

BrailleGrid

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Design Problem

Braille displays generally range in cost from \$3,500 to \$15,000.

Home > Blindness Products > Braille Displays/Notetakers > Active Braille



Active Braille

★★★★★ 0 Review(s)

Your Price: \$6,495.00

Starting at \$226/mo or 0% APR with [affirm](#). See if you qualify

In Stock.

Part Number: 263

Quantity

1

ADD TO CART



\$2,795.00

- 16 concave piezoelectric braille elements
- ATC: relaxed reading without pressing the Advance key
- integrated practical functions such as editor, calculator, scheduler, and more
- write, read and send messages via smartphone or PC
- interactive connection via Bluetooth and USB with up to four devices at the

When using a computer, people with visual impairments require assistive technology. This typically comes in the form of a Braille- or voice-based interface. However, the steep pricing of commercially-available Braille displays is currently prohibitive to widespread use.

Our project is to design a low-barrier, affordable device to support Braille display of computer content.

Software



<https://github.com/mimiZhang130/braille-grid>

Extension

Enter API Key

Set API Key Start

Next

- ❖ Language used: Javascript
- ❖ Actions:
 - Retrieves text from page
 - Parses the text into 100 word groups
 - Use OpenAI API to summarize the text
 - Use Braille package to convert text into braille
 - Send result in post requests to Go service

```

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service-worker.js:2293
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6, 160, 143, 226, 160, 129, 226, 160, 155, 226, 160, 145, 226, 160, 128, 226, 160, 14
3, 226, 160, 151, 226, 160, 149, 226, 160, 187, 226, 160, 138, 226, 160, 153, 226, 160,
145, 226, 160, 142, 226, 160, 128, 226, 160, 138, 226, 160, 138, 226, 160, 138, 22
6, 160, 149, 226, 160, 151, 226, 160, 141, 226, 160, 129, 226, 160, 158, 226, 160, 13
0, -1]
Decoded response from service:
service-worker.js:2294

```

TUI Client to setup the server

❖ Framework used: Go Bubbletea

❖ Flow

- Select port to connect to
- Enter baud rate
- Start server
 - Server can now receive post requests and echo them over serial comms.

```
+ service git:(main) go run main.go
Please select the serial port to connect to?

/dev/cu.Blueetooth-Incoming-Port
> /dev/cu.usbserial-110
/dev/tty.Blueetooth-Incoming-Port
/dev/tty.usbserial-110

Press q to quit.

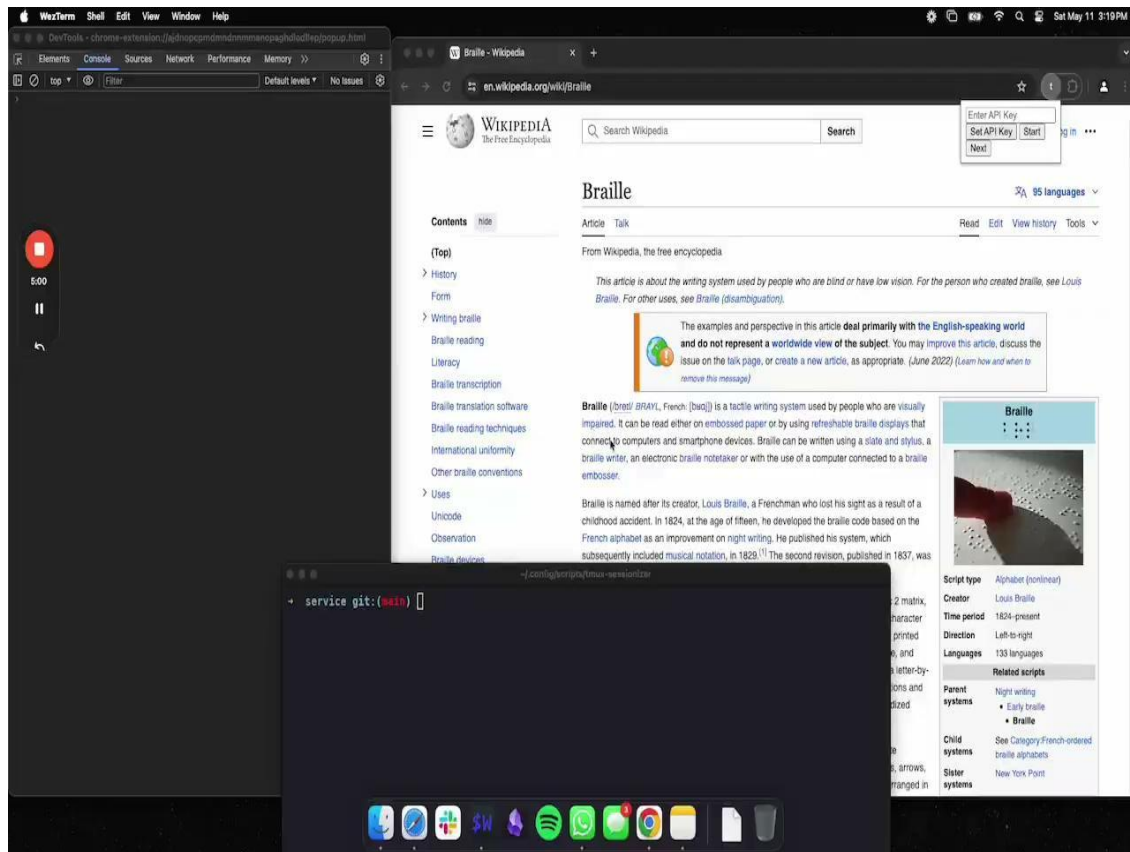
+ service git:(main) go run main.go
Baud rate?

> 9600

Press q to quit.

+ service git:(main) go run main.go
Serving http server at localhost:3000
Press q to quit.
```

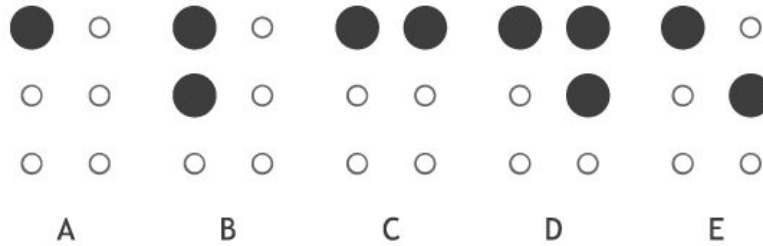
Demo



Hardware

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Intro



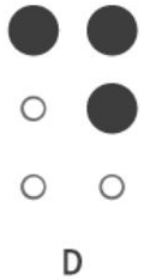
- ❖ Each braille cell is made up of 6 dots.
- ❖ We chose 6V solenoids with only 2 stages: ON/OFF. We control them with an Arduino.
- ❖ In order to display only 5 letters we need to control $6 \times 5 = 30$ solenoids, which would require 30 independent output pins from a microcontroller. This is impractical and inefficient.
- ❖ We used shift registers to solve this problem.

Shift Registers

Each shift register has 3 important inputs: DATA, CLK, and RST. Output are Q0 - Q3.

On every clock cycle, DATA -> Q0 -> Q1 -> Q2 -> Q3

We will use two to control rows and columns and flash through the matrix quickly so that the solenoid stays actuated during the off stages.

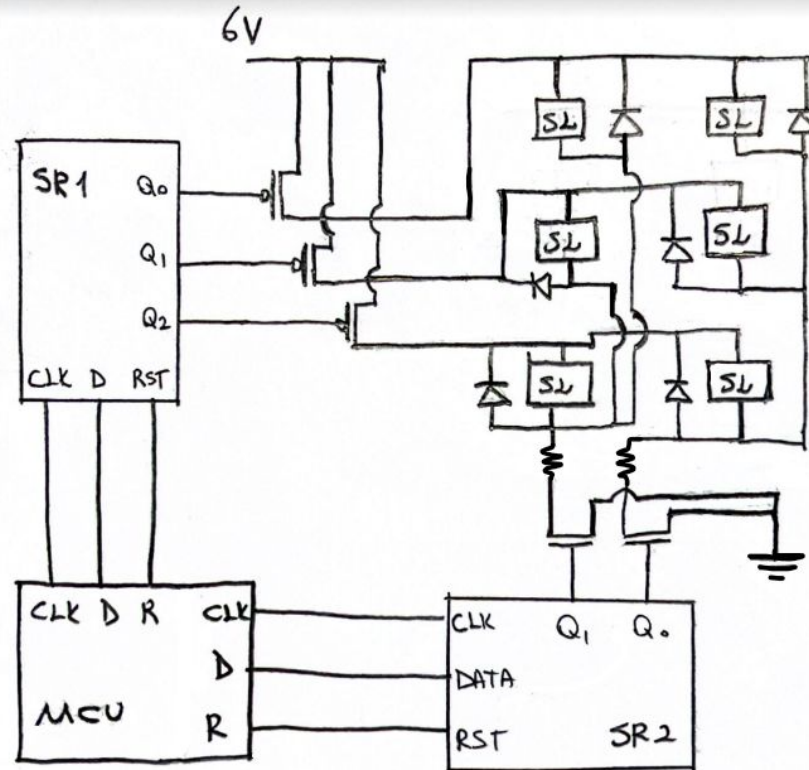


Steps	Row Data	Selected Col
1	011	1 (10)
2	001	2 (01)
3	011	1 (10)

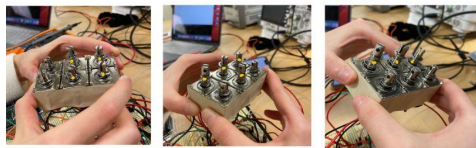
```
void shiftonebit_row(uint8_t data) {  
    digitalWrite(registerA_data, data);  
    digitalWrite(registerA_clock, HIGH);  
    digitalWrite(registerA_clock, LOW);  
}
```

This reduces the total IO pin counts to 6 per ... 4x4 solenoid - *reduced by 63%*!

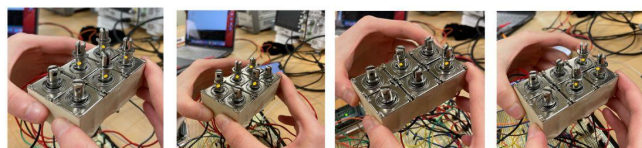
Schematics



Demo



B R L



G R I D



H E L L O W O R L D

Conclusion

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Total Project Costs

Microcontroller (1) Arduino UNO Rev3	\$27.60
Shift Registers (1)	\$0.97
Push-Pull Solenoids (6) \$7.50/each	\$45.00
Transistors - pMOS (3), nMOS (2) \$10/15 pcs	\$3.35
6V Battery Pack (1)	\$12.00
Total	\$88.92

At this stage, additional cells would require 2 nMOS transistors and 6 solenoids (~\$46.24) each. For every additional two cells, another shift register is required (+ \$0.97).

Predicted reductions

- Smaller solenoids
- Minimal microcontroller

At larger-scale production

- Mass ordering of solenoids
- PCB components

Further development on the software side...

Interface:

- Improve visuals for interface

Installation:

- Create an installer for the extension and pre configure the server so that the user does not need to do so

Previous:

- Add in software to go backwards in text for re-reading

Text filtering

- Filter only what is being read by the user rather than all text on a page

Image Processing

- Generate short text summaries for images and videos

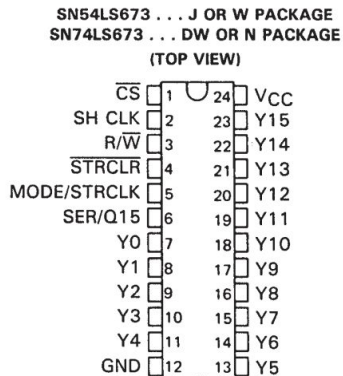
Further development on the hardware side...

Solenoid Specs:

- Lower power by reducing current (currently 2A)

Shift Registers:

- For larger scales,
Use Wider SR to Reduce Pin Count



User Interface:

- Add Control Buttons
- Tactile Instructions/Navigation
- Add form factor

Product Scale:

- Increase Size
- Expand Alphabet Capacity
- PCB design



Thank you!

Any questions?