**Tactile MapTile Project**
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## Task Analysis

This project will focus on the high-level goal of developing a tactile map that can be used to aid users with low to no vision in navigating around a designated area. A user with low to no vision should be able to navigate both a familiar and a new environment with the map, identify surrounding points of interest, and determine an accessible route for getting to particular points of interest. There are three main user interactions that we will focus on making accessible in our project development, which are detailed as follows.

The first will focus on the user interface for generating the 3D-printable STL file representation of a tactile map. The process of generating this STL file will follow a clear sequential process for easier map construction and personalization. This process will include searching for a particular point of interest, adding features of interest to the map (such as bus stops, points of interest, street names, etc), and indicating the size of the map before generating the STL file. In order to gather this information, the technology behind this project will gather current information about the area of interest for OpenStreetMap data and gather all of the features available to this area. We will then work to display the features on the tactile map in a clear manner by working with both Jess and Jacob, our two Needs Experts, to determine the best way to represent the feature information for any low to no vision user. We will work on coming up with good texture representations as well as including Braille text for the tactile aspect of the map. We will also work on determining how to 3D print in more than one color for our users who can discern information from high-contrasted mediums. The technology will then generate the appropriate STL file representing the map the user has created via the user interface.

When working with this user interface, the user will be able to observe the contents of the user interface with a visual representation and/or an audio representation, which we will create to follow available accessibility standards. When making use of the visual representation, the user will be able to see a high-contrast view with larger font sizes incorporated into the process. Any images displayed in the process will be capable of zooming in or will be displayed in a larger format, as well as include a textual description of the image. For the audio representation, the user will be able to navigate the interface using a common screen reader such as Microsoft Narrator. To ensure navigability and understanding, we will accompany images with text that can be captured by the screen reader and include navigational buttons with labels so that the screen reader can identify them to the user. This process of working with the user interface for generating a map will occur once per map creation and will be dependent on using a computer (either public or personal) and having access to the internet. We will not work on making this project compatible with mobile devices or tablets at this time.

The second user interaction will be the process of printing out the tactile map corresponding to the generated STL file. Since 3D printers are becoming more and more common and materials

for 3D printing are becoming cheaper, many users will be able to obtain access to a 3D printer on their own to print out their generated tactile map. However, 3D printers are still not universally available to users. For this reason, the original user interface described previously will also include a final step in the process of generating a map where the user can either download the STL file so they may print the file themselves at their own discretion or have the file sent somewhere to have it be printed and mailed to them. This way, users who have difficulty using a 3D printer or who do not have access to one can have the option to have another facility print the tactile map for them, for some fee which will be determined later. In either case however, this project does require that a 3D printer be available for generating the tactile map. From a technology standpoint for this second user interaction, the project implementation will provide information for facilities that offer 3D printing services and the appropriate fees for printing and mailing the resulting tactile map to the user or allowing the user to operate their 3D printers to produce the tactile map. Operating a 3D printer may require assistance from another person, especially if it is the user's first time using a 3D printer, if the printer needs to be restocked with resources, or if the printer encounters problems while printing.

The third and final user interaction will be the process of using the 3D-printed tactile map. As stated before in the first user interaction, in the map generating process, the users themselves will decide on what features to include on the tactile map. By working with Jess and Jacob in the development process, the technology will focus on making sure that the feature representation will be understandable and usable on a tactile map, in terms of texture, Braille text, and visual elements on the map. In order to ensure the clarity of map labels and textures, we will use distinct feature representations and include a key with the map detailing how a particular feature is represented on the user's generated tactile map. Since it is likely to be difficult for a low to no vision user to read the map while navigating an area, we anticipate that this map will be used either prior to arriving at the area of interest (as in the comfort of the user's home, for example) or at a stop along the way to safely study the map. This task of using the map will likely be performed multiple times on any visit to the area displayed on the map. Because of the multiple number of uses, the plastic filament used in 3D printing will be resistant to heavy use of the tactile map.

The user will also need to understand that the information displayed on the map will be correct given the time of the print and that information on the map is subject to change over time. Though the tactile map will likely remain valid over shorter periods of time, the user may need to reprint maps as time passes to ensure that more current information is displayed on the map. It is also important for the user to understand that since the data for generating the tactile map comes from OpenStreetMap, which is "built by a community of mappers that contribute and maintain data about roads, trails, cafés, railway stations, and much more, all over the world", data represented on the map can possibly be incomplete and/or incorrect at times. Thus, it is important to understand that the tactile map representations may not be perfect representations of the area it represents, and that these maps should be used in complement with observations made about the world to ensure the best travel possible.