

Product Requirements Document

Braille Display Device

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Introduction:

A Braille displays is a piece of hardware that turns text on a screen into Braille, allowing visually impaired individuals to access information to read emails, text messages, eBooks, and other digital content, it is also equipped with a built-in Perkins Keyboard for typing, generally connecting to a cell phone via Wi-Fi. As each braille character can have up to eight dots, every braille “cell” (a space for a single character) must contain eight small pins, and an actuator to raise and lower each one. The Braille-line also includes a removable battery for extended use. Its compact size and lightweight design make it easy to carry in a pocket or bag, providing convenient access to Braille reading wherever the user goes.

In order to decide what text to display in Braille, the user is generally responsible for controlling the outputting text to it using a smartphone application through voice commands.

Vision:



This product is envisioned as a Braille-line with 20 Braille-cells, Perkins-style braille keyboard with function keys, working with mobile application through WebSocket for a persistent, bi-directional, full duplex TCP connection from a user's web browser to a server in order to obtain high-quality connection. This product is also aiming to be low-cost, and as a result, will seek to utilize already-existing features offered by mobile phones so that this system can be easily reproducible on a production line.

Environment:

The system will be designed for personal use, it will be used by visually impaired individuals at home, school, work, etc., so it must be easy to carry and light in weight. The device should be designed for use about 12 hours a day.

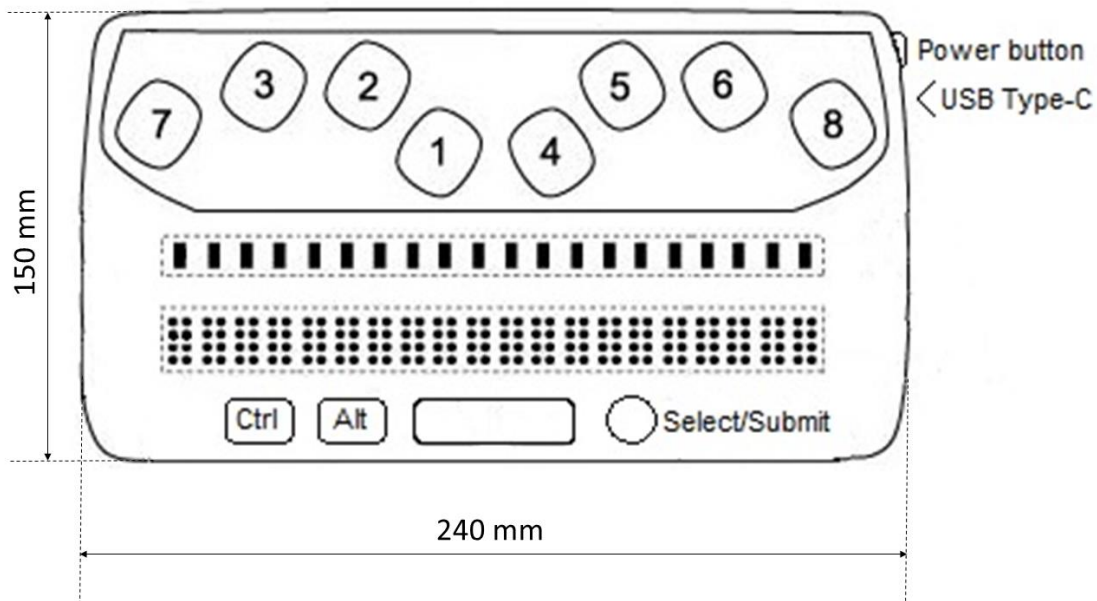
Product Requirement Document:

The following details describe the requirements for the end product:

- First and foremost, we seek to utilize most of the features offered by mobile phones, which will make our product less costly, more efficient, and with less weight and size.
- Using our product, the visually impaired can read and write, the application associated with it (through WebSocket) on the mobile phone makes using the product very easy.

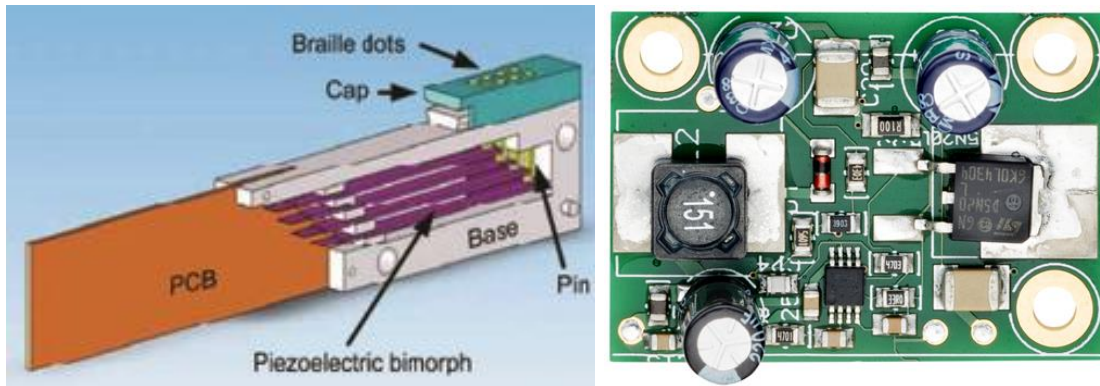
Main features:

- Braille-line with 20 Braille-cells with 8 pins.
- Perkins-style braille keyboard with function keys, as well as Alt, Ctrl keys and space bar, that helps read and reply to emails, for example.
- Connects to Wi-Fi devices.
- Battery life: 20 hours.
- It can be handled and controlled through mobile application, making it easier and smoother to use.



1. Physical specifications:

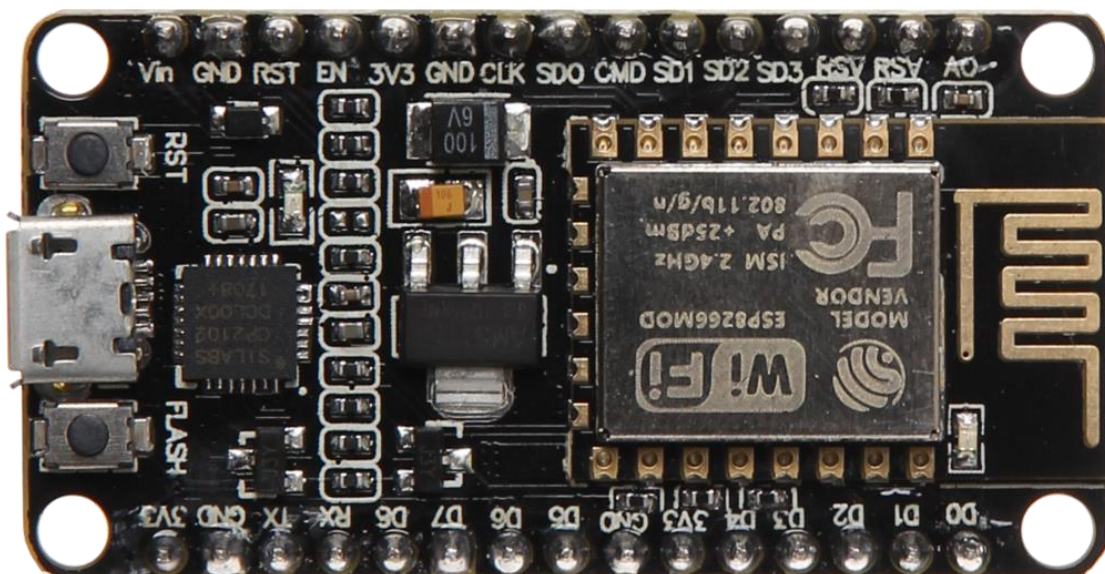
- Its 20 Braille-cells containing 8 pins, driven by piezo-actuators. Integrated drive electronic with 200V power supply, the use of piezo bending actuators as drivers provides excellent performance and reliability along with extremely low power consumption.



- Device weight: < 800g
- Device dimensions (L x W x T): ~ 240 x 150 x 20 mm
- It has a Power button (On/Off), extra button used to select an option or submit an input.
- Perkins-style braille keyboard with function keys, as well as Alt, Ctrl keys and space bar.
- Replaceable lithium-polymer battery, Charging via USB to a computer system or power adapter.

2. Technical specifications:

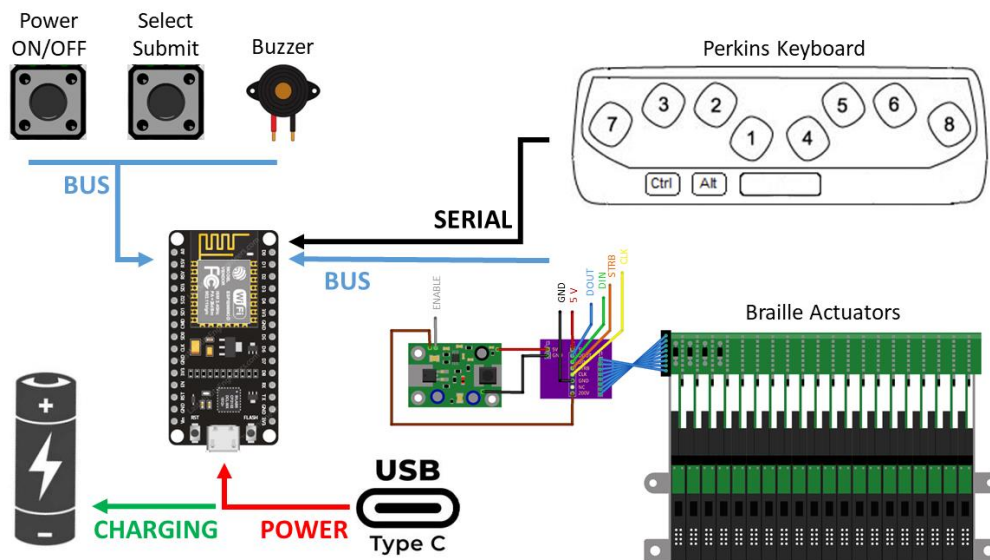
- NodeMCU based on the ESP8266.
- Tensilica LX106, 80 - 160 MHz processor.
- 64 kB of RAM memory.
- 96 kB of internal storage capacity.
- Wi-Fi 802.11 (802.11 b/g/n); Frequency band (2.4GHz).



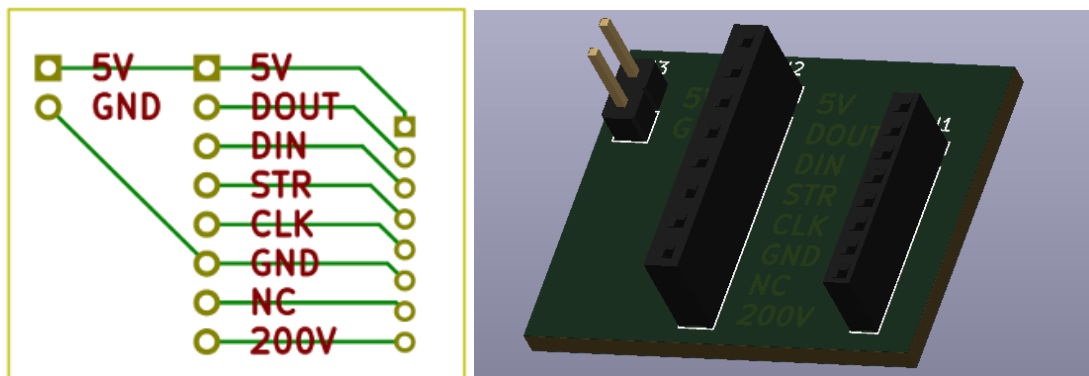
- Rechargeable ~3000 mAh Li-Ion battery, with approximately 16 hours of use.
- USB type C device high speed interface for connection and recharge, it also has a buzzer for battery charge level.
- Fast charging mode up to DC 5V 18W.

3. Connections:

The following diagram shows the connections for all system elements in general, where you have the flexibility to determine the MCU pins you want to use.



The PCB design of the interface circuit is illustrated in the following figure.



4. Pin pattern information:

The microcontroller (MCU) receives the text sent via WebSocket after converting it to bytes according to Braille language. The first byte is placed in the first character of the Braille display, then the second byte is placed in the second character, and so on, until all characters are written. The eight bits should be written on 8 pins for each character in the following order:

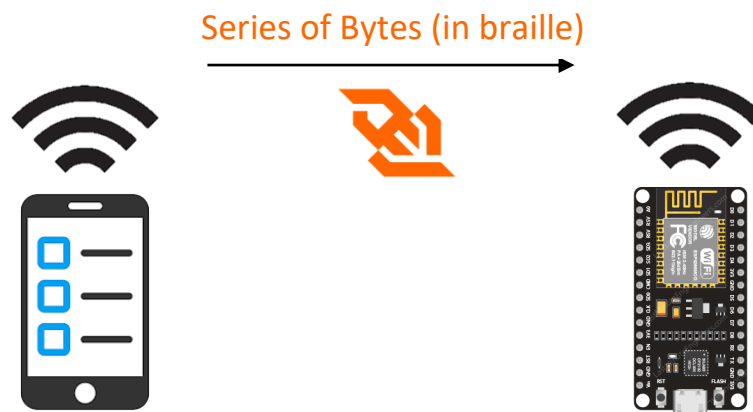
Position		Corresponding bit	
1	2	128	64
3	6	32	4
4	7	16	2
5	8	8	1

0 0 1 0 1 1 0 1
128 64 32 16 8 4 2 1

Received byte

In addition, the display order will be from the first character on the right to the last character on the left.

5. Diagram of system:



Some requests for the manufacturing process:

You are responsible for studying the design and implementing it, such as assembling the circuit and programming the MCU, with the same specifications mentioned, and configuring the websocket to be fully ready to connect it to our application. This design should be suitable for later production in large quantities. After that, the external structure of the product must be designed to be practical and elegant, and of course, necessary tests must be performed to examine the quality of the design.

Note that my product does not have the same buttons shown in the first image.

You may find the following products suitable for the device I want

Braille line Flat 20, USB controller, DC/DC converter from METEC.

I would also like to receive a timeline before starting the work. Please inform me first before making any changes to the required specifications and keep me updated.

Want:

Prototype + Help documents for customer use.

References:

You may find the following links useful in your study, design, and implementation processes.

- <https://forum.arduino.cc/t/metec-braille-cells/230318/1>
- <https://metec-ag.de/downloads/braille-line-flat20.pdf>
- <https://metec-ag.de/downloads/dcdc-converter-5to200v.pdf>
- <https://github.com/bertrandmartel/metec-braille-driver/tree/master>