Design Criteria and Target Specification

Introduction

All team members took copious notes during a meeting with the client - Talia, from Sandy Hill Community Centre - on January 21, 2020. This provided us with descriptive insight into what Talia was looking for.

The "needs" Talia mentioned were translated into several criteria that could be used to judge prototypes. An example of this translation is converting Talia's need of "relatively small" to a specific metric constraint of "must be less than 15 cm^3."

After all needs were translated to mathematical constraints or verifiable requirements (whether they were functional or not), team members reflected back on the meeting once more. This time, we looked for how important these criteria were to Talia. Each design criterion was ranked with a priority rating from 1 - 7. *Figure 1* visually displays the identification process used.

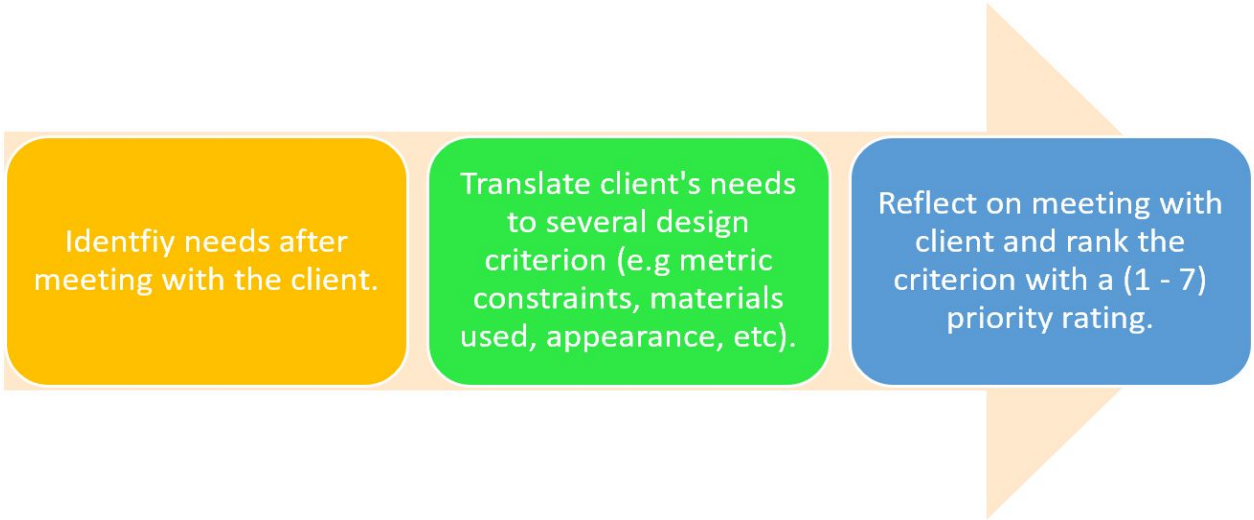

Figure 1. A graphic displaying the thinking process used for creating a prioritized list of design criteria.

Initial Constraints

1. Cost ($)
2. Time (deadlines)
3. Portability (cm^3)

4. Hardware: capabilities of devices being used (Arduino/Raspberry Pi)
5. Software: capabilities of each programming languages (Python, C, etc.)

Requirements

Functional requirements

- Real time monitoring of blood oxygen saturation levels.
- Accurate location tracking services able to send location to ER.
- More than 24 hours of battery life per charge.

Non-functional requirements

- Discrete and small
- Comfortable for user.
- Not obtrusive in user's daily life (i.e device can't go on fingers).
- Affordable (less than CAD$100)
- Eye catching/ aesthetically pleasing

Table 1: *Priority listing for each design criteria distinguished by category*

Design Category	Identified Needs	Design Criteria	Priority
Functionality	The device can measure blood oxygen saturation levels	Able to detect the blood oxygen saturation levels and breathing rate to determine if the user is overdose.	**3**
	Can send location (via GPS) to emergency services	Send an emergency GPS signal to ER in less than 3 min.	**1**
	Can call for help in a timely manner.		**1**
	Can be worn for a long time.	A single battery charge can last more than 24 hours.	**6**
Affordability	Device is affordable for the user.	Device cost less than CAD$ 100.	**4**
	The device is hands-free	No need for any user-operated functions (i.e autonomous).	**5**

User-friendly	Device is durable and can be worn for long periods of time (comfortable)	Light but strong (i.e composite material which doesn't cause irritation).	**6**
	The device is discrete and does not disturb one's daily life	Very discrete/light colour (i.e gray) and not worn on hands.	**7**
Safety	The device is accurate	-Measurements by the device must be precise as it will cost one's life -The accuracy will affect the time length of the help given to the user if there is an emergency.	**2**

Table 2: *Benchmarked products*

Criteria Category	Mibest OLED Finger Pulse Oximeter	Digital LCD Automatic Oximeter Health Monitor	AK1980 Fitness Tracker
Picture of Product			
Physical Product	This is a pre-existing device that uses a SpO_2 sensor (saturation percentage of oxygen in the blood) to check and display real-time levels as well as pulse strength. The design is simple and fairly compact. While it does require to be worn on the finger, the device provides accurate measurements and is quite	This is a wristband look alike device that comes with the function of monitoring blood pressure, pulse, and heartbeat rate. This design can also acts as a watch as it has time displayed on the screen.	This device is similar to a fitbit, it tracks the heart rate, along with distance walked, sleep cycle, and much more. The tracked numbers are then displayed on the screen for the user to refer back to at anytime. It is also very easy to use and fairly handy for any person. In order to to keep track, the device must simply be worn on the

	compact.		user's wrist.
UI	The device comes with batteries, a neck lanyard, and a storing pouch. The user interface itself is easy to follow and requires little effort to use since it uses a One Button Operation; a single button is used to start, stop, control brightness and other settings.	The device comes with LCD display to display blood pressure, pulse, date, time, time and low battery icon, and memory record number. The device is user friendly as it has a large backlight LCD for easy reading and it is easy to operate.	The device is equipped with an LED screen to display the visuals for the user. A charging cord that charges the device for daily use. The touch screen lets the user also change certain settings to preference, such as brightness and sounds.
Safety	This is a portable and user friendly device that can easily accommodate all ages. It also requires minimal setup effort and previous knowledge regarding the device.	This is a portable design that allows user to monitor the blood pressure easily at anytime. The device is also able to memorize the measuring data and time of the most recent 60 times.	This easy to use and small device is very user friendly and safe for all ages. Very few steps are required to setup and get the device working.
Perception	The luxury design of dual color oximeter displays reading in 4 directions, 4 display modes and 10 levels of adjustable brightness. Besides that, it also comes with a battery-low indicator.	This is device is good for sports and outdoor activities as it can be worn on the wrist at all times and does not hinder the movement of the user. The information that is measured by the device provides the user the vital measurements that the user needs to know to keep track of their health.	The easy to assemble wrist watch is also waterproof, making it very durable. It also has a long battery life and is made of flexible rubber material for all wrist sizes. Along with warnings/ notifications for unusual activities or abnormalities in the users' daily routines or body system. Such as an abnormally high heart rate.
Cost	$24- $30	$65-$70	$35-$40

Discussion

Determining which specifications we want for our project has been challenging mainly due to our lack of experience. When creating our design criteria and identified needs, it was difficult to ensure that everything was properly ranked in terms of priority. This project greatly relies on software and technology, making our technical aspects not very specific due to our inexperience. As a result, our benchmarking and criteria are not definite and will most likely be edited as we explore further ideas for creating our device.

Conclusion

Now that we have converged on prioritized design criteria, we are ready to diverge onto several prototype ideas. Benchmarking some current devices allowed us to see what the market has to offer. This was especially useful since we now know what the "standards" are for similar devices (in terms of size, appearance, UI, etc.). In addition, we can consider modifying one of these products to suit our client's needs.

We now move on to drafting conceptual designs that either use raw components to build a device which exceeds current market benchmarks, or using an already-existing device with modified functions.

All design ideas will need to be analyzed based on our design criteria. However, now we also need to gauge the feasibility of ideas. This means familiarizing ourselves with circuit theory, computer programming, soldering, etc., and asking ourselves "is this actually doable?"

In essence, we have a lot of decisions to make and a lot of material to learn. However, with these fundamentals established , we are well equipped to do so.