EyeTouch - Portable Refreshable Braille Translator
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BACKGROUND

WHAT IS BRAILLE?

Braille is a reading and writing system used by the visually impaired that relies on the sensation of touch. Each character is distinguished by a unique arrangement of 6 pins that make up a "cell"

OUR PRODUCT

Our product, EyeTouch, is a portable refreshable text to braille translator. It connects to a smartphone (currently Android) through Bluetooth technology and solves the problems of portability and cost that the other models in the market face.

Our translator is designed to limit the need for audio assistance and allows users to rely on touch only. EyeTouch can be used for both educational and personal purposes.

SOFTWARE METHODOLOGY

The software components are mostly prevalent through the microcontroller and Smartphone components of the design.

- We detect any audio input from the user through Android’s SpeechRecognizer API, and translate it to programmable text.
- We directed our application to do things such as read SMS messages from the phone and translate to our Braille Encodings.

- We used the Arduino Nano as the main microcontroller due to its computational strength, and more importantly, its size; The Nano interfaces with the smartphone via a Bluetooth slave chip which will receive and send byte data that will be directly manipulated within the Nano.

TECHNOLOGY USED

Network technologies: Bluetooth; Development tools, and software environments: Android, Ionic Framework, Cordova, C Development Kits: JVM, JRE, V8 Engine, Arduino IDE Linux Standards (underlying the Android operating system)

PAST AND CURRENT METHODS

Braille is most commonly read and written in embossed paper. Recently with the prevalence of smart phones and tablets, refreshable braille technology has arose to make communicating through braille more accessible. But these technologies are not used due to their heavy size and unreasonable cost.

JOURNEY

SEMESTER GOALS

In the four months we had to work on this project, our deliverables included a portable and lightweight cell that was paired with the Android via Bluetooth, and an application that received any messages sent to the phone and converted this text to braille.

FUTURE GOALS

Apart from dynamically changing and improving the design of this device to best work with the needs of Braille users, we would like to work on Braille schools so this tool can be used as an educational device to teach Braille. Fewer than 10% of blind individuals can understand Braille, mostly due to a chronic instructor shortage and inadequate education tools. We would like this technology to help solve this problem while the current model is a read-only device, we would like to incorporate a tool to allow the users to directly type in braille.

OUTREACH

Vision Loss Allience:
- Aims to create and deliver expert programs and services that build confidence and improve the quality of life for individuals living with profound vision loss
- We were able to contact representatives and those who actually use braille in order to validate our product and make changes as required

HARDWARE METHODOLOGY

The hardware has two parts - the logic design (mosfets/transistors that connect the Nano with the pins and relay the current) and the braille character pins that move up and down based on the laws of electromagnetism.

- The nano directs its output pins with a voltage HIGH or LOW that passes or doesn’t pass a current based on the specific Character formation. This is done by receiving byte data from the smartphone based on the letters, parsing the encoding correctly, and assigning the output pins the correct voltage. The Nano is connected to four Rs485 shift registers that allow the users to scroll through the characters to read a word.

- The Arduino only outputs 0.02 amps which is not nearly enough to drive the pin. We used IR4540 Transistors to increase the output current in order to power the pins and IN4001 diodes to control the current sent to the pin after the logic goes back to LOW.
- Each pin in the EyeTouch contains two magnets inside and is surrounded by tightly wound loops of conducting coil. When the current is passed through the coils, a controlled magnetic field is created and the magnetic repulsion forces the pin to move up.

HARDWARE USED

Arduino Nano L298N
R5485 Shift registers IR4540 Transistors IN4001 Rectifier Diode 3D print Markforged

REFERENCES