

Digital Braille Watch

Chandresh Singh – Leader & BWIG
Nick Anderson – Communicator
Luke Juckett – BSAC

Clients: Holly and Colton Albrecht
Advisor: John Puccinelli



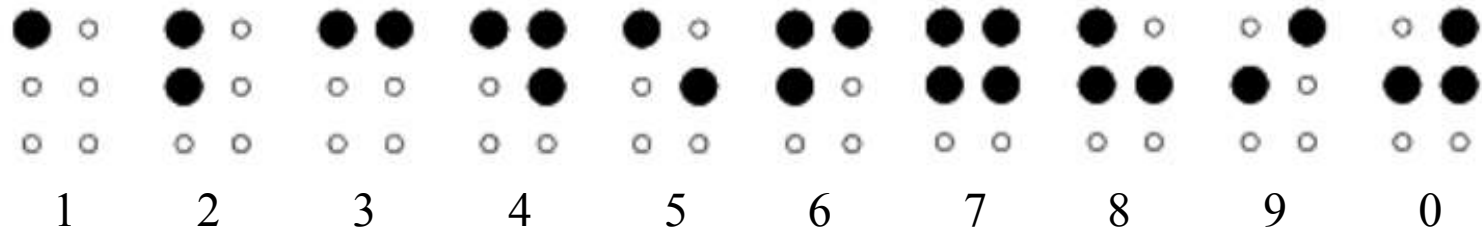
October 21st 2011

Overview

- * Braille Background
- * Problem Statement
- * Current Methods
- * Design Summary
- * Refinements
- * Manufacturing Considerations
- * Future Work

Braille Background

- * Size standards
 - * Each character consists of 3x2 grid
 - * Dots at least 0.092 in. apart
 - * Characters at least 0.245 in. apart
- * Four characters needed to display time
- * Braille numbers use only top 4 positions



Problem Statement

- * Develop a Digital Braille Watch that...
 - * Uses standard Braille numbering and spacing
 - * Has a self-contained power supply
 - * Can be manufactured accurately with durable materials
 - * Is the size of a standard wristwatch

Current Methods

- * Talking Watch
 - * Disruptive
- * Tactile Watch
 - * Fragile
 - * Difficult to read
- * Haptica Braille watch
 - * Idea developed by David Chavez
 - * Just a concept, no design



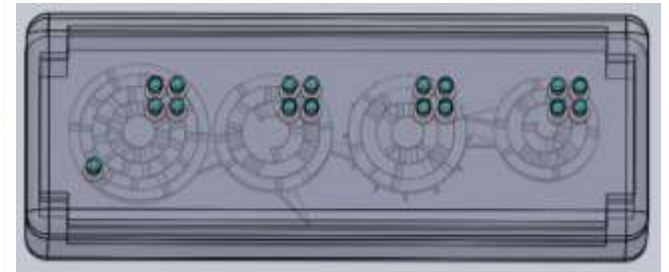
<http://watchluxus.com/braille-watches-auguste-reymond>



<http://www.tuvie.com/haptica-braille-watch-concept/>

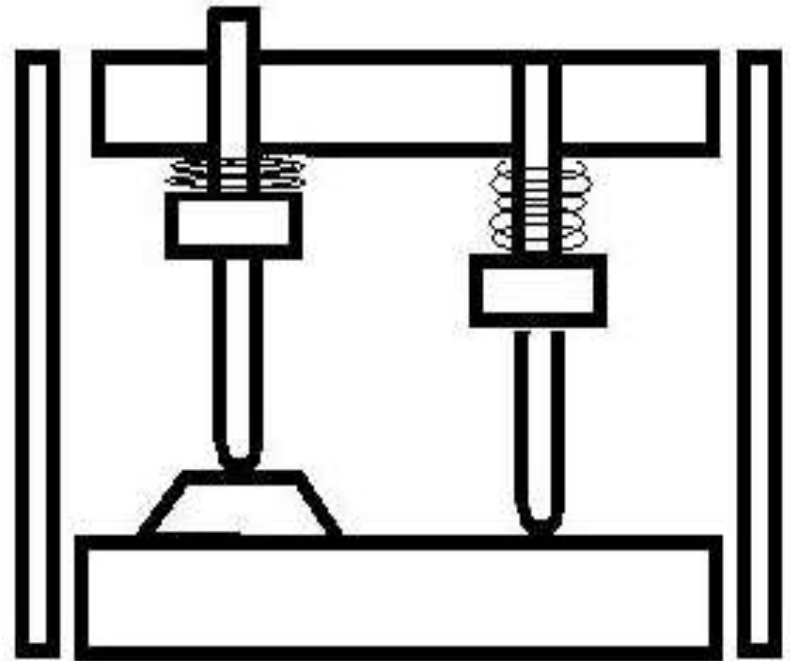
Past Design Projects

*MANY!!!



Design Feature 1 – Pin Mechanism

- * Pins rest atop a disk with raised and lowered surfaces
- * Raised pins can be detected

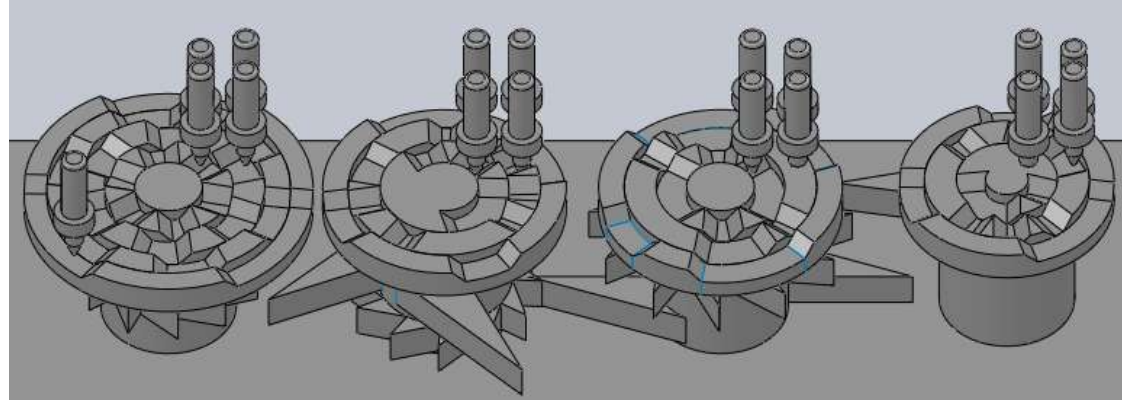


Design Feature 2 – Disk Surface

- * 4 pins rest upon each disk to create a Braille number
- * Each disk surface is designed differently to correspond with the numbers it must display

Hour

Minutes



Disk #1:

Displays

0 or 1

Disk #2:

Displays

1-9; 0-2

Disk #3:

Displays

0-5

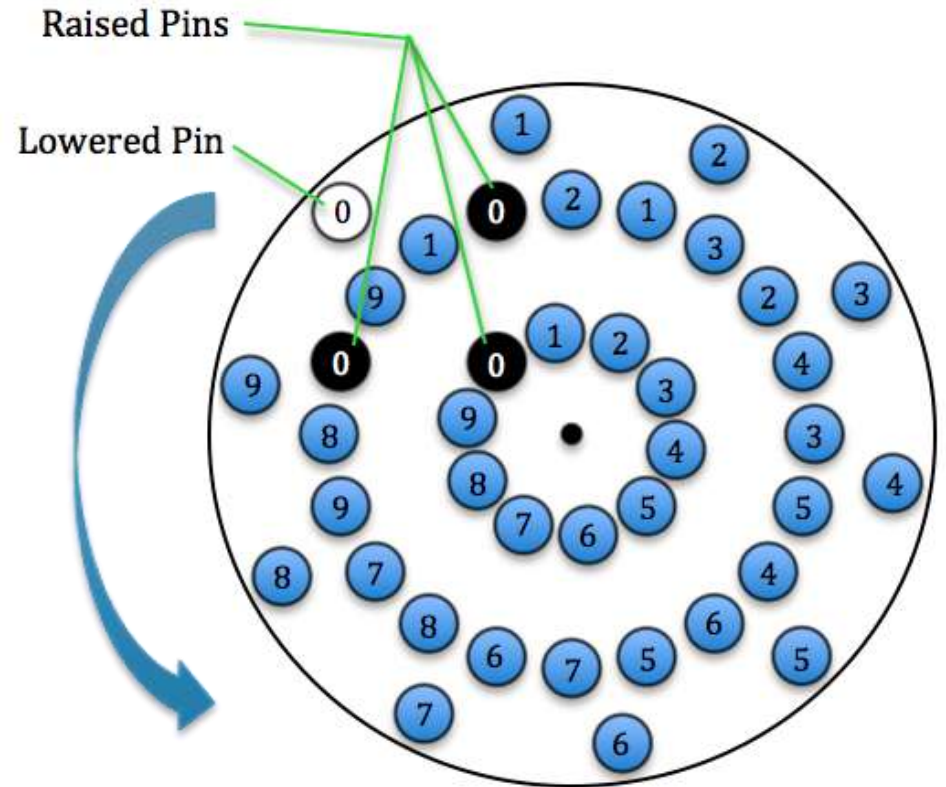
Disk #4:

Displays

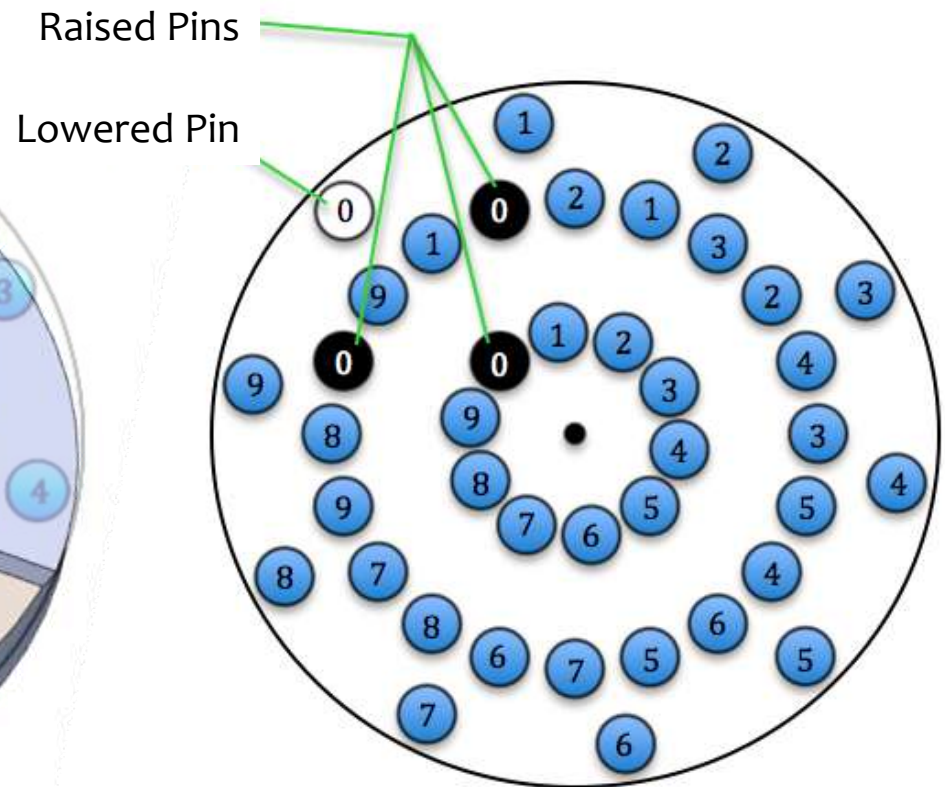
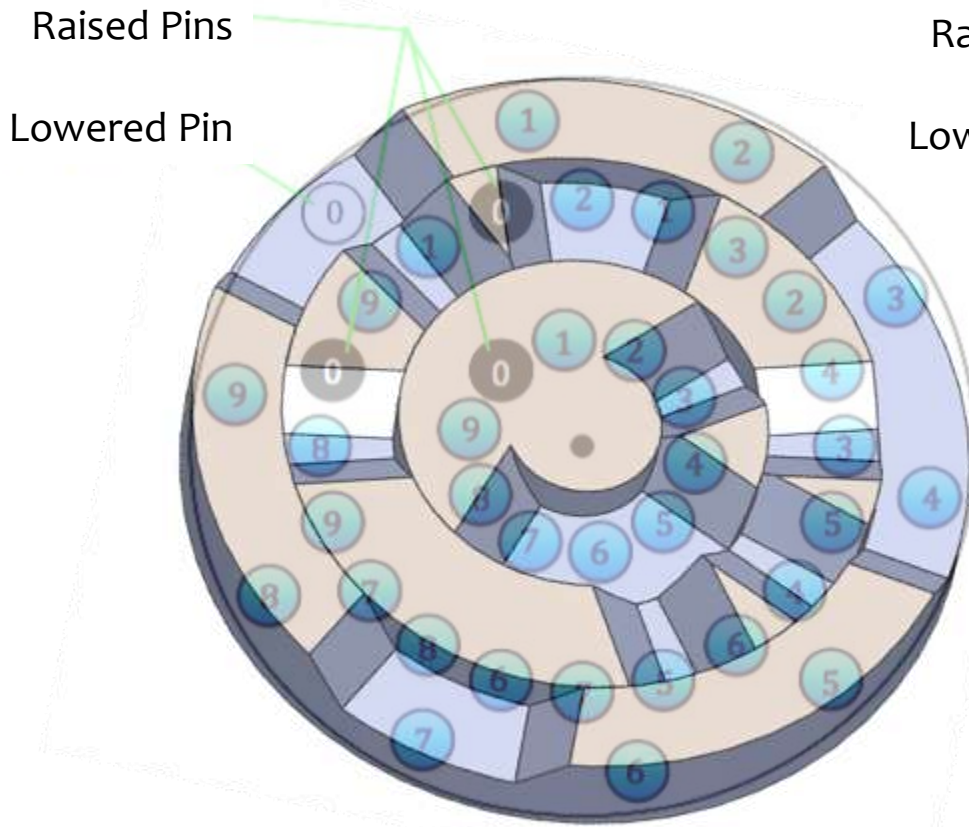
0-9

Design Feature 2 – Disk Surface

- * 4 pins rest upon each disk to create a Braille number
- * Each disk surface is designed differently to correspond with the numbers it must display

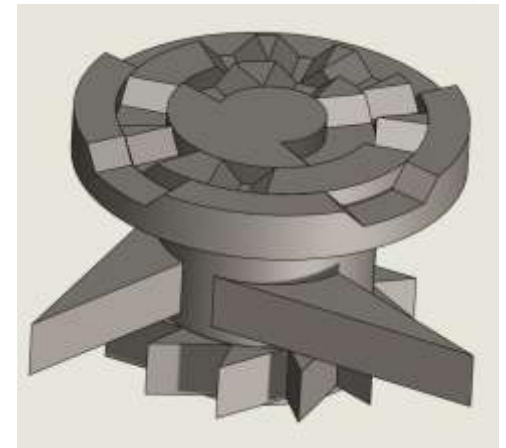
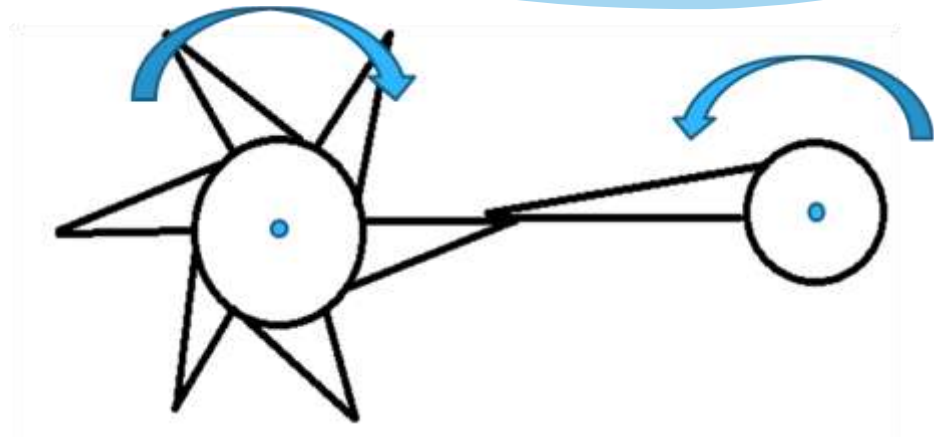


Design Feature 2 – Disk Surface

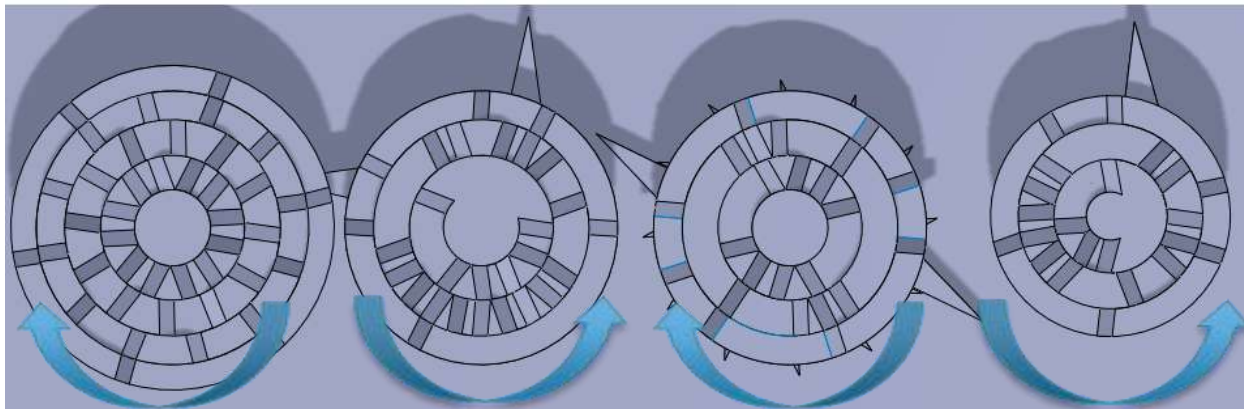
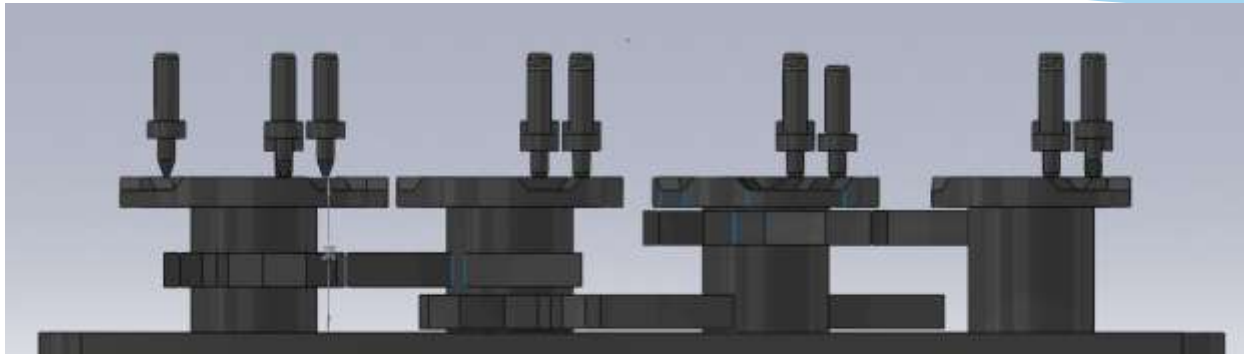


Design Feature 3 – Gear Mechanism

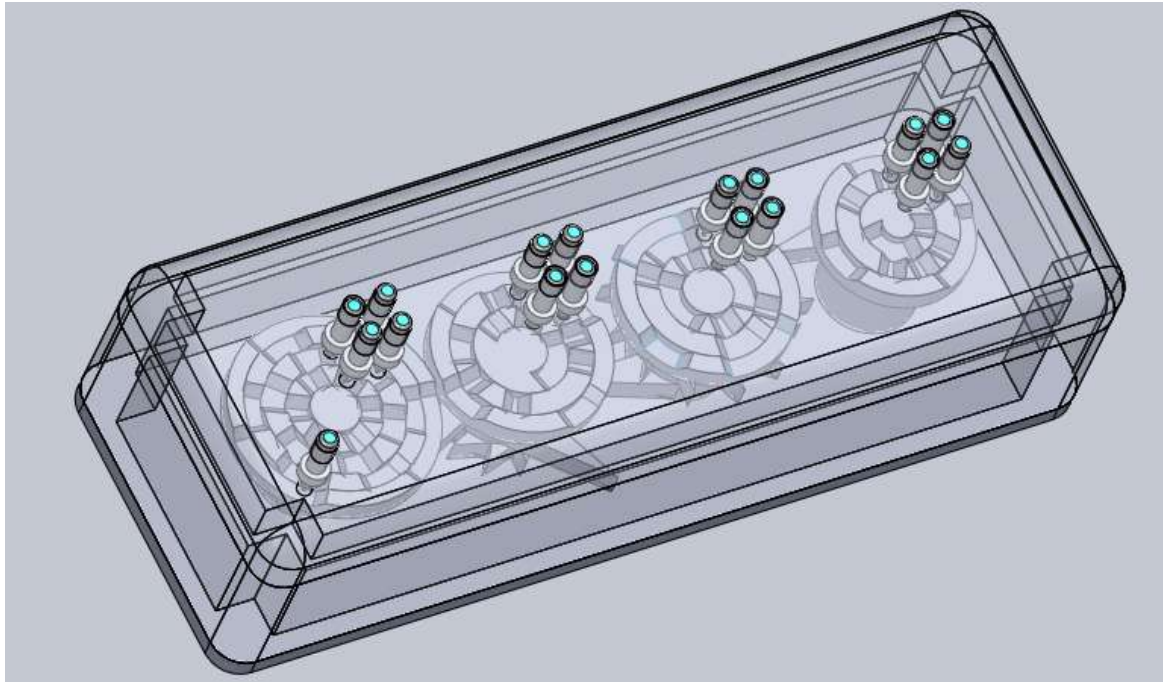
- * Complete rotation of one tooth gear corresponds to a partial rotation of another
- * Creates “odometer effect”



Design Feature 3 – Gear Mechanism



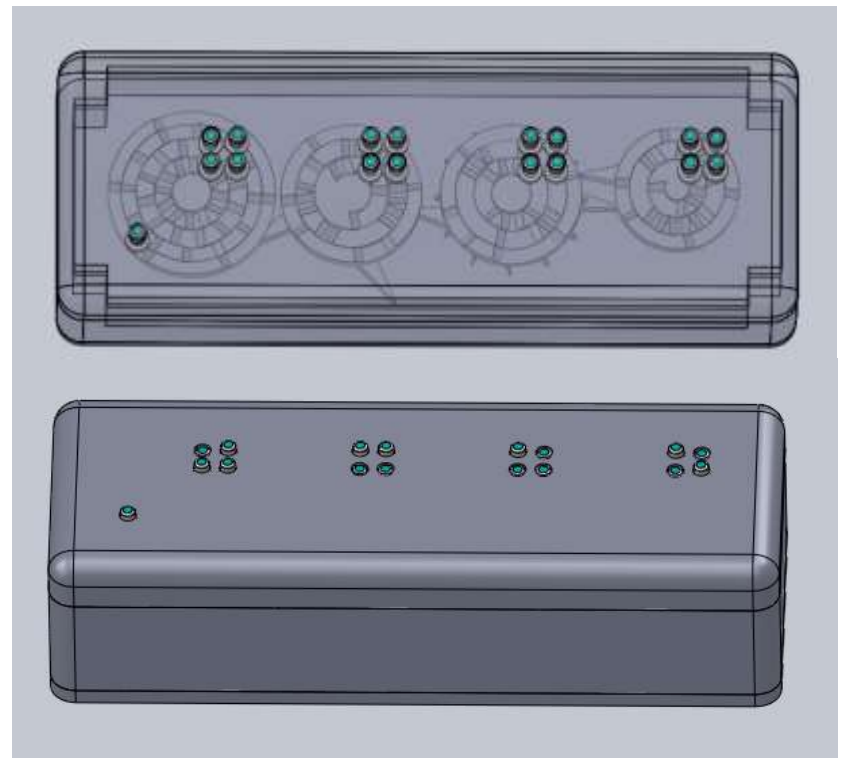
Complete Assembly



But it's not perfect yet...

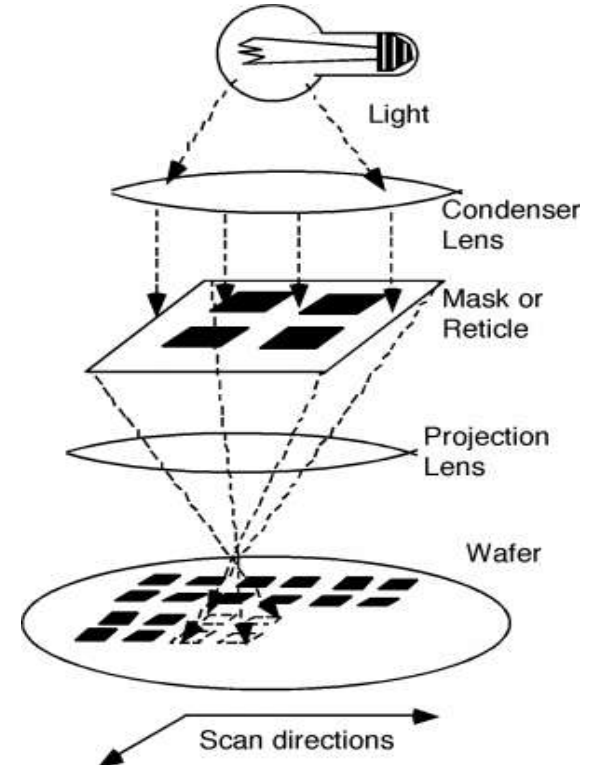
Design Improvements

- * Size reduction
 - * Overlapping disks
 - * Minimize thickness
- * Correct spacing between characters



Manufacturing Option 1 – Photolithography

- * Use UV light to create a geometric pattern from a photo mask
- * Pros
 - * Microscopic features
- * Cons
 - * Difficult to create 3D geometry
 - * Cannot make metal parts



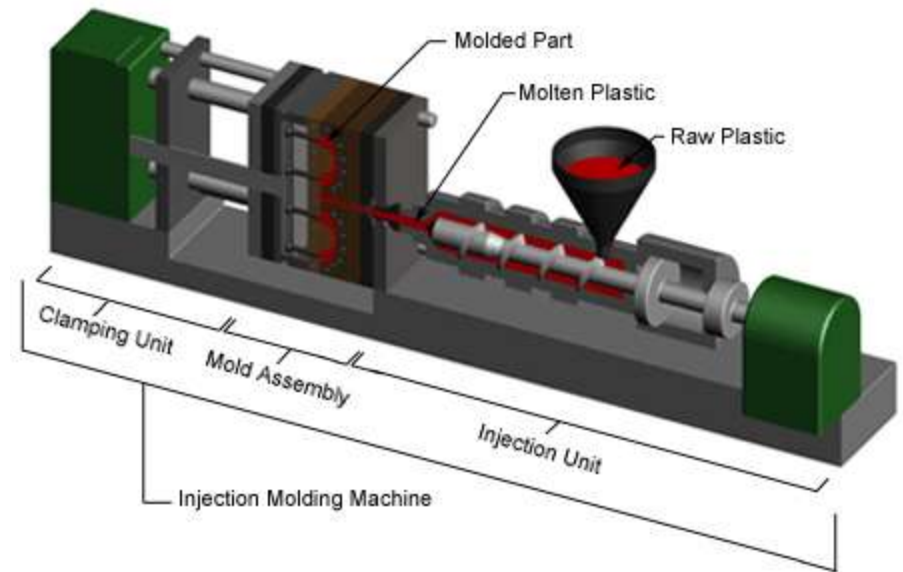
Manufacturing Option 2 – CNC Milling

- * Computer numerical control to machine solid materials
- * Pros
 - * Metal parts
 - * Accurate up to 25 μM
- * Cons
 - * Requires design modification
 - * Requires a CNC specialist



Manufacturing Option 3 – Injection Molding

- * Compresses thermoplastic using a mold
- * Pros
 - * Complex geometries
 - * Wide range of materials
- * Cons
 - * High initial cost
 - * Plastic parts



Copyright © 2007 CustomPartNet

http://www.custompartnet.com/wu/images/im/injectionMolding_machine_overview.png

Design Matrix

| Design Aspects | Photolithography | CNC Milling | Injection Molding |
|-----------------------------|------------------|-------------|-------------------|
| Aesthetics (10) | 7 | 9 | 8 |
| Accuracy (25) | 23 | 21 | 20 |
| Part Durability (15) | 9 | 14 | 13 |
| Cost (15) | 13 | 8 | 5 |
| Functionality (25) | 17 | 24 | 22 |
| Availability (10) | 9 | 9 | 8 |
| Total (100) | 78 | 85 | 76 |

Semester Goals

- * Many improvements still needed...
 - * Standard Braille spacing
 - * Manufacture accurate and durable parts – Tosa Tool
 - * Functional product



Acknowledgments

- * Holly and Colton Albrecht
- * John Puccinelli
- * Past Braille Watch Design Teams
- * Biomedical Engineering Department

References

- * <http://www.pharmabraille.co.uk/braille-alphabet.html>
- * <http://watchluxus.com/braille-watches-by-auguste-reymond>
- * <http://www.tuvie.com/haptica-braille-watch-concept/>
- * http://www.custompartnet.com/wu/images/im/injectionMolding_machine_overview.png
- * <http://www.labvolt.com/uploads/products/full/5600-cnc-millnew.jpg>
- * <http://cnx.org/content/m1037/latest/5.15.png>
- * <http://www.orientalwatchsite.com/choosing-the-right-watches-movements-affects-quality-and-lifespan/>