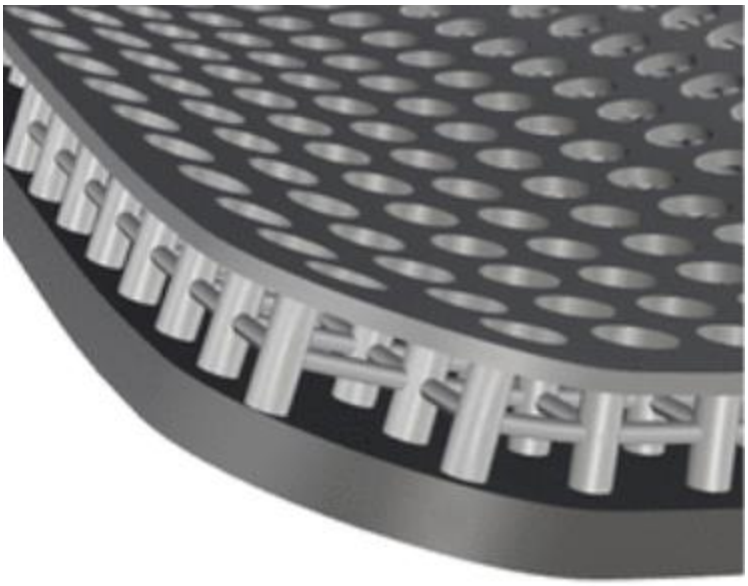
HEAT RESISTANT GLOVES

B) concept b involves leaving the glove as it is in order to allow padding to be fitted inside the fingers of the gloves offering greater protection for the client.
These gloves are often used in the handling of heavy machinery where a burn hazard is likely, the material they are made of is naturally an insulator.
These gloves are also abrasion resistance which means it offers protection from scrapes and grazes, this could be invaluable to our client as I believe that tics could be particularly dangerous near sharp and rigid objects.



C) I also suggested that the gloves could be fitted with some nitrile padding which is often used in MMA gloves.

Ritaj
A) "Shin pads" made from a variety of common materials (polypropylene or polyethylene) and high-resistance materials (glass fibre, carbon fibre or Kevlar) then add lots of foam cushioning on both sides. Can be 3D printed to sizes suitable for knuckles to give durable protection.



B) Hard plastic “framing”. 3D printed thin plastic that will act like frames or splints for the knuckle to keep them in place and separated. This will be done in hopes of securing the knuckles etc from dislocations.
C) Kevlar as a material for the overall glove. It has a very high heat resistance and is very durable.

3. Analyze and evaluate all concepts provided by each team member based on the target specifications of Project Deliverable B. Use simple calculations and/or simulations to make decisions. Justify the process and methods used for analysis and evaluation.

Eric
Eric’s idea for the cut resistant palm material is very promising given the research he conducted, and the client likes it as well. His idea for knuckle protection is also good, and he rightly added that we should put more protection on the middle knuckle as the client has more problems in that area. Eric’s final idea was colour selections for aesthetic purposes, and the client indicated they like the first colour.

Ethan
Ethan’s idea for silicone palms was good for heat resistance, but concerns were raised that it may get uncomfortable after long periods of use. Ethan and Ritaj had similar ideas for knuckle protection, where there would be a hard knuckle cap covered on either side by foam padding for extra protection and comfort. Ethan’s last idea was a removable sleeve for aesthetic purposes that would be replaceable in case of damage.

Etinosa
Etinosa had the idea to use a material called Terry cloth which is used in welding gloves, as it is both burn and abrasion resistant. The client was worried that this material may not be breathable enough for long term use. He also suggested that the padding could be made of nitrile.

Ritaj

Ritaj suggested using fiberglass or carbon fiber to 3D print knuckle caps in a lattice structure with added padding for more protection and comfort. Ritaj also suggested adding splints between the fingers for extra support against dislocation.

4. Choose one or a few promising solutions you wish to develop further based on your evaluation.

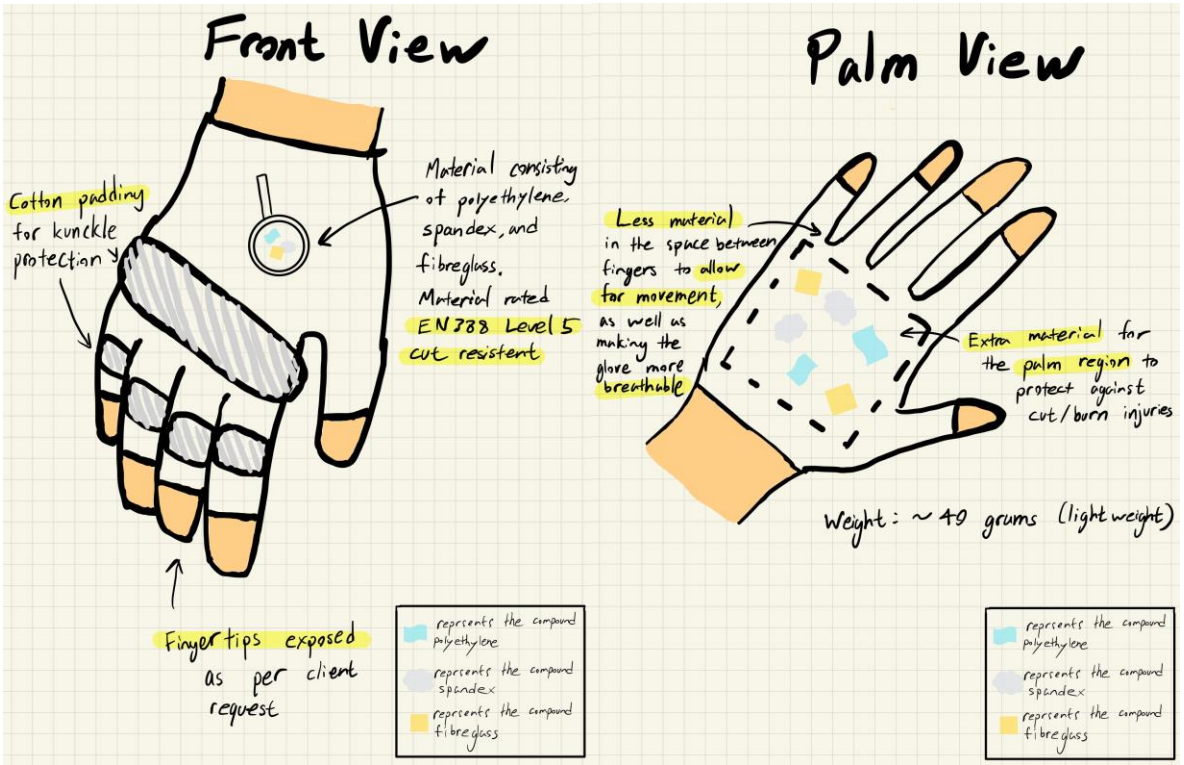
The client specifically asked that we use Eric's idea for the polyethylene spandex fiberglass palm so we will continue to develop this idea further. We will also conduct more research on Ethan and Ritaj's idea of hard knuckle caps with added padding and incorporate Eric's suggestion to reinforce the middle knuckle which the client says is more prone to injuries. We will continue to look at stylistic options later in the semester once we have a more functional prototype.

5. Develop a group design concept which is either an integration or modification of the promising concepts chosen in the previous step, or a brand-new concept created from these ideas. Justify your approach.

We worked on integrating a few of the concepts presented, we decided that the glove should be made of materials consisting of spandex, polyethylene, and fiberglass to maximize elasticity in order to fit more padding. it would be best if the fingertips were exposed to allow it to be more breathable as per the client's request. Paddings would be fitted on the knuckle and finger joints for protection while a heat-resistant material would be used to pad the palm. The glove should be lightweight and only weigh about 40 grams.

After deliberations we decided that these features correspond the most to our client requests while still integrating various things that we believe are necessary in our product.

6. Visually represent (sketch, diagram, CAD model, etc.) your group concept.



7. Provide a few lines explaining your concept's relationship to the target specifications, as well as its benefits and drawbacks. Your target specs can evolve from PD B.

The main target specifications concluded are:

- Heat resistance: ideal >150C, acceptable >100C
- Blunt force protection: ideal >1500N, acceptable >800N
- Mobility/flexibility: up to the client
- Fit of the glove: up to the client
- Cut resistance: ideal index 4, acceptable index 2
- Aesthetic: up to the client, earthy/neutral tones

The design is incorporating a level 5 cut resistant material, approximately 40 grams so very lightweight. It is also a very thin and light material hitting the mobility and flexibility targets. The blunt force protection may need to be revisited as the cotton may not protect the acceptable force but will need further testing and perhaps added protection along with the cotton. Another drawback is the heat resistance, the material being used is heat resistance but may need extra cushioning pending testing.

C.2 Project Plan.

Wrike has been updated with new milestone, due dates, and task dependencies.
- Number of missing tasks has also been added.

C.3 Prepare for your client meet 2. Explain your plan and provide a list of questions that you'd like to ask your client.

The plan for the client meet is to present all our individual ideas to gain feedback and see where their preferences lie. Due to the similarities with all of our concepts, we thought it was best for the client to decide which they prefer to proceed with our design. We also wanted to get their feedback regarding colour and styles of the overall glove. We are planning to meet with our client in the coming days in order to get sizing down to proceed with the design of prototype #1. Our main goal is general feedback opposed to many questions.