Design Studies

Magnetic Field

This test was used to determine if the magnetic field powering the Braille cell pins were working with the solenoid design. Different turn densities were analyzed to understand which one produced the strongest resistance of the solenoid.

OCR Software

In this test, a camera will be connected to a Raspberry Pi and this visual input will be analyzed by the Python-tesseract library to output the text. Then, this text will be converted to Braille Unicode characters using the PyBraille also on the Raspberry Pi. This conversion to Unicode is a simple mechanism to map visual text to Braille. In addition to this, the text will also be converted to boolean formats of the Braille cell modules. These booleans will define which Braille dots are present in the character.

LED Test

The LED test was used to test the driving electronics and ensure that the electrical current can be controlled between specific braille modules.

Operation of Device

1 OCR and Text-to-Braille

1. Connect to at2024, Password: *****
2. Go to http://jimbo.local:5000/
3. View the camera feed, the text being pulled from the feed by Tesseract, and the text converted to Braille Unicode characters.
4. To shutdown Raspberry PI, enter sudo shutdown -h now in terminal

2 OCR and Text-to-Braille

1. Connect Arduino to power source.
2. Run code and verify LED action.

Safety

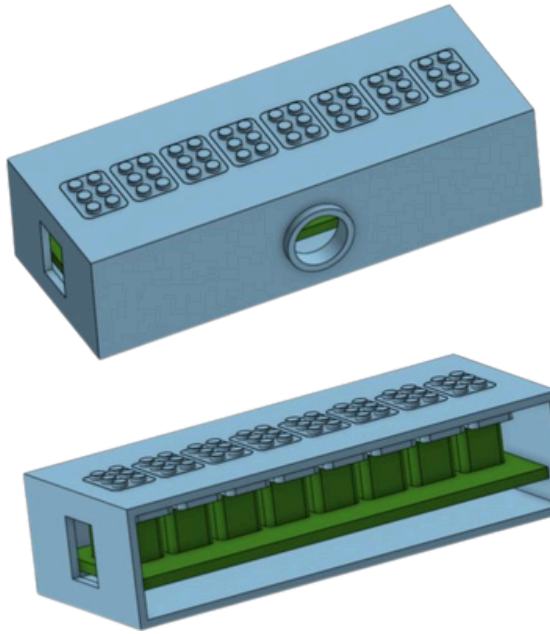
Do not immerse device in water

This device is a prototype; don't rely on this device in high risk environments

Optical Text-to-Braille Translation Device

Dot.

Abigail Figueroa, Charuvi Singh, Derek Desrosiers, Kruthi Gundu, Samhitha Bodangi
Advisor: Kevin Crowthers, Ph.D



Optical Text-to-Braille Translation Device

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Advisor: Kevin Crowthers, Ph.D

Methodology

Initial sketches
Brainstorming, idea development and need investigation

CAD Modeling
Design variations, visualization, design decision making

Electromechanical construction
3D printing Braille cells and tools, solenoid winding, PCB soldering, cam + magnet placement

OCR implementation
Microsoft Tesseract, Margin conditionals, input from camera, character by character translation

Text Conversion + Display
Text to Braille Module Conversion, ESP32-S3 to Arduino Nano, Arduino code to select, set, reset, and turn off pins.

Assembly Instructions

Problem Statement

Visually impaired people (VIPs) encounter significant challenges in accessing written information. Learning Braille from a young age aids with literacy, enhancing future life implications for VIPs. However, there is a lack of interactive educational devices for younger VIPs.

Engineering Goal

The goal is to design an assistive device for VIPs that uses optical character recognition (OCR) to take pictures of text in the environment. The device translates text from the image into Braille configurations and provides a tactile medium for the VIP to read the translated Braille.

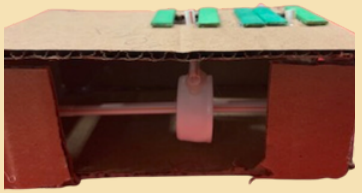
Conclusion

The Assistive device is more affordable and portable than existing devices on the market. It is easily adaptable to include more Braille characters. The simplicity of device allows for easy and adaptable Braille education

Designs

Design I

Axle-display

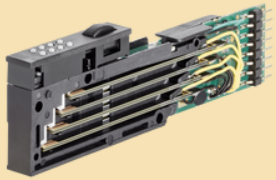


Pros:
- cost-effective
- simplistic design

Cons:
- difficult to control several cels

Design II

Piezoelectric Braille Cell

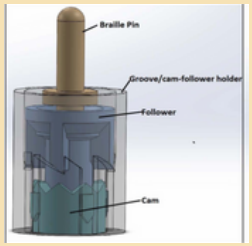


Pros:
- compact
- easy to implement

Cons:
- very costly → limits # of cells

Design III

Cam and Follower Assembly



Pros:
- simplistic design
- solenoid powered

Cons:
- large motor
- costly