

Senior Capstone Design

Project: **Braille Business Card Printer**

Team: **Vandal Printer**

Primary Author:

John Cosso

Last Updated:

8/4/2020

Design Validation Plan & Results (DVP&R)

Requirement	Test	Test Subject	Target Date	Result	Recommendation
Create a CAD model to determine braille letter sizing	Use solidworks to create a model	RevA indentor	6/29/20	We have a baseline prototype model to build off of	To determine a method of containing the braille letter so they don't move around
Create a tolerance test to determine the amount of shrinkage	Use solidworks to model a braille pieces inside a sliding rail	RevA tolerance test	6/29/20	Huge amount of error within parts, would not work as shown	Measure the gap using micrometers, adjust dimensions with measured distances, and reprint
Finalize tolerance testing	Redisng initial solidwoks model using updated dimensions	RevB tolerance test	7/1/20	Perfect fit, will move forward knowing how much our parts with shrink	Not all 3D printers will have the same amount of shrinkage, this is noteworthy once the product goes open-sourced
Finalize braille sizing	Use RevA-RevD to determine best printed sizes	RevA-RevD	7/1/20	After roughly 100 different test sizes we have determined a range of sizes that can be used	Have someone who can read braille determine which size is the absolute best
The stamp must be able to hold a static force up to 100 lbs	Placed prototype inside arbor press, saw a load of 2000 lbf, nothing broke	RevC intendor	7/7/20	Very successful	Design is strong enough to withstand a 100lbf load
The stamp must have a designated location for the business card	Prototype 2 has a built in recessed shelf for the business card to sit in	Prototype 2	7/8/20	The recessed shelf helps keep the business card aligned, so that is successful	We need to get a better embossment, which is not due to the recessed shelf but changes need to be made
The stamp must have a designated location for the braille lettering	Prototype 2 has a built in slots for the braille lettering to slide into	Prototype 2	7/8/20	The slot and braille letter tolerance is spot on and works well!	Add a feature that makes the braille letters stay in their specified location
To be able to apply create a sufficient braille embossment that stays readable for 48 hours	Place a test car inside a wallet and after 48 hours take it out and determin if it is readable	RevC business card	7/9/20	Successful, we had our contact Clarissa confirm that after 48 hours our wallet test was still readable	There is always room to improve indentation performance
Have an in-person inspection to determine the best braille sizing	Use Clarissa to determine which size she perfers	RevC and RevD	7/9/20	Clarissa identified multiple sizes that will work	We want to use the smallest size possible to allow us to increase the amount of information we can print on a business card
Maximum user effort shall not exceed 25 lbs to emboss business card	Use weights to determine the minimum load that is required to emboss business card	Prototype 2	7/14/20	Failure! We need to somehow decrease the amount of force it takes	Introduce a new design that incorporates a roller on the negative side
Maximum user effort shall not exceed 4 lbs to open the stamp	Use weights to determine the minimum load that is required to open business card after	Prototype 2	7/14/20	Successful	Easy to remove card, no recommendation

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The user must be able to swap braille information in less then 5 minutes	Time the user mulitple time to determine the average amount of time it takes to swap information	Prototype 3	7/21/20	Successful. To completely fill the board it takes about 3 minutes	Pieces are very small and can be difficult to hold. Having your letters organized before hand is
Have prototype 3 printed and tested before meeting with Clarissa	Upon succesful print try to get a variety of words for clarissa to read	Prototype 3	7/27/20	Successful, we got a great PLA print and have printed "eric matson," "cinema," and "can" as our tests	We think that adding a feature to negate the chance of the braille cells sticking into the busineses card is a good idea, reilly is working on this.
Meeting with our client (Eric Matson)	Approval of current design and updated requirements	Prototype 3	7/27/20	Eric was very pleased with our design and had no complaints	Provide Eric with a printed final version for him to use
In-person validation check on a test sample (braille word)	Use Clarissa to determine if the print is readable	Prototype 3	7/28/20	Major success! Clarissa could read our printed brialle	Focus on consistancy to make it as easy as possible for the braille reader
Maximum weight shall not exceed 5 lbs	Use a scale to weigh the final product	Final Product	7/30/20	The final weight was 3.6 ounces	It is substainially under the maximum weight requirement
3D print a prototype to emboss a braille indentation	Use the Sindoh printer to 3D print the CAD model	RevA indentor	6/29/20	Not good, too much variety, Not enough penetration	Narrow down the size gaps
		RevB indentor	7/2/20		Reduce the indentation length
		RevC indentor	7/5/20	To much indentation, broke through paper	Add a fillet on the negative side
		RevD indentor	7/5/20	Good results with only minor break throughs With the added fillets less break throughs	stick between 10-30 thousandths of indenation lift

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