Digital Braille Watch

Nick Anderson   Chandresh Singh   Kyle Jamar   Taylor Milne

Client: Holly and Colton Albrecht   **Advisor**: John P. Puccinelli[1]

[1]Department of Biomedical Engineering – University of Wisconsin-Madison

Abstract

The Braille system is the primary reading and writing method for 284 million visually impaired individuals worldwide, yet no device exists that utilizes Braille to indicate time. Currently, the visually impaired rely on tactile or talking watches. However, tactile watches are difficult to read, while talking watches are disruptive. Since the current methods are inadequate, a Digital Braille Watch was designed.

The final prototype uses four rotating disks, each positioned beneath four pins. Each disk contains raised and lowered surfaces which dictate the pin orientation. Based on the arrangement of raised and lowered pins, the corresponding Braille numeral can be felt on the surface of the watch. The four disks are integrated with a gear system, allowing the watch to be controlled via the constant rotation of one disk.

Final testing of the prototype confirmed the functionality and marketability of the design. Future work includes manufacturing the watch using metal parts, which would increase watch durability and decrease its size.   Furthermore, gaining a patent through WARF and earning the interest of companies would allow for the advancement of the Braille watch into a buyer market.

Background

Braille Basics[1]
- Method of written communication used by the visually impaired
- Numerical characters use a two-by-two grid
- Using different combinations of raised or lowered dots, all ten numbers can be displayed
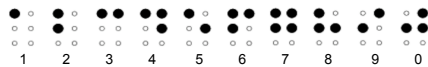
Braille Numerals (Figure 1)

Figure 1: The Braille numbers 0-9 each consist of four dots

http://www.dotlessbraille.org/AboutBraille.htm

Motivation

- The visually impaired frequently rely on others to determine the time
- A well-designed watch would allow for more independence
- Current watch designs for the visually impaired are disruptive and challenging to read

Goal: To create a digital Braille watch that allows the user to accurately and discretely check the time

References

[1] "Size and Spacing of Braille Characters." Braille Authority of North America. n.d. 27 Jan. 2010. <http://www.Brailleauthority.org/sizespacingofBraille/>.
[2] "Braille Watch". UW-Madison Biomedical Engineering Design Courses – Project Pages. 2008. 11 Feb. 2010. ArduinoBoardDuemilanove?action=diff>.
[3] "Haptica Braille Watch Concept". Tuvie Design of the Future. 2009. 25 Jan. 2010. <http://www.tuvie.com/haptica-Braille-watch-concept/>.

Final Design

Design Concept
(Figure 2)
- Four rotating disks are located beneath watch surface, one for each Braille digit (Figure 3)
- Each disk has raised and recessed surfaces, which raise and lower pins (Figure 4) creating desired number
- Disks interact via integrated gears, which allow for control of the watch (Figure 5) by rotating one disk
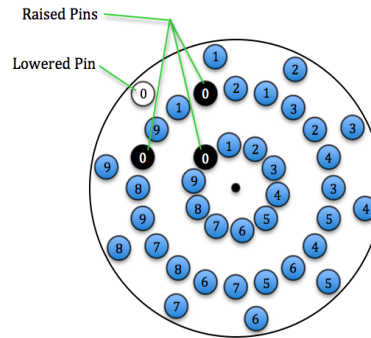

Figure 2: The raised and recessed surfaces on the disk cause different numbers to be displayed

Features
- Components manufactured using Viper si2 SLA printer
- Parts precise up to 0.002 inches
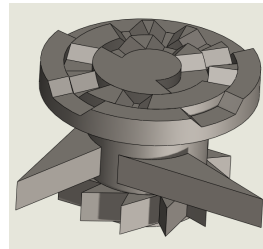- 12-hour watch with AM/PM indicator pin

Figure 3: The gear integrated disks contain raised and lowered surfaces to move the pins above and below the face of the watch

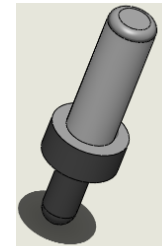Figure 4: Each Braille pin is held in place using a compression spring

Testing
- Volunteers from Wisconsin School for the Visually Impaired provided feedback on prototype
- Spacing was ideal
- Easy to read
- Diverse market
- Necessity for product exists

Figure 5: Final Braille Watch assembly displaying the time 03:15 PM

Design Criteria

Client Requirements
- Size of a standard smartphone
- Silent and without vibrations
- Time displayed in standard Braille
- Self-contained power supply
- Improve on previous designs (Figure 6)

Functionality
- Accurate and reliable
- User-friendly

Additional Specifications
- Aesthetically pleasing
- Safe

Figure 6: Fall 2010 fully assembled Digital Braille Watch

Competition

Talking Watch (Figure 7)
- Audibly communicates the time
- Disruptive

Figure 7: The Talking Watch announces the time to the user when prompted

Image courtesy of Tel-Time: http://ecx.images-amazon.com/images/I/41hK4nPA-zL._SL500_AA280_.jpg

Tactile Watch (Figure 8)
- Similar to standard analog watch
- Difficult to read
- Fragile

Figure 8: The user determines the time by feeling the display

Image courtesy of No Time to Waste: http://www.timebooth.com/wordpress/wp-content/uploads/2009/05/braillehitouchwatchax7.jpg

Haptica Braille Watch[3] (Figure 9)
- Designed by David Chavez
- Individual dots move in and out of display to form Braille numerals
- Just a design; no mechanism

Figure 9: Sixteen disks rotate to display the time

Image courtesy of Tuvie Design of the Future: http://www.tuvie.com/haptica-braille-watch-concept/

Future Work

Size Reduction
- Overlapping gears
- Custom rotating and power mechanism

Material
- Utilize metallic parts
- Increase durability

Further Considerations
- Apply for patent through Wisconsin Alumni Research Foundation
- Gain company interest
- Market final product (Estimated Market Value < $25)

Acknowledgements