Deliverable D - Conceptual Design

Introduction

The objective of this document is to develop and showcase a set of conceptual designs for the steampunk wearable the our group is developing. We started by deciding on developing a steampunk chestplate that will involve user interaction. From there, we decided that the subsystems would consist of the look of the chestplate (i.e., how "steampunk" it looks), and the actual user interaction of the chestplate. We also had an idea for steampunk goggles that could be worn along with the chestplate, so we have included a few sketches of that idea. The goggles would just be an "add-on" to the chestplate to enhance the steampunk look, so it is not decided yet if those goggles will be included.

As specified form the client and decided on in the last deliverable, the focus of this product is on the steampunk theme of the ensemble. Throughout our sketches we focused mainly on creating a steampunk look that the client would be happy with. We know that she wanted a detailed outfit that would light up and look interesting in dark lighting, so our sketches and designs reflect this request. We focused less on the user interaction part in these sketches since it is not as important to the client. Instead, we tried to make our pictures as detailed and steampunk-themed as possible.

Subsystem Design Ideas

The two subsystem design ideas were the "look" of the costume and the circuitry of the user interaction part. Some common ideas in the physical design subsystem involved gears, and a central piece that sits in the middle of the chest. Almost all of our design ideas had a center chest piece on it, and we all had the idea of having that piece do something. All of us really liked having gears on the chest plate to make it look more detailed and intricately designed. We mixed it up with ideas of having the chest plate made out of cloth vs. metal. A cloth design can be seen in Figure 2, while a metal chest plate can be seen in Figure 3.

For the circuitry subsystem ideas, we all leaned towards the idea of a heart rate sensor that would light up and LCD screen with every heartbeat. Additionally, we proposed a muscle sensor for when the user would flex, and just a simple button system where once the button was pressed, the chest plate would light up.

In Figures 4, 6, and 10, we have included sketches of goggles, which we have debated adding to the overall design but are not sure about yet. We have decided to include these designs in case in the future we want to add them to the design. The goggle lenses would be mechanical irises, where the user can open and close them by turning the lenses like gears, and the strap would be made out of leather. We have experimented with different ideas for the goggles but have not chosen a final one.

In the end for the final three designs, we borrowed the ideas for them from the subsystem sketches and combined them into three fully-fleshed out designs. Since we know that the client prefers design over user interaction, the majority of our subsystem sketches focused on that. The focus was on adding as much detail and imagination into the physical designs as possible.

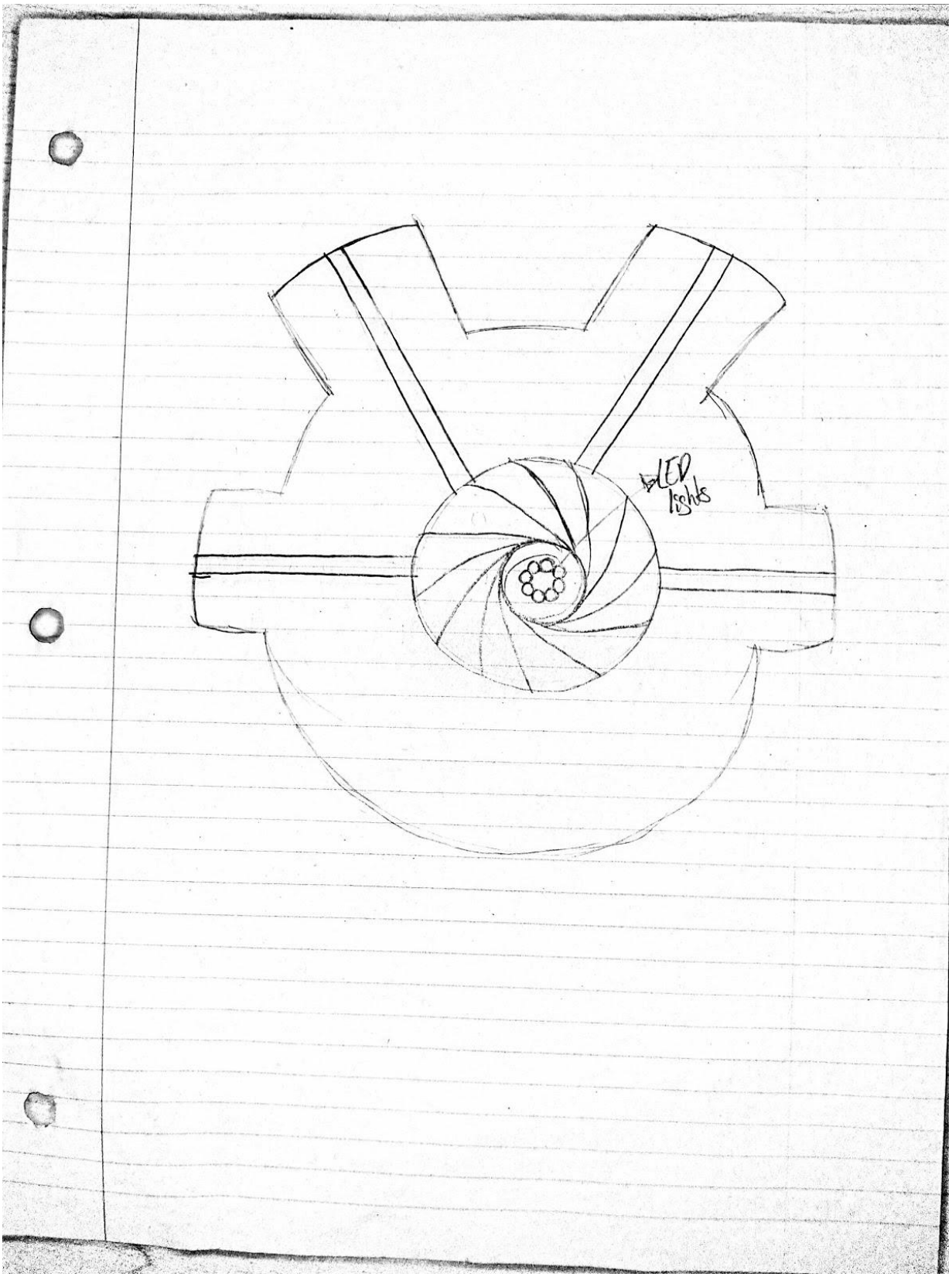


Figure 1 - Drawn by Kate

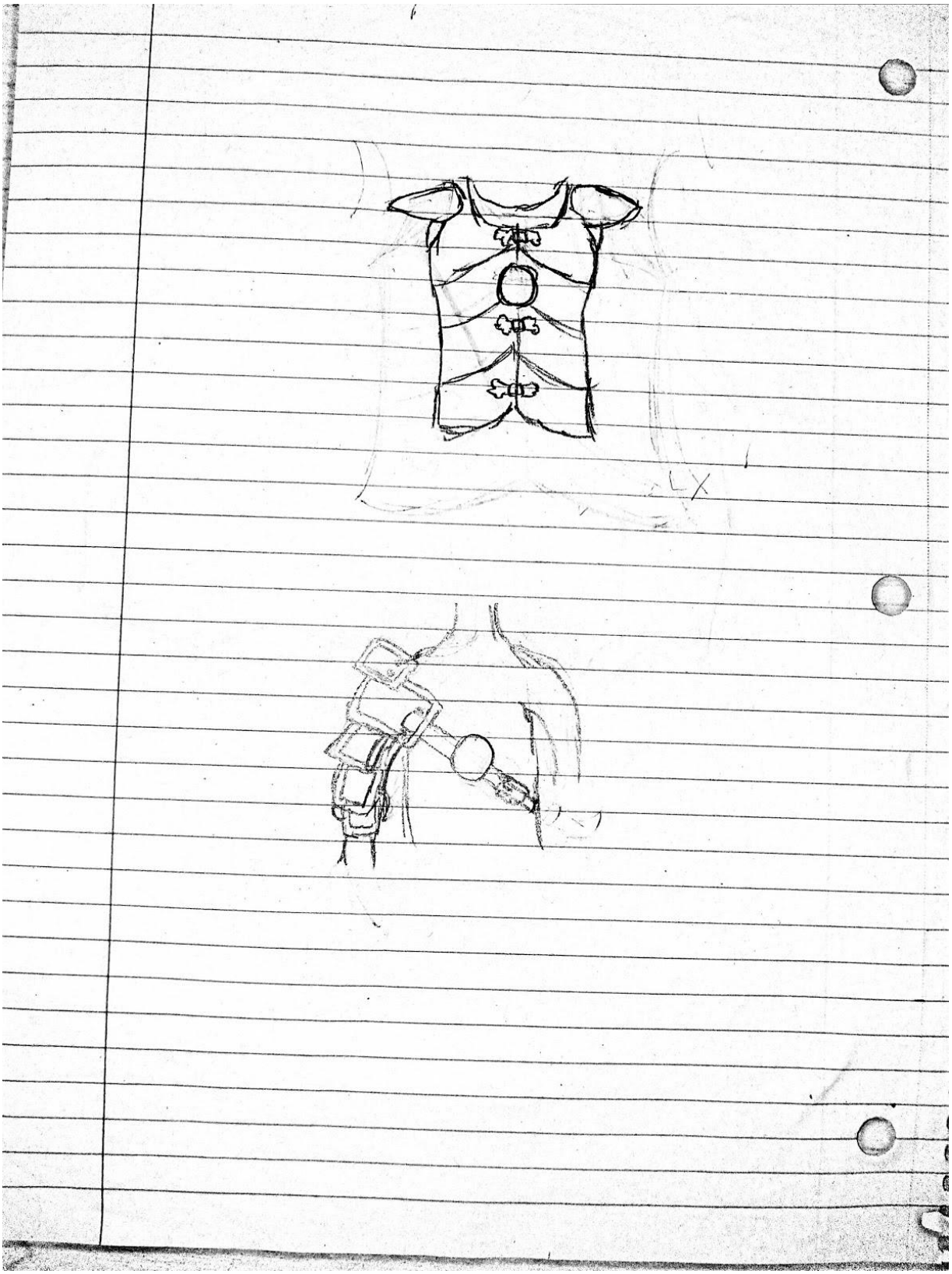


Figure 2 - Drawn By Douglas

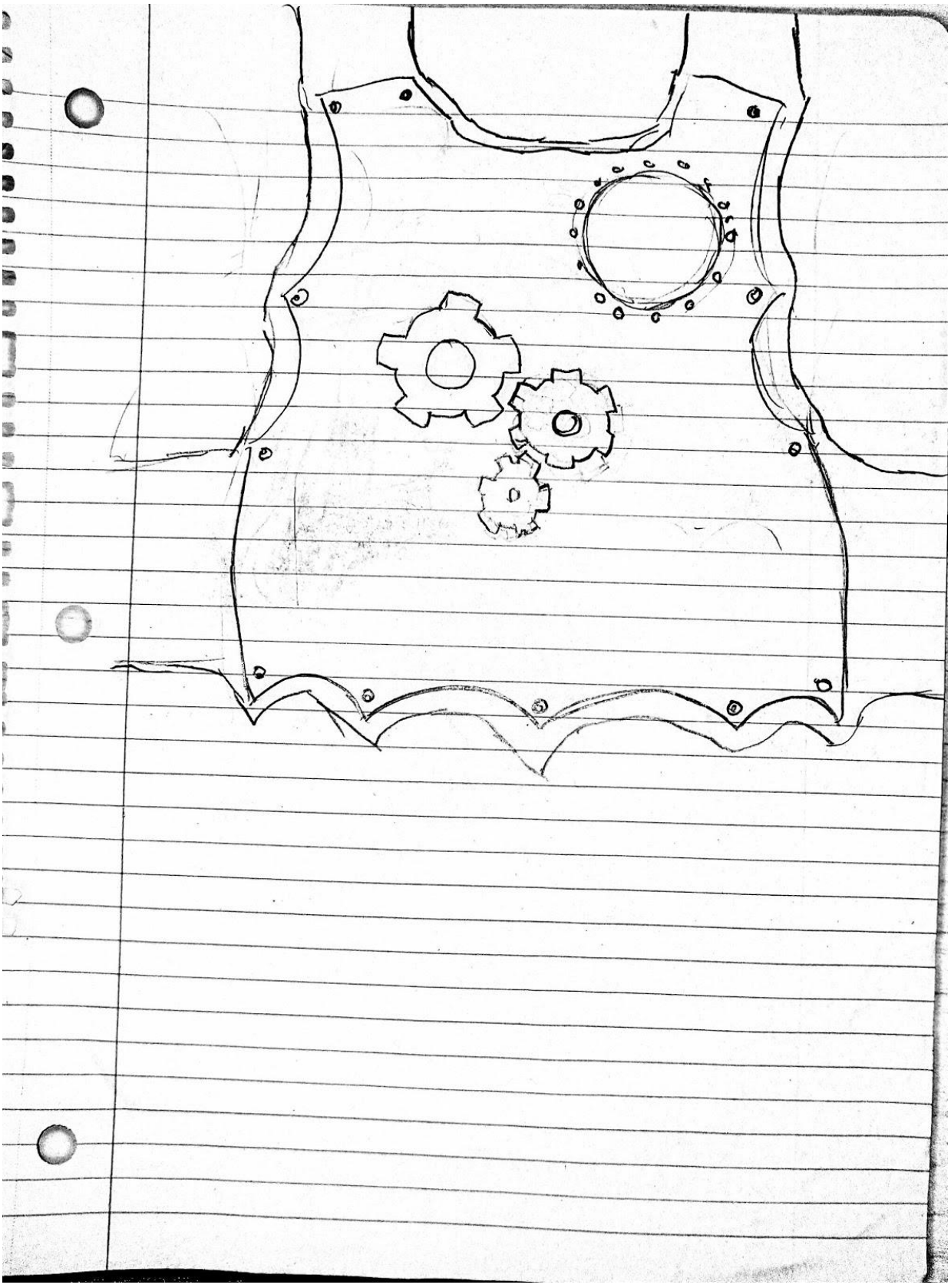


Figure 3 - Drawn By Douglas

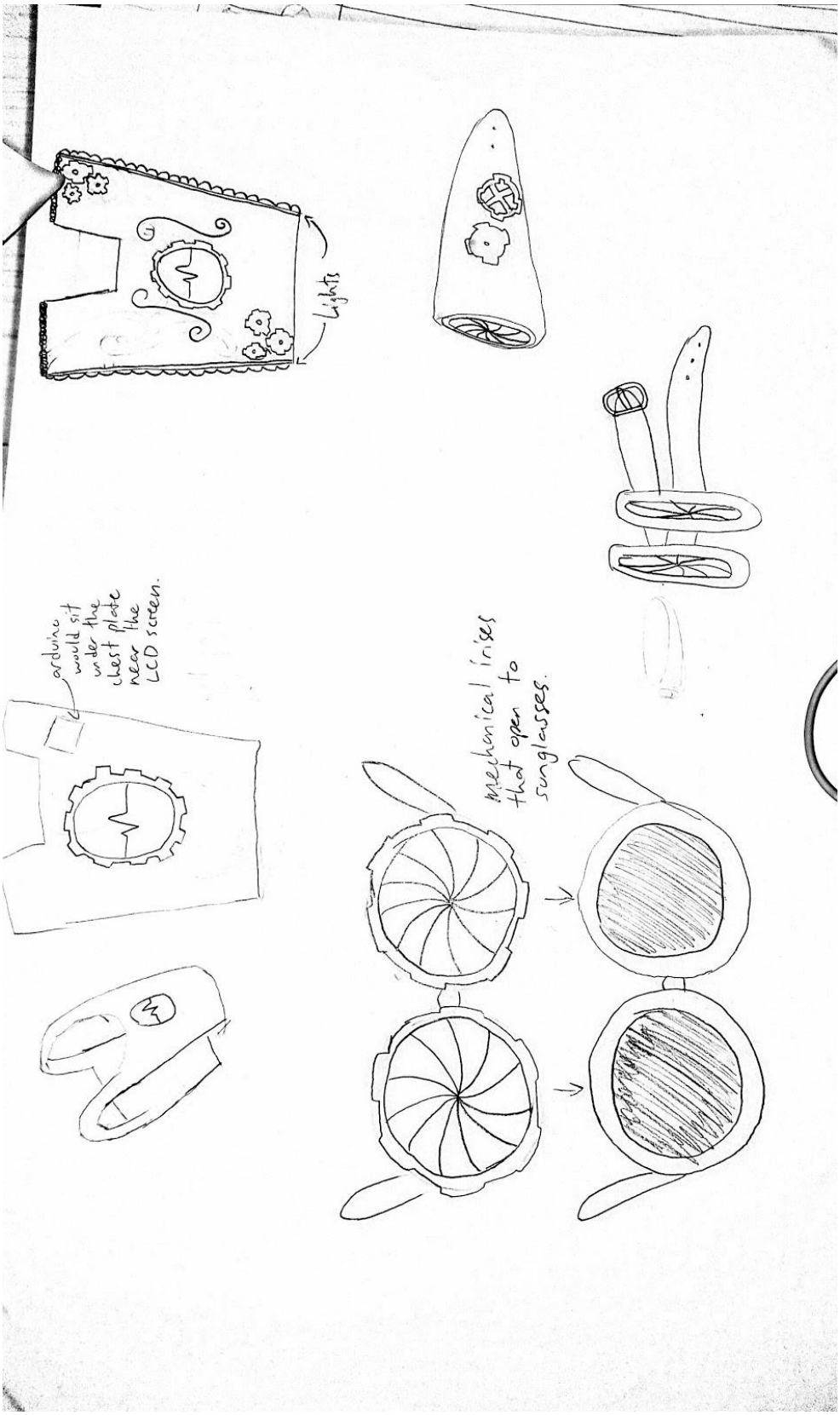


Figure 4 - drawn by Miranda

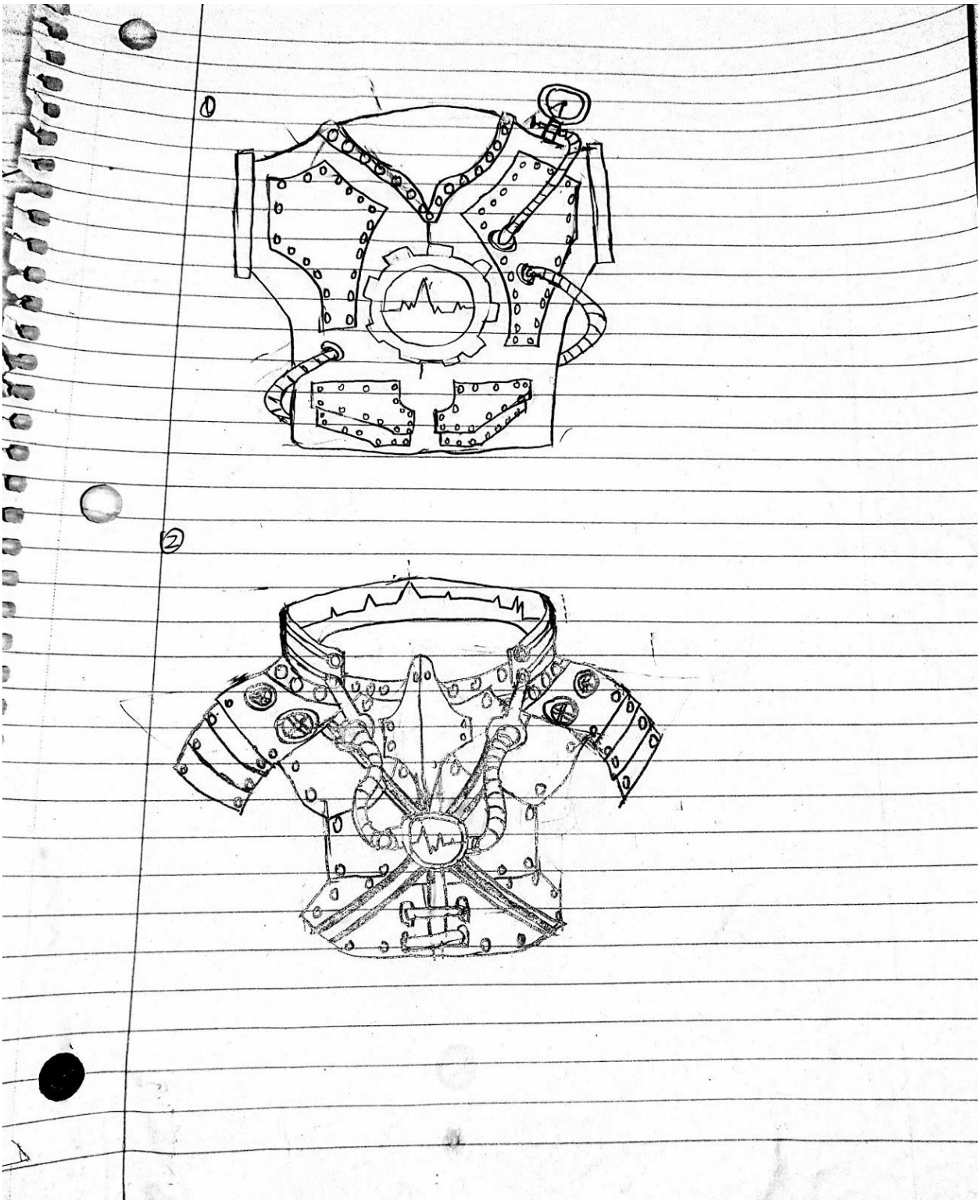


Figure 5 drawn by Mengxuan

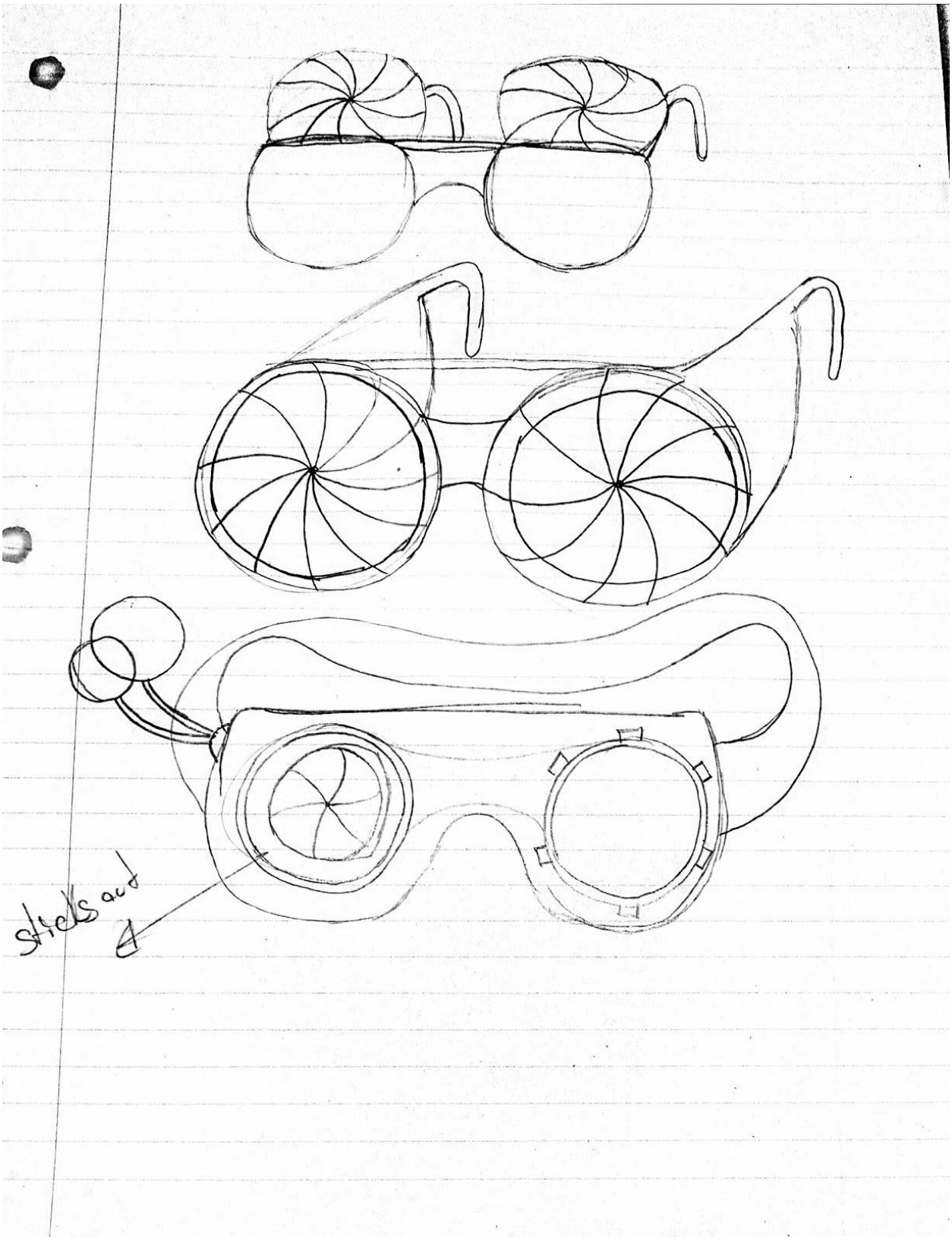


Figure 6 - Drawn by Kate

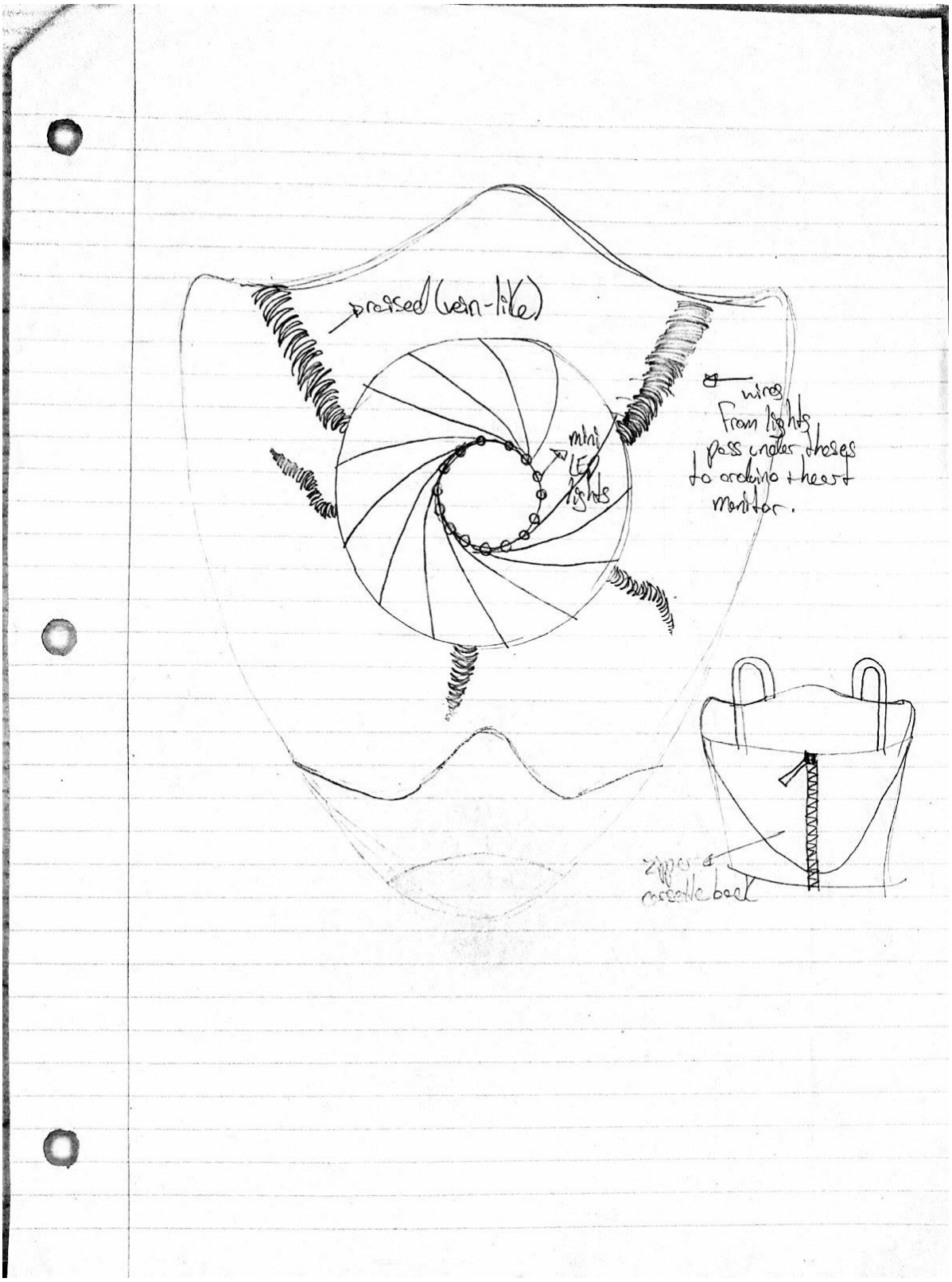


Figure 7 - Drawn by Kate

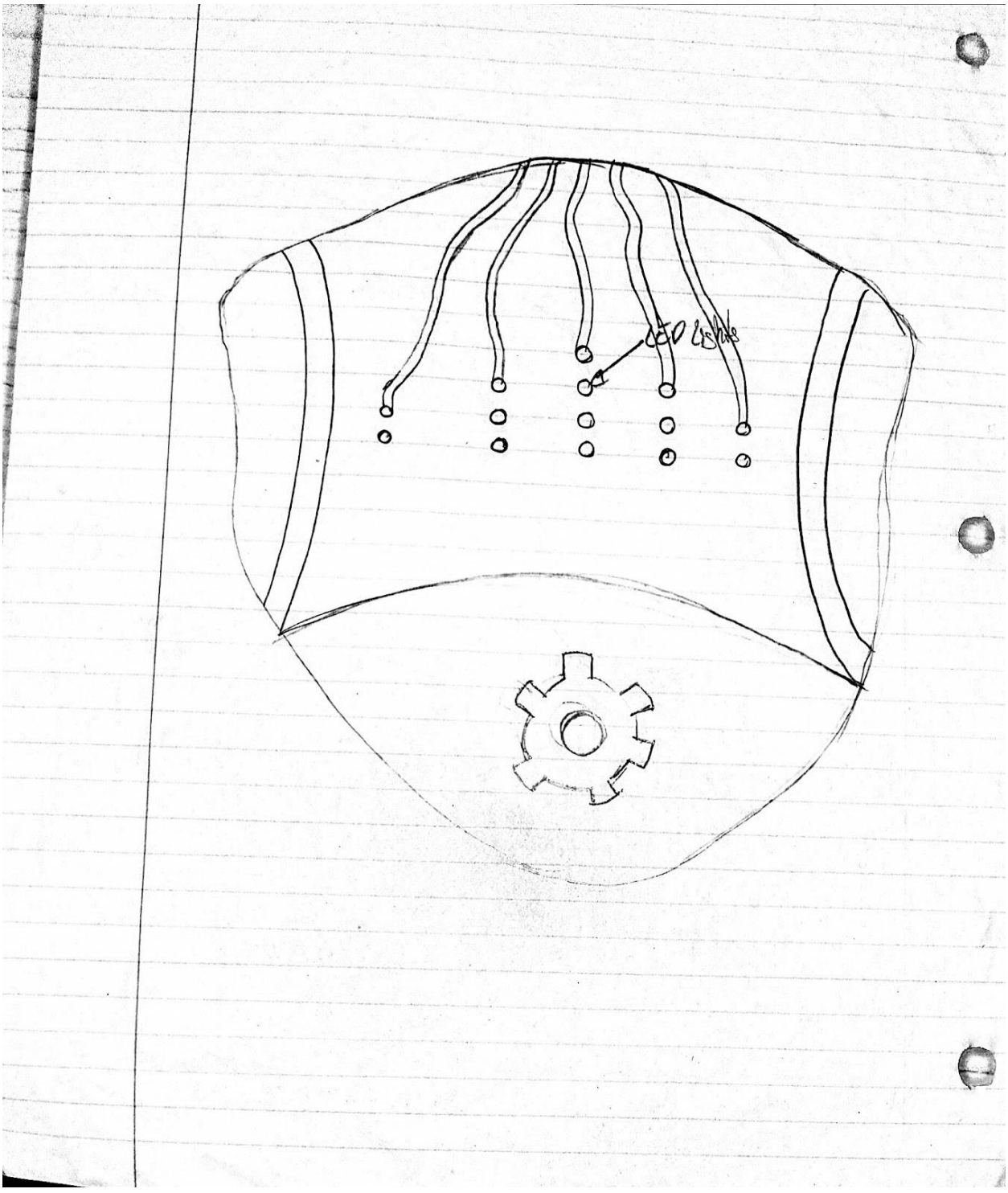


Figure 8 - Drawn by Kate

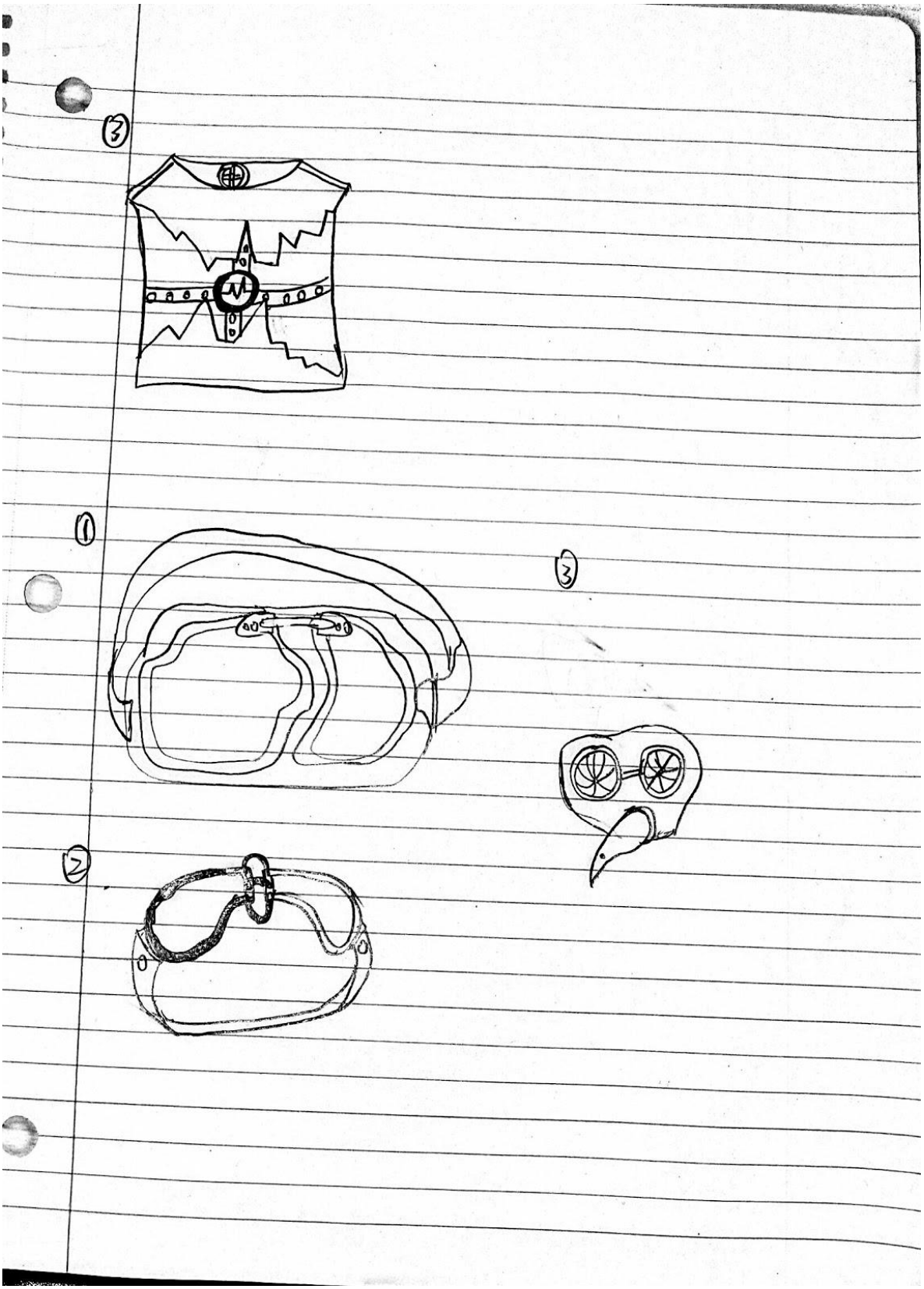


Figure 9 drawn by Mengxuan

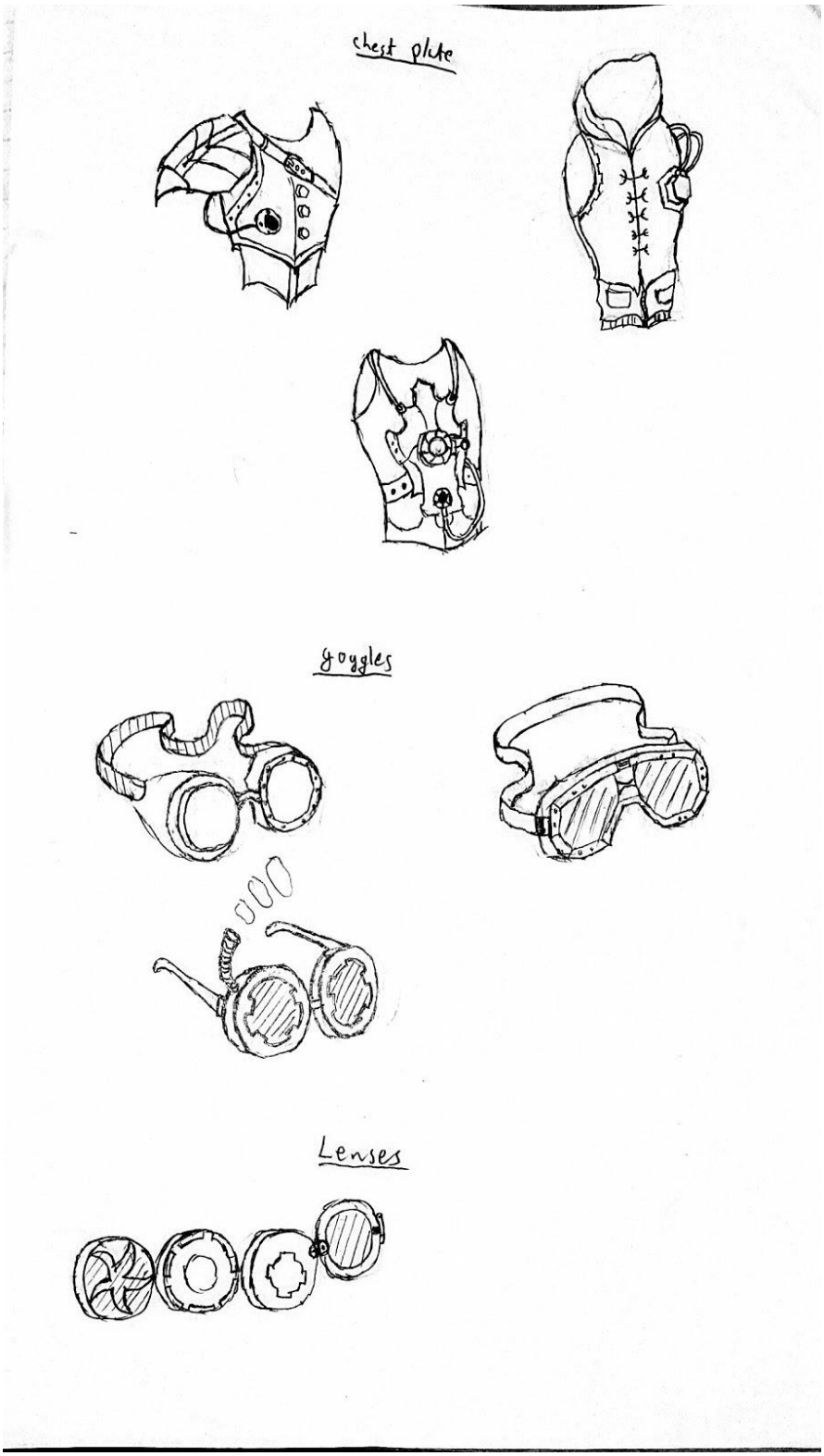


Figure 10 drawn by David (Lekang)

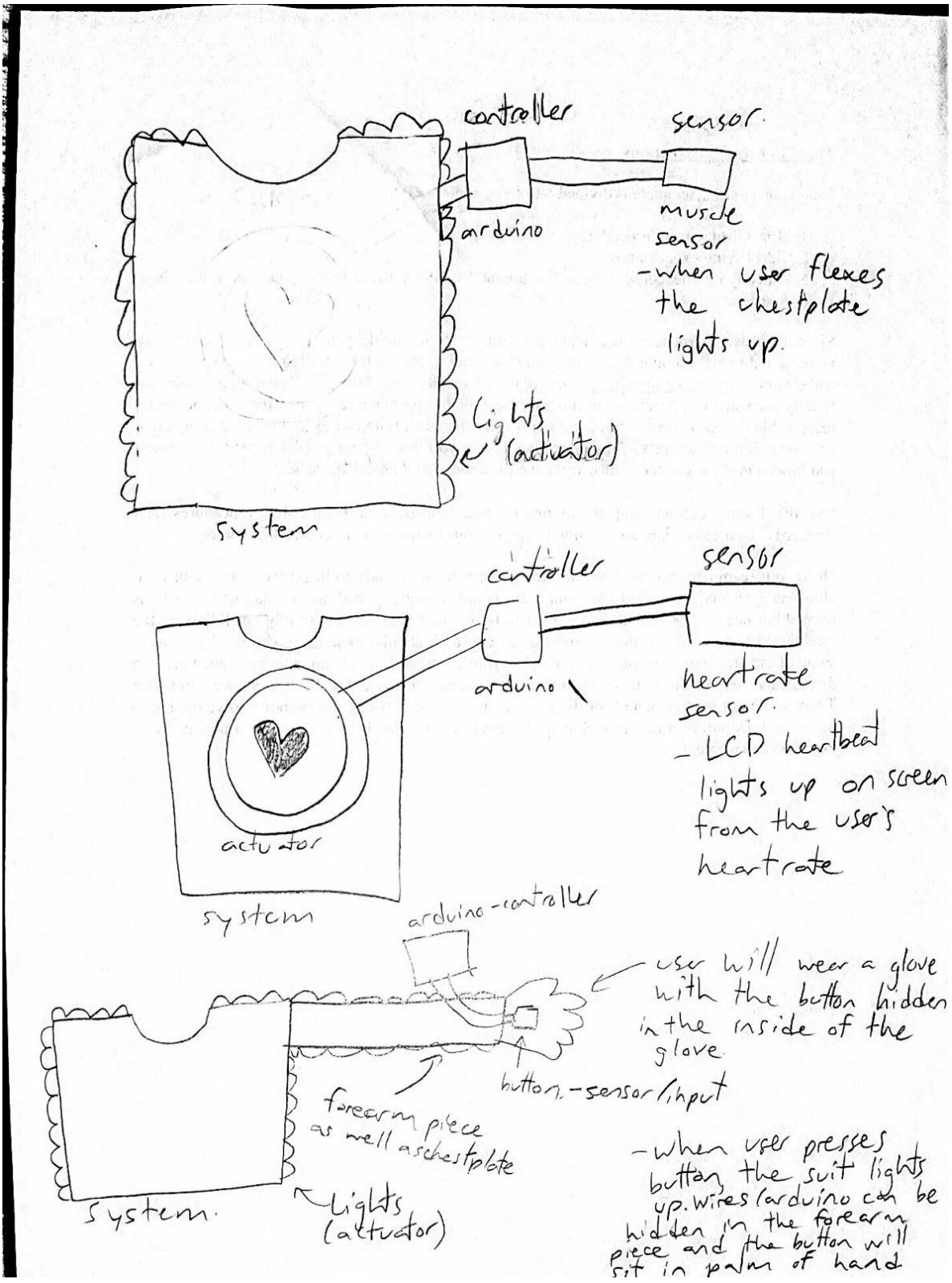


Figure 11 - drawn by Miranda

Three Global Conceptual Design Ideas

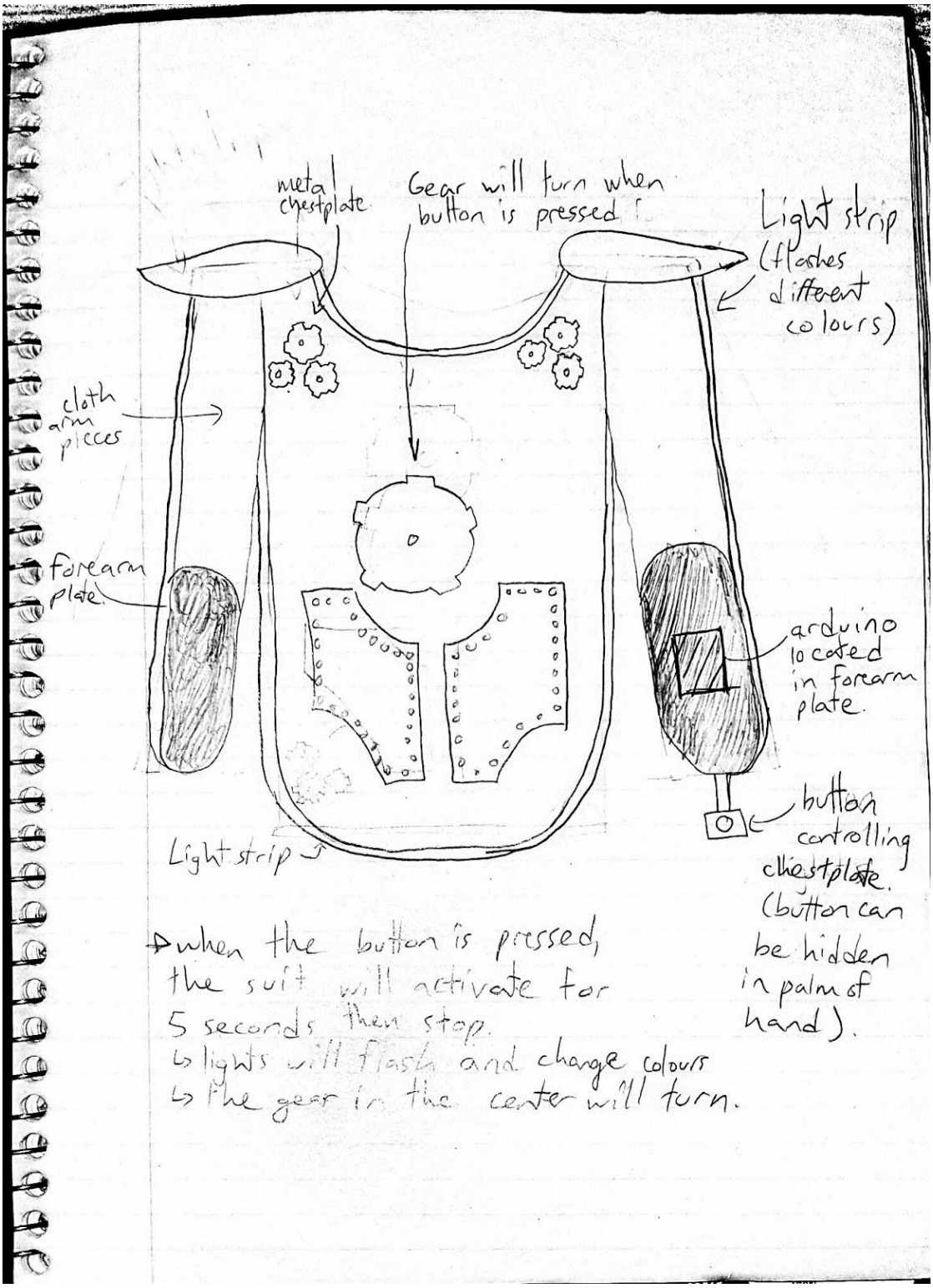


Figure 12: Design 1 – drawn by Miranda

In this design, the user interaction will be a hidden button that can be pressed to turn on the suit for 5 seconds. We went with the suit being made from both cloth and metal pieces, where the forearm pieces and chestpiece will be metal while the upper arms will be made from cloth.
The turning gear in the center will have a motor behind it to turn the gear, so the gear will stick out of the chestplate quite a bit to compensate for that motor.

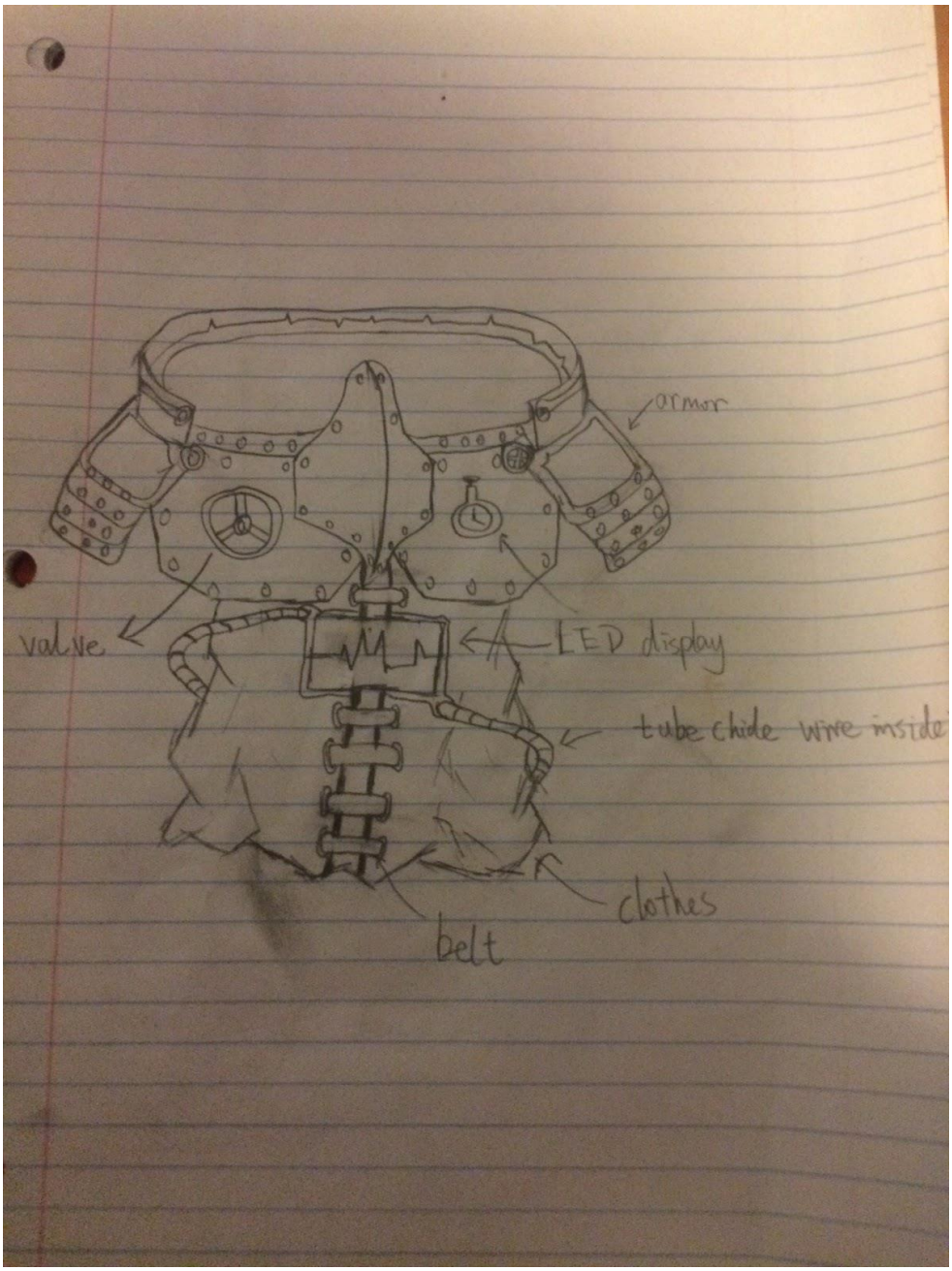


Figure 13: Design 2 drawn by Mengxuan

In this design, the user interaction will consists of a muscle sensors attached to an arduino, which will then light up the LCD display when the user flexes their muscles. The arduino will be hidden on the back of the suit, where it won't be seen. In order to have the wires from the arduino to the screen hidden, we will enclose them in tubes, as seen in Figure 13, which will also help make the costume look more "steampunk". The base of the chestplate for this costume will consists of both metal and cloth components (the metal components are the "armour" label).

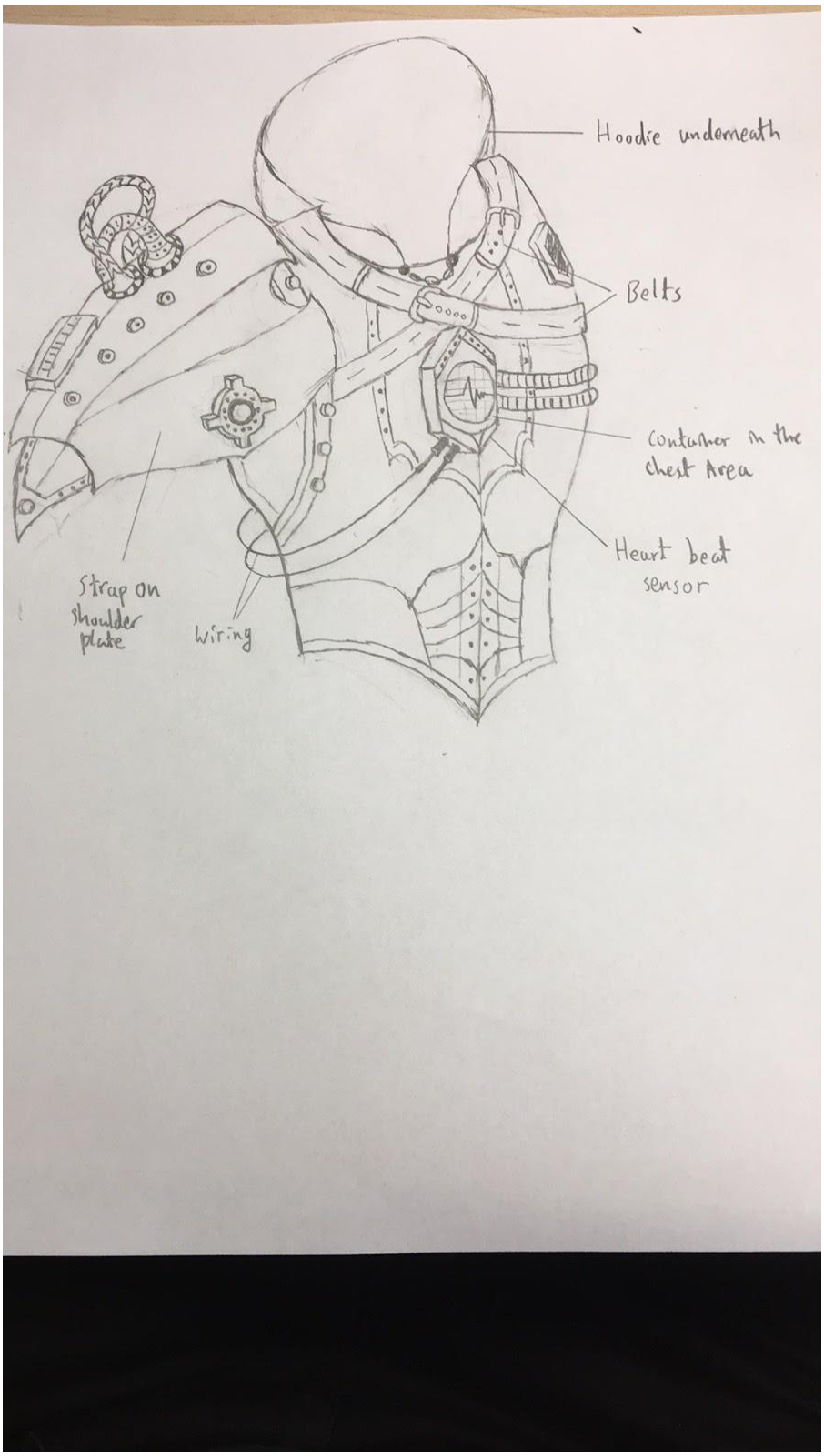


Figure 14: Design 3 Drawn by David (Lekang)

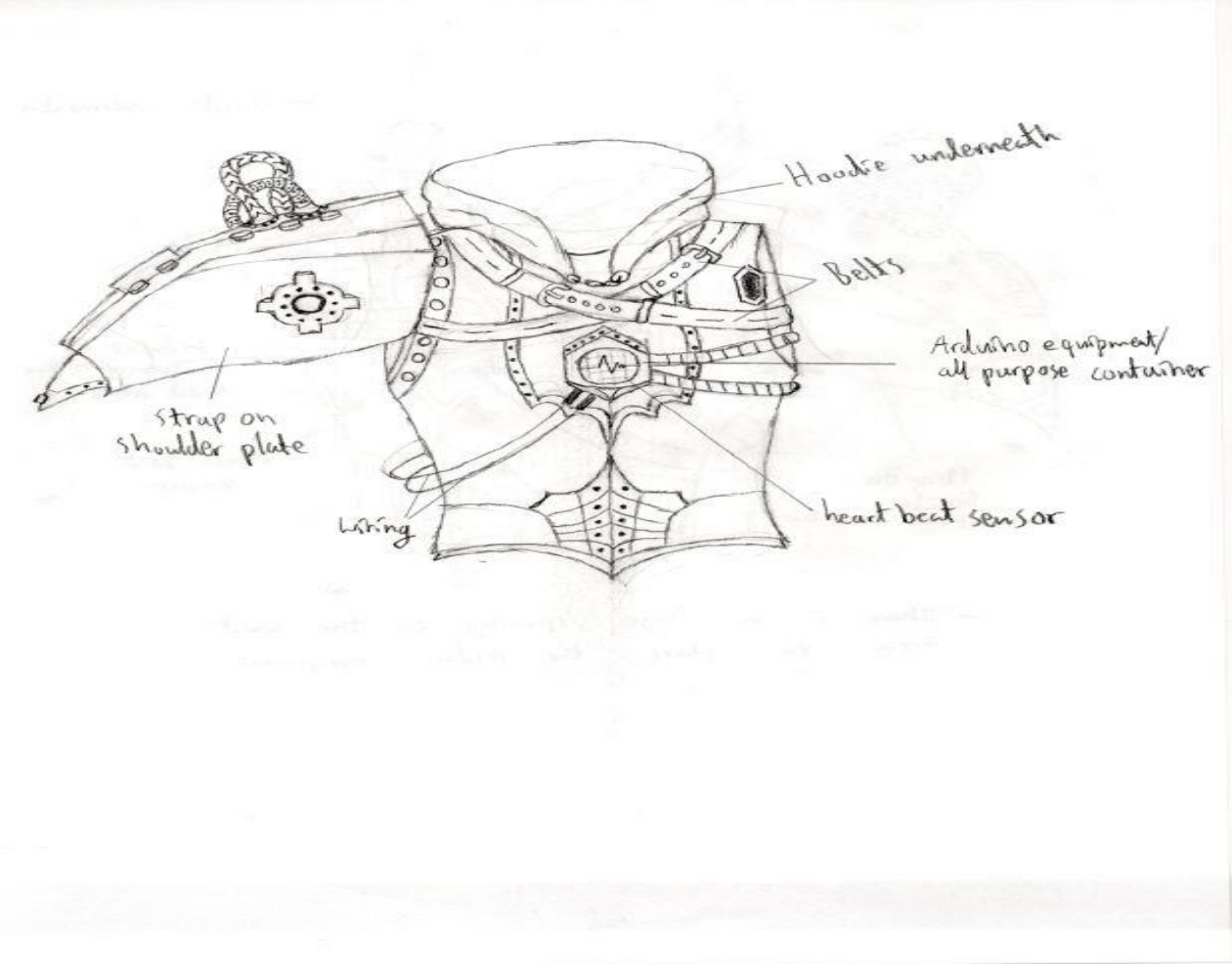
In this design, the user interaction will consists of a heart rate sensor attached to an arduino micro controller , which will light up a “heartbeat” across a LCD screen on the chest each time the user’s heart beats. The arduino will go inside the chest container and the wirings will run from there to the back of the chest plate. The base and shoulders for this chestplate will be made completely out of layers of metal, but a hoodie will be underneath the chestplate in order to make the outfit more comfortable to wear.

Comparison Matrix of Three Conceptual Designs

Design Criteria	Importance (weight)	Design 1	Design 2	Design 3
Steampunk aesthetic	5	3	3	2
Detailing	4	1	2	3
User Interaction	2	2	3	3
User Comfort	4	3	1	2
Total		35	33	36

Final Conceptual Design Idea

Design 3 was chosen as our team's final conceptual design due to its performance in the established matrix above. The matrix thoroughly compared the three designs based on their 4 design criteria, steampunk aesthetic, detailing, user interaction, and user comfort. Each of these design criteria was given an importance weighting based on the client’s needs (as outlined in our Needs Identification Report and Design Criteria Report). The weighting was used to multiply the rankings from 1-3 that each design was given by our team. Design 3 received a higher criteria ranking overall. It was given a Steampunk aesthetic rating of 2 as although it embodies the steampunk nature, it may be perceived as too futuristic especially compared to the other two more simplistic and original designs. What it lacked in theme orientation, this design made up for it in it’s intricate detailing, demonstrating specific materials, layout, design and aesthetics that are appealing to the more general population that will be viewing it. This design also received a 3 for user interaction. The design includes an LCD screen that will flash according to the user’s heart beat, fully communicating whatever stresses the user's body may be under. Lastly, we appropriated the user’s comfort with a score of 2 as the materials used, although may be heavy, are lined with an interior coat made of a fleece-like fabric. This design also includes many straps and places for the armour to sit and be held to the user’s body, creating a comfortable fit.



Final Design: Drawn by David (Lekang)

Conclusion

With our finalized conceptual design, we can move forward in beginning the planning and testing process. This includes the cost estimates, milestone deadlines, and specific individual tasks assigned to each team member. We will also begin creating and testing prototypes, as well as continuing to meet with the client, displaying our progress and taking into consideration their ongoing thoughts, concerns, and feedback.