Project Deliverable D

Large Font Pedometer

Submitted by

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October 7, 2021

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1 Introduction

DEEN Support Services need a large font pedometer for a client with a visual disability and they are collaborating with the University of Ottawa in the context of GNG 2101 to have a custom made accessible large font pedometer. Our group oversees the realization of that project. Following our second client meeting with DEEN, where we presented a rough design of the product, we obtained great feedback from the customer to refine our idea.

This deliverable aims to summarize the discussion points from our second client meeting, as well as any other subsequent contact we had with the client. A detailed design will also be presented as an improvement to the design ideas we pitched to the client. This deliverable will also include details about our first prototype and the testing we did to validate that it meets the client specifications. The information gathered for this deliverable will be helpful when we meet with the client again in the next few weeks. Finally, a bill of materials will also be listed down below to give a general understanding of what materials we will need and how much it will cost. This preliminary works sets the foundation to a successful first physical prototype, which we aim to produce in the next few weeks after obtaining the basic material.

2 Summary of Client Meeting 2

Throughout the second client meeting, our group showed the client two possible prototype ideas. The first was the pedometer attached at the waist with a lot of tactile buttons, while the second was a pedometer using a phone application with only one tactile button. After talking to our client in our second meeting, we have received and listed what needs to be changed and improved in our design. This list states the remarks our clients had, group thoughts, and personal thoughts about what needs to be changed in our project:

- **Headphone jack**: may be complicated to integrate (more a want than need)
- **Waterproof screen**: may produce glare – so need to address that
- **Clip**: client may play around with it, which could break (so wrist might be a better option)
- **Arm/Wrist band**: Velcro straps would be needed to detach and attach (as opposed to a clip)
- Primary function: step count
- **Motivational speech and music** would be fun but are not the most important features
- **Buttons**: should be wide enough and coloured
- **Power source**: charging is better, but batteries work as well
- **Display** should not be too overcrowded with text (should stick to the numbers)
- **Reset button**: should be a bit challenging to reset (e.g., press three times) since it will create disappointment if it resets by accident

All these points vary in importance. For example, the second point is very valid as the visibility of the design is of the utmost importance. Audio features are more of an aesthetic part of the design since the main function of the pedometer should be to count steps and the integration of audio is difficult/inefficient. The display is an important aspect, given the project’s main purpose.

The client was also contacted to gather more information on the desired screen size. This was done as we looked for programmable screens to buy and found the size varied and the bigger the size, the heavier the module, meaning that the case and placement on the body would need to change. Their feedback was that they would prefer a wrist pedometer that has a 1.54" screen. The preferred option was chosen as it is not too bulky and easily visible as opposed to a waist pedometer that would be cumbersome to use. This is also reflected in the prototype and the detailed design.

3 Detailed Design

After our second client meeting, we gathered all the feedback and improved and changed our design to fit in with what the client was requesting. A wrist pedometer was deemed to be the best approach, as it would fit in with the user’s needs and would be more efficient than a waist option. The design would include a rechargeable battery, an accelerometer sensor, a display, and some possible audio additions.

The main goal of the product, as outlined by the client, is to count steps and have a clear display. Also, the client indicated that the product should have mechanical buttons instead of digital buttons on a touchscreen. The added audio features are very much an optional feature and is technically the least important part of the design. The client was very happy with the waterproofing idea but warned us to make sure that the screen’s glare is not too noticeable. Moreover, charging the device would be a highly welcome feature as it would be more economical and ecological.

Following the latest discussion with the client, we concluded that the wrist attachment, even though it provides a smaller screen allowance, is preferred over the waist attachment.

3.1 Software prototype:

The following is our detailed design concept. Attached to the deliverable will be the CAD drawings of the whole watch and the pedometer holder. In the appendix, there are additional photos of the design.

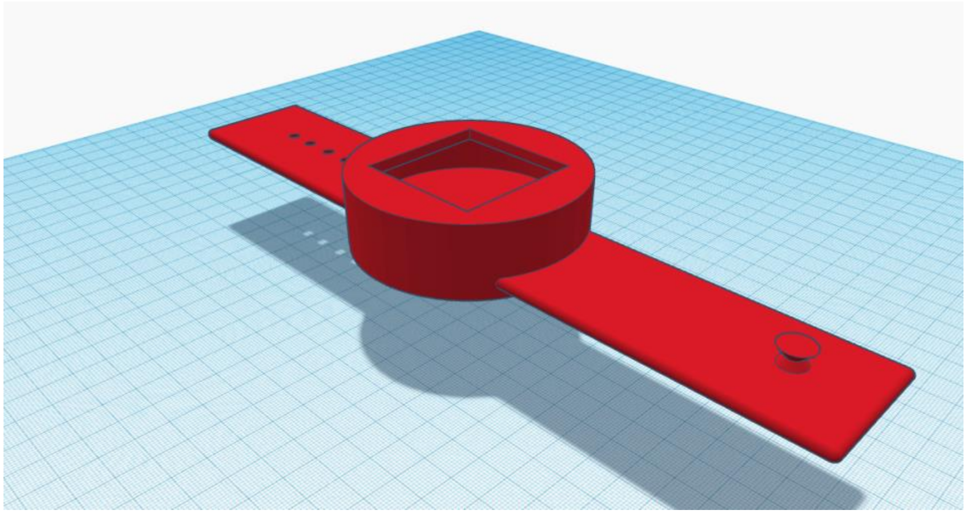

Figure 1. Our final design with all the aspects

This design uses an LED display connected to a controlling unit circuit. This controlling unit connected to a rechargeable battery, which is charged using a USB/micro-USB cable. The design also includes a couple of buttons that control the device in many ways. This is also a rough outline of how the electric part should look like:

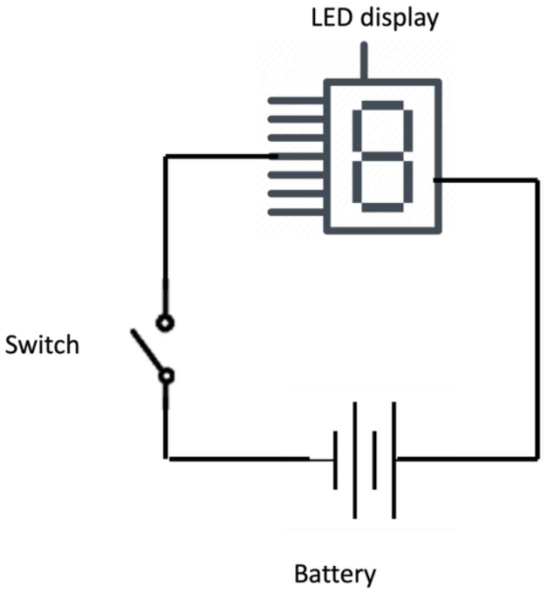

Figure 2. A rough look at the electric connections for our design

4 Critical Product Assumptions

The product’s main function should be to count steps and display them with clarity. It should also be comfortable to wear as to not hurt the user. The buttons must also be easy to use and accessible, while not being it too easy to break. The case should be big enough to accommodate the parts but not too big that it is not wearable. The display will also have to have high contrast levels to be visible.

First product prototype:

4.1 Testing Assumptions and Objectives for this Prototype

The goal of this prototype is to ensure that some main parts of the design satisfy the specifications. The prototype also serves as an initial representation that will be further modified to show the client later. The prototype will include a CAD model and a test of the different colors of the screen. The testing of this prototype will be done by checking the dimensions of the CAD model and by doing an eye test for the colors. These tests will aim to help us understand some of the previously mentioned critical assignments.

4.2 Description/Documentation of Prototype

This part of the deliverable will include the description and documentation of the prototype. The prototype is broken into many main subfunctions:

1) The CAD model shows how the pedometer’s case will look like and gives rough dimensions of the module that will be contained. We also created another CAD drawing of the whole pedometer (holder and wrist band).

Through this online design, we made sure to include a reasonable screen size display as per request of our client. This makes sure that when we test our product, it satisfies the client's needs by not making the screen obnoxious for our user. A wrist band is also in this CAD module which is at a proper length to fully wrap around a wrist. We used a watch as reference for the length of the wrist band to make sure that it will satisfy a user. This test helped us by not using a too small length wrist band.

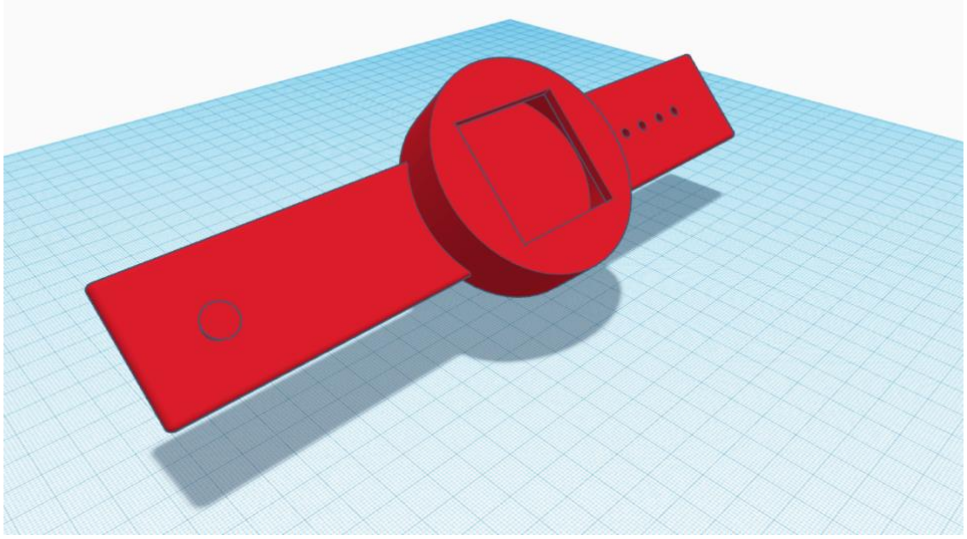

Figure 3. Design of the whole pedometer (holder and wrist band).

2) We did a detailed breakdown of the different colors that can be shown on the pedometer's screen

This part of the prototype may seem like a small and insignificant part of the design. But in fact, it is arguably one of the most important aspects to ensure is perfected early on. The point of this part is to check on the various color combinations and to make sure that the colors are visible in many different lighting settings. The testing of this aspect was carried out as outline below.

5 Prototype Testing

1) Case Design Test

This part was tough to make sure of, given the time constraints and the difficulties obtaining a slightly accurate design dimension. What we decided to do was to make a basic CAD model of a kind of watch and made a tiny representation of how the buttons would look like. The designs we made are subject to change depending on the products we decide to purchase and use. This part of the prototype is great because the testing is continuous. We show the client a design, they give us feedback, and we keep on going in this cycle till we achieve the closest thing to perfection. Here are some pictures of the current model.

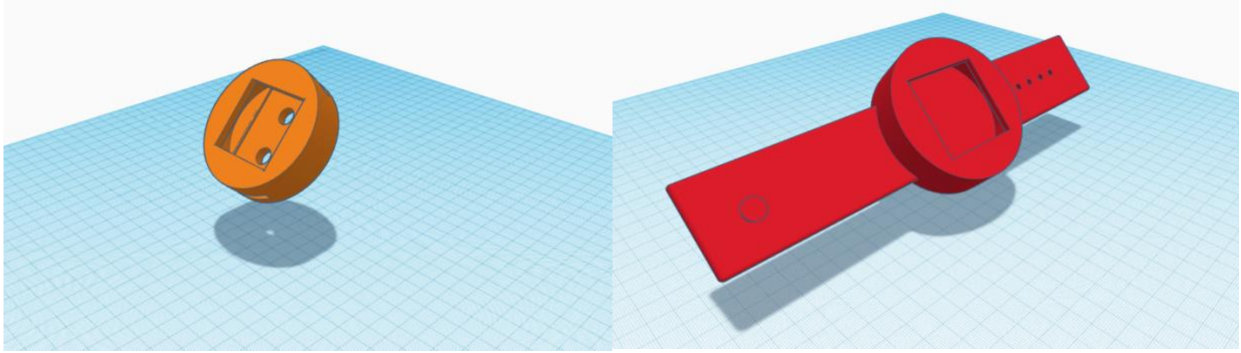

Figure 4. Two CAD designs of the pedometer holder and the final product with the wrist band.

2) Color Testing

This part will look to list all the color combinations that are optimal in terms of the pedometer's visibility. The was this test was done was by going outside on a sunny day and attempting to look at different text and background combinations and determine the best options by ranking. The color combinations were first thought of and compiled by research. According to what was found, the best combinations are those with a dark and light combination. This table illustrates everything said and elaborates on it.

Text color	Background color	Ranking (out of 5)
Black	Yellow	4
Black	White	4
Pink	Light Grey	4
Blue	Black	2

Yellow	Black	2
White	Dark Blue	5
Bright Red	Black	3
Blood Red	White	1
Neon Green	Dark Grey	1

What was found out is that very dark colors on bright colors is a pretty good combination. We be pitching our highest rated color combinations to the client, and we will also come back to this when programming the screen to display the steps.

#	**Design Specification**	**Relations (=, < or >)**	**Value**	**Units**	**Verification Method**	**Expected Value**	**Actual Value**
Functional Requirements							
1	Display Size	>	50x 50	mm	Experiment	60x 60	53.3x 53.3
2	Weight	<	30	g	Test	25	23
3	Clarity of the display	=	Yes	N/A	Test	Any high contrast colors	Yes
Constraints							
2	Cost	<	100	$	Experiment	100	93.20
Non functional requirements							
1	Water-Resistant	=	Yes	N/A	Test	No	Yes
2	Auditory features	<	80	dB	Test	60	40

6 Client Meeting 3 Preparation

Our team intends to present a virtual prototype to our client, which outlines the overall shape, form factor, and size. We will present the prototype created in our CAD software. We created two designs on CAD (See Appendix for images). One is for the pedometer holder and the other is a combination of the pedometer holder with the wrist strap.

This CAD design highlights the form factor chosen by the client. The client prefers a watch form factor due to its ease of accessibility during exercise and its lightweight nature.

In the next client meeting, we will aim to gain the following information:

- Any specific requirements for the UI- would it be fine to have multiple screens?
- Are the dimensions appropriate?
- Does the screen display bright and colorful text that would be easily seen by the client?

Furthermore, this client meeting will ensure that our group is on track for the project, and it will confirm that we have added all the intended materials the client wanted us to implement. We will also look to contact the client when any feedback is needed due to our meeting being before the reading week break.

7 Preliminary BOM

Materials	Dimensions	Unit	Quantity	Cost Per Unit (CAD)	Total Cost (CAD)	Cost with Tax (CAD)
Circuit Playground TFT Gizmo - Bolt-on Display + Audio Amplifier	53.3 x 53.3 x 9.4	mm	1	$25.04	$25.04	$28.30
Circuit Playground Bluefruit - Bluetooth Low Energy	50.6	mm	1	$31.32	$31.32	$35.39
Breadboard-friendly SPDT Slide Switch	33	g	1	$1.20	$1.20	$1.36
Lithium-Ion Polymer Battery Ideal for Feathers - 3.7V 400mAh	35.5 x 16.6 x 7.6	mm	1	$8.72	$8.72	$9.85
Fully Reversible Pink/Purple USB A to micro B Cable - 1m long	3.5	mm	1	$4.98	$4.98	$5.63
JST-PH Battery Extension Cable - 500mm	500	mm	1	$2.45	$2.45	$2.77

Adafruit Micro-Lipo Charger for LiPo/LiIon Batt w/MicroUSB Jack - v1	21 x 19 x 2	mm	1	$8.76	$8.76	$9.90

8 Conclusion

To conclude, our first prototype will provide the client with a general idea of where our project is headed. Gaining the client’s feedback is crucial in this stage as it allows us to change any requirements before we financially commit to any designs. It is important that we develop a product with a client-first mentality, thus checking in with the client at this early stage of development will help us refine any details. It is also important to confirm that the design will fit the user and the colours chosen for the text will be easily visible. Throughout the next couple of weeks that are coming, our group is aiming to really get in on the details of the pedometer and the screen as we look to perfect the Large Font Pedometer prototype by adding all the features stated in our previous deliverables to satisfy our client needs.

9 Appendix