

ECE4011/ECE 4012 Project Summary

Project Title	Blindle
Team Members (names and majors)	Jordan Altaffer Cameron Davis Dimitry Jean-Laurent Annie Luo Emmy Perez
Advisor / Section	Jennifer Hasler / Section D1A
Semester	2020 Fall
Project Abstract (250-300 words)	<p>Blindle is an e-reader for users who are visually impaired. Blindle's main feature is a Braille interface made from an electrotactile display and a minimal user interface that allows users to seamlessly navigate a book of their choosing. The goal of Blindle is to optimize accessibility and portability: many current e-reader prototypes for the visually impaired are unwieldy, whereas we want Blindle to be able to fit in a handbag.</p> <p>Our prototype for Blindle will not be an entire e-reader, but rather something to test the interaction of the various technologies involved. We see the prototype as likely being a small screen that can produce two letters, as well as two buttons to allow the user to parse through a preloaded sentence and display each letter in the sentence as a Braille character. We will likely use arrays of 6 LEDs to first test the functionality of our code and the microcontroller to make sure the correct patterns are being displayed. This design will access a microSD card with some additional sentences stored for testing. A simple mobile app interface will allow us to select from a small selection of text files to translate into braille and transmit to the storage device.</p> <p>The final design will be a full e-reader, with the display accommodating 14 characters across the width and 6 characters down the length (traditionally, a Braille character and the immediate following space is 6 mm by 10 mm, we will be blowing these sizes up to 2.4 cm by 4 cm, and will fit this onto a sheet roughly the size of printer paper). This product will have a button for traversing forward and backward a page, home and select buttons, a power button, and a button to toggle the intensity of electrical stimulation that we are using to output the braille lettering with. It will also be able to interface with a more complex mobile app that can download the e-books. We understand that such an app means that the user will need a seeing friend to help them get the books for their reader; however, adding an additional feature of text to audio can also eliminate this obstacle at a later point in the project or for future groups to pursue.</p>

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List codes and standards that significantly affect your project. Briefly describe how they influenced your design.	<p>Braille Standards: Braille standards will dictate how we actually display the data, including the spacing of the Braille, the actual formation of the Braille characters, and other ways to make our product accessible to the visually impaired. Translation of readable text to Braille script will be done using the standard translation tables (Grade 1, Grade 2, Grade 3) for English Braille.</p> <p>Communications Standards: Both the communication protocol we use to interface with the application, as well as working at an acceptable communication frequency (if we use Bluetooth, then this second part is not important).</p>
List at least two significant realistic design constraints that applied to your project. Briefly describe how they affected your design.	<p>Size: The Blindle is designed to be portable, thus there will be constraints on the size of the device. A larger size allows for more features but less portability, while a smaller size has better portability but allows for less features. A smaller size is ideal, but it needs to be large enough to implement all the desired features.</p> <p>Power: The Blindle will require a good battery life to function well as a portable device. Higher power consumption could result in a short battery life, while lower power consumption could limit the abilities of the device. Ideally, the Blindle will consume the least amount of power possible while maintaining full functionality. Increasing the amount of power that is needed to operate will also increase the final size of the device.</p> <p>Cost: Cost is expected to be a heavy constraint on the final design. While braille-based readers already exist on the market today, many of them are prohibitively expensive for the hard of seeing. Thus we will need to research methods of implementation which are functional yet cost effective.</p> <p>Display: The Blindle will have 84 braille characters which will mean 504 electrodes that will need to be coded. Having a way to allow each of these electrodes to hold a state for a certain amount of time and not have to hard code every single dot is something that needs to be taken into consideration.</p>
Briefly explain two significant trade-offs considered in your design, including options considered and the solution chosen.	<p>Accessibility vs Functionality : Greater functionality complicates accessibility for visually impaired. A device design is needed that strikes a balance between having enough features to be a viable e-reader device while not being complex to the point that the device is difficult for the visually impaired to use. This is a uniquely difficult problem to solve through a non-visual medium.</p> <p>Ease of use vs. Cost : While it may be beneficial to replicate the interface of braille books as closely as possible, designs on the market such as these have so far come at a high cost for end users. From our research we can conclude there are other approaches that have potential in significantly reducing cost, but mostly at the expense of possible discomfort and a short battery life due to the power consumption on an electric display.</p>

<p>Briefly describe the computing aspects of your projects, specifically identifying hardware-software tradeoffs, interfaces, and/or interactions.</p> <p><i>Complete if applicable; required if team includes CmpE majors.</i></p>	<p>To simplify the microcontroller code and reduce its memory requirement, it might be beneficial to perform the braille translation in a separate application. The program would take the PDF version of a book and convert it into a readable, plaintext file that could then be translated into Braille script. The program's output is stored into an SD card or USB drive. Once the memory has been connected to the Blindle, the DMA (direct memory access) inside of the UART system would take care of the file retrieval process.</p> <p>Braille translation could also be implemented onto the actual device. A separate application would still be required to convert any file format (specifically PDF) into plain text before the transferring of data.</p>
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<p>Leadership Roles (ECE4011 & Forecasted for ECE4012) (NOTE: ECE4012 requires definition of additional leadership roles including:</p> <ol style="list-style-type: none"> 1. Webmaster 2. Expo coordinator 3. Documentation 	<p>Documentation: Jordan Altaffer Webmaster/Team Leader: Annie Luo Hardware Lead: Dimitry Jean-Laurent Design/Testing Lead: Emmy Perez Software Lead: Cameron Davis</p>

<p>International Program: Global Issues (Less than one page) (Only teams with one or more International Program participants need to complete this section)</p>	<p>(10 point font, single spaced)</p>
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