DigiBraille

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Product Pitch

Nearly 3.2 million Americans suffer from serious vision loss, and simple tasks for sighted people, such as reading a recipe or jotting down a quick note can become a complex undertaking for a visually impaired person, even with the aid of existing technologies. Current accessible technologies, such as braille printers, electronic braille readers, and braille writing slates, can be expensive and time consuming to use.

We propose a device that allows blind users to connect to a wireless braille printer directly from a web-app available via smartphone, which has many accessibility tools that blind users take advantage of everyday. Our web-app will allow users to either input notes or search a product name that they would like instructions for using accessibility features. They can then send a print request to our braille embosser, which will provide them with a braille version of their input at a lower cost and comparable timeframe to state-of-the-art devices.

System Architecture

Users will input requests into a web-app developed using Flask and Python. Their requests will then be translated to braille, or input into our web scraping algorithm before translation, depending on the input type. The translation will then be mapped to motor and solenoid signals, which will be sent to our Raspberry Pi (RPi). The RPi communicates with an Arduino, which controls most of the circuitry, over UART. The solenoids will emboss the paper, the stepper motors will control movement in x/y directions.

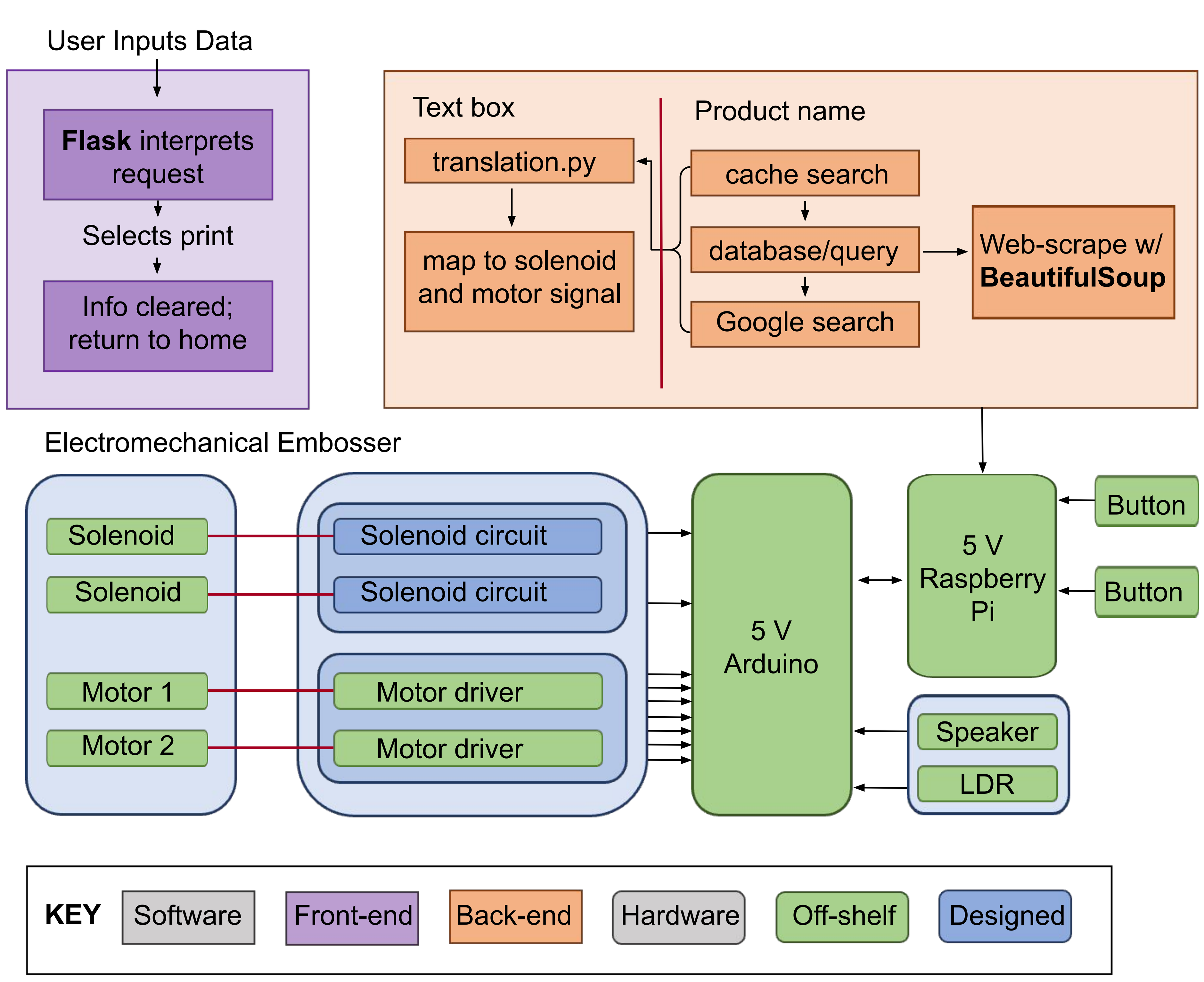


Figure 1. System block diagram

Conclusions & Additional Information

Our low-cost phone-controlled embosser enables information to be easily accessible through braille, and streamlines the process for getting directions for products, and leaves the possibility for inputting other information. We learned about 3D modelling, modular design, how to integrate complicated subsystems, and more about the braille alphabet. Future possibilities include integrating with Amazon Alexa and other accessible software features.

System Description

Our systems consists of two primary components: a phone accessible web-app (**Figure 2**) and an electromechanical embosser (**Figure 3**). In the web-app, users can elect to enter notes or search a product name for instructions. Our web-app will connect to our embosser wirelessly over wifi. The embosser is comprised of 2 solenoids, a stepper motor with a lead screw, rollers, and a light sensor (**Figure 4**). The two solenoids move in the x direction and are responsible for the embossing of the braille. The stepper motor with the lead screw shifts the solenoids across the x-direction. The rollers will move the paper in the y-direction once a single line of raised dots is finished embossing. The light sensor will be used for paper registration, and we will have a speaker to communicate status to the user.

Figure 2. Webapp homepage

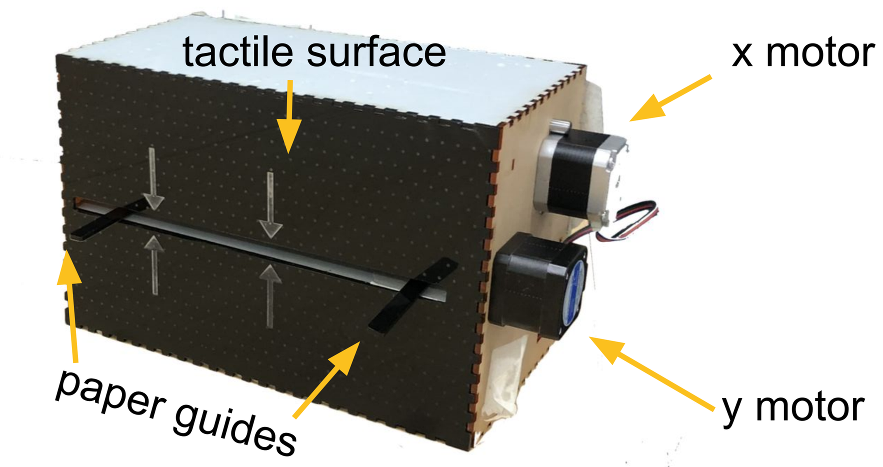


Figure 3. Electromechanical embosser

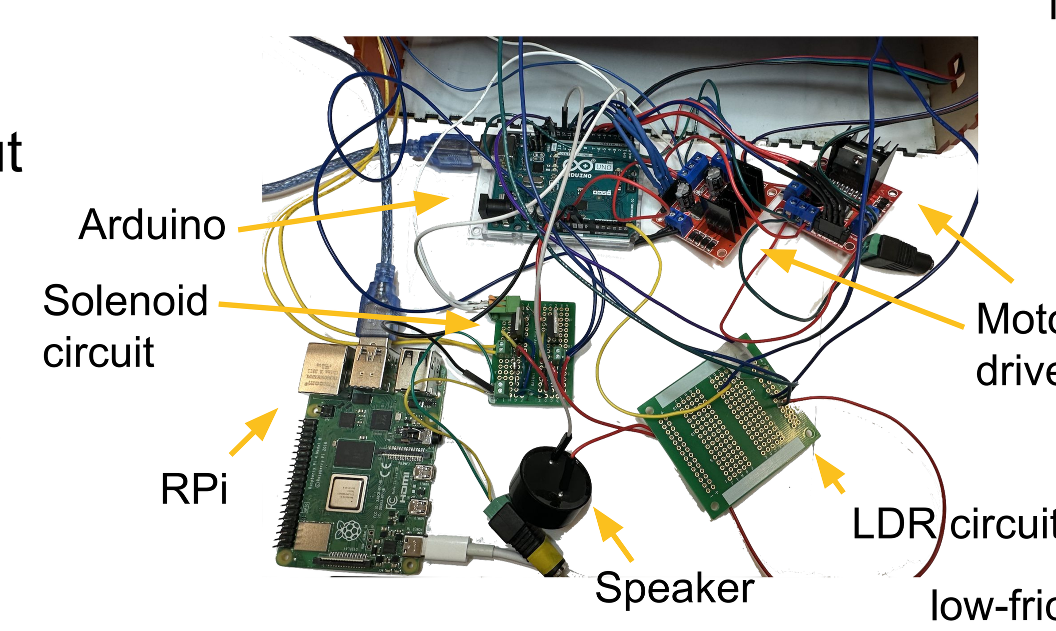


Figure 4. Circuit view

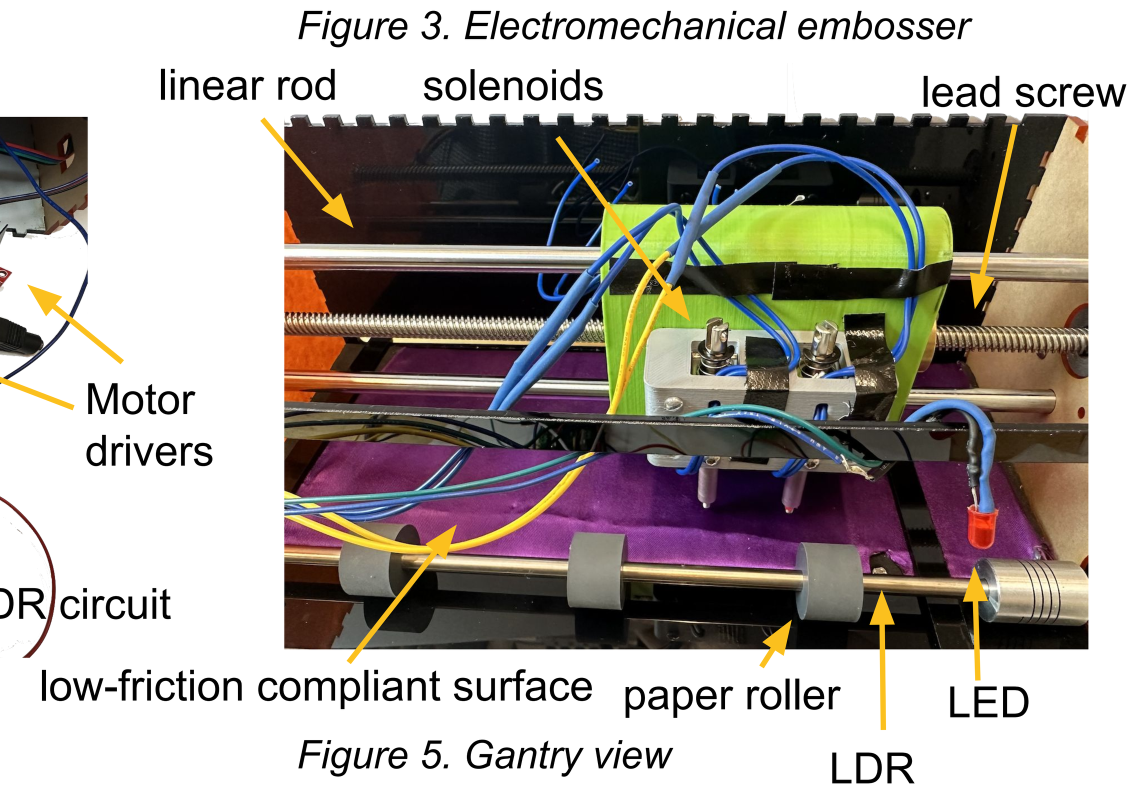


Figure 5. Gantry view

System Evaluation

Speed Results - *based on timing runtimes for components*

Component	Goal	Result
Emboss single braille cell	**< 12.5 sec**	7.5 sec
Product search time with	**< 1 sec**	.5 sec average w/ database 5.32 sec average w/ query

Table 1. Speed Results

Accessibility Results - *based on 1-5 satisfaction rating survey questions*

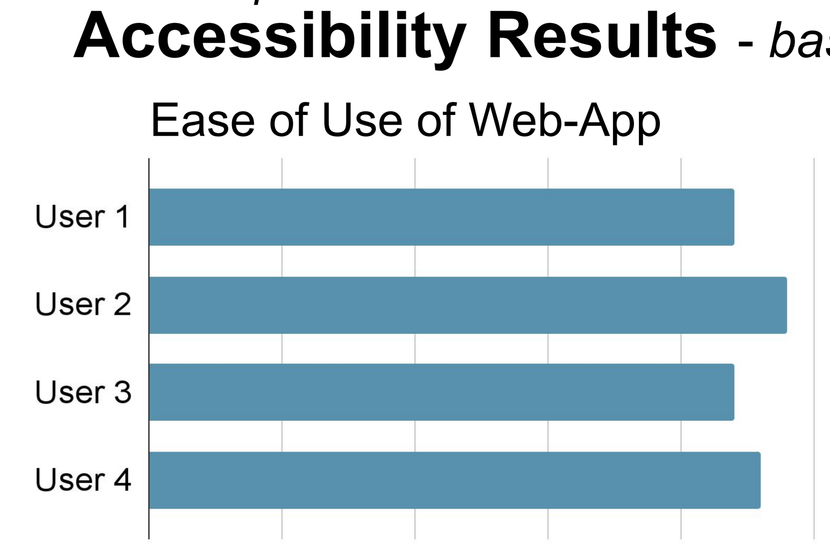


Figure 6. Web-app survey result

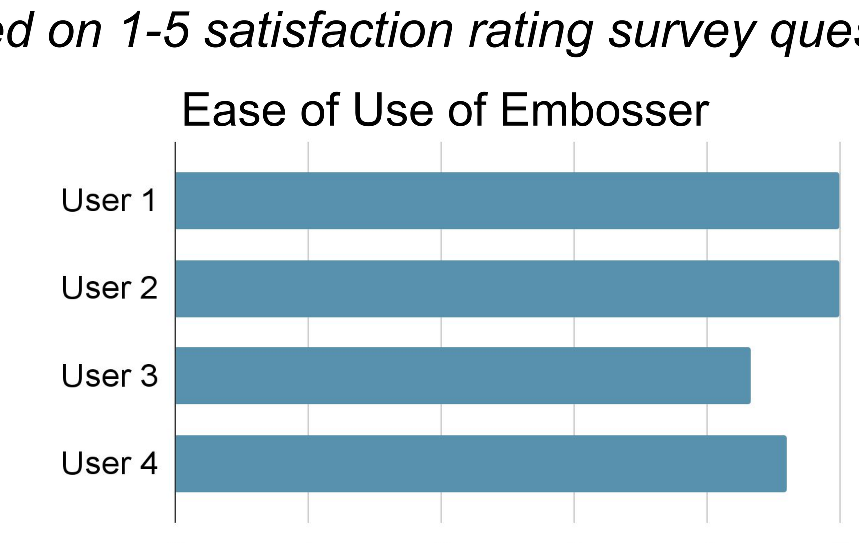
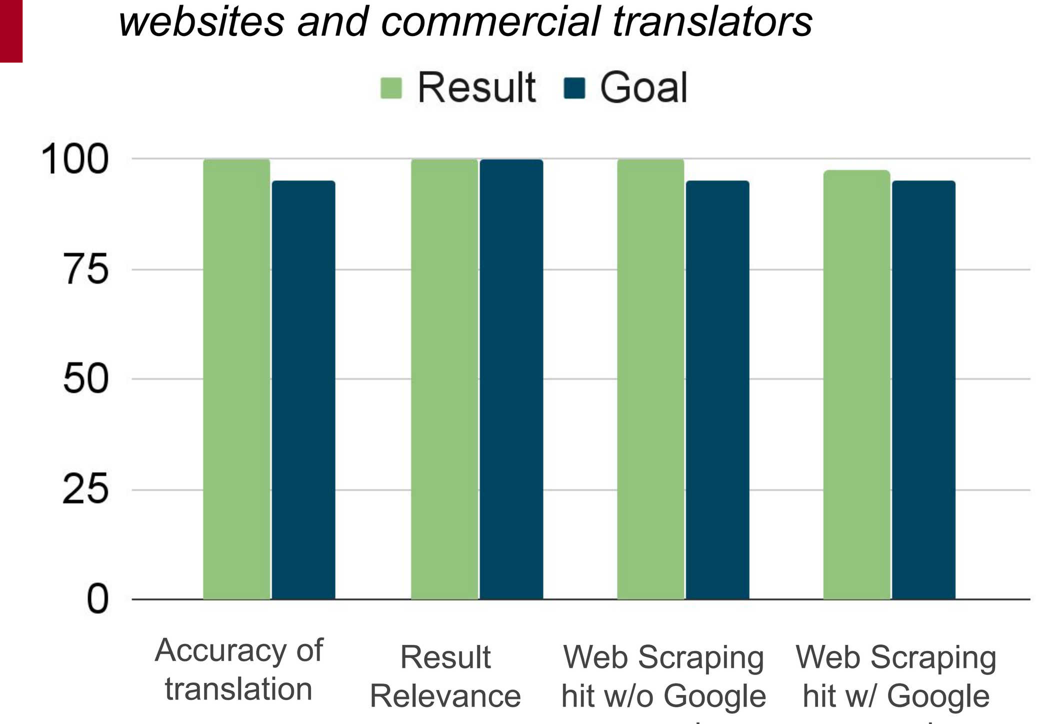


Figure 7. Embosser survey result

Completeness & Accuracy Results - *tested against popular product websites and commercial translators*



Trade-Offs

Design Choice	Trade-Off
Solenoid Quantity	Cost vs Speed
Database	Robustness/Storage vs Speed
Arduino + RPi	Cost vs Speed
Laser Cut parts	Cost vs Mechanical Robustness

***Total Cost:** $184.76*
***Weight:** 2.3 kg*