

Manufacturing Prototype

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Table of Contents

Table of Contents.....	2
Research and Photographs.....	3
Brainstorm Sketching of Possible Solutions.....	4
Isometric Assembly Drawing of the Entire Prototype.....	5
Detailed Drawings of the Individual Parts (In millimeters).....	6
Photographs of Construction Process of Prototype.....	9
Photographs of Design Improvements and Product Testing.....	10
Bill of Materials.....	13
Plan of Work Log.....	14

Research and Photographs

Everyday, thousands of memories are made, fossilizing precious moments between friends and family members in the hearts of all who witness them. However, with time, these precious moments can grow difficult to recollect, and a memory aid may be necessary to recall these moments. One of the easiest ways to remember these memories is to take a picture of the event and frame it to hang up, granting the ability to share these memories with others. However, these picture frames can be mundane and may require additional interactivity and practicality to them. There have been many attempts to solve this problem.



One such example includes the above example with storage contained inside of the picture frame, adding a layer of practicality to the design. Another potential solution to this problem is the following design involving a plant:



Detailed Drawings of the Individual Parts (In millimeters)

Note: All of the dimensions of the following parts are listed in units of millimeters (mm)

Cover (2x)	
<p>The cover was 3D printed using white PLA filament.</p> <p>This part serves as a cover for the rectangular holes to prevent the candy from falling out. Additionally, the circle portion on the bottom of the part holds the dial in place so that it can turn and not fall out of the frame.</p> <p>The cover was constructed using a 136.53 mm long rectangular piece with a circle on the end. The circle has an outer diameter of 18.42 mm and an inner diameter of 25.4 mm. Also, the cover is 3.81 mm thick.</p>	
Dial (2x)	
<p>The dial was 3D printed using white PLA filament.</p> <p>The dial is one of the main mechanisms on the picture frame. The purpose of the dial is to dispense candy and ensure that candy only comes out when the dial is turned. Without the dial, candy wouldn't be constrained in the frame and fall freely.</p> <p>The dial was constructed as a 17.78 mm long cylinder which has a crescent-shaped</p>	

cut out at the bottom for dispensing the candy. Additionally, the handle on the knob is 12.7 mm long and the diameter is 6.35 mm.

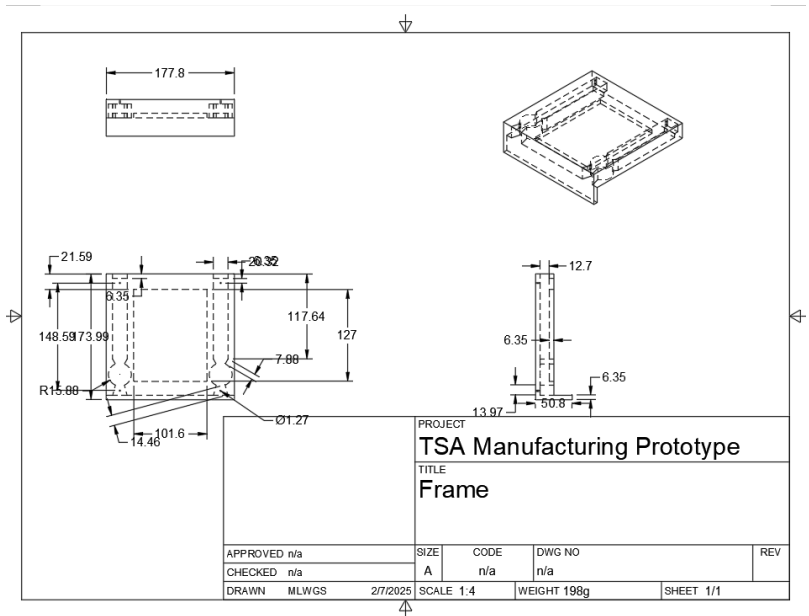
Frame

The frame was 3D printed using black PLA filament.

The frame is the main part of the product and serves as the foundation for all of the other components of the picture frame.

Two identical rectangular holes were made on the top of the frame for stocking candy. Additionally, two identical cutouts were made on the front of the frame to collect candy, put in the dial, and place the cover.

The main frame is designed as a 173.99 mm wide and 173.99 mm long block that is 25.3 mm thick.

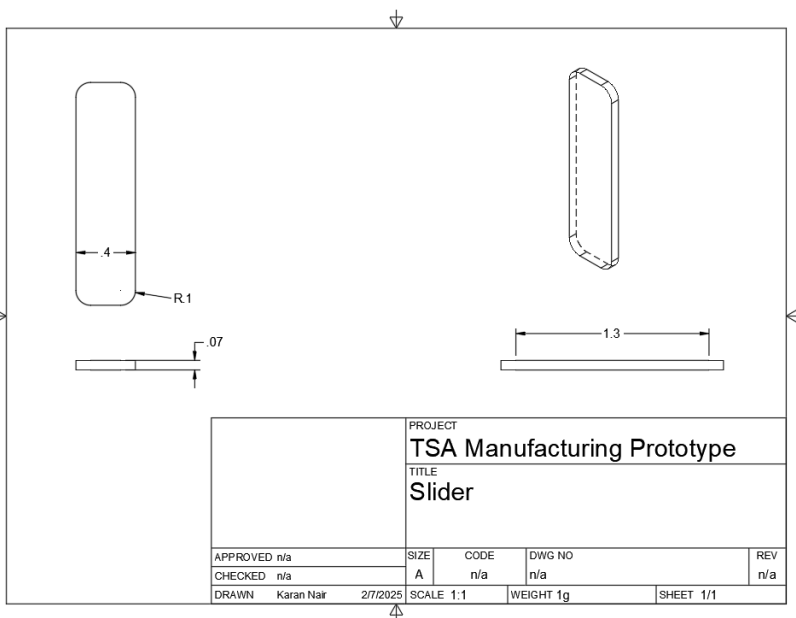


Slider (2x)

The slider was 3D printed using white PLA filament.

The slider's purpose is to cover the entry holes for both chutes by sliding into the lid block. This prevents candy from falling down the entry chute in case of an accident such as the frame being knocked down.

The slider was constructed with a 1.3mm long rectangle with rounded edges in order to fully cover the entry holes. Additionally, the slider has a thickness of 0.07 mm and a width of 0.4 mm

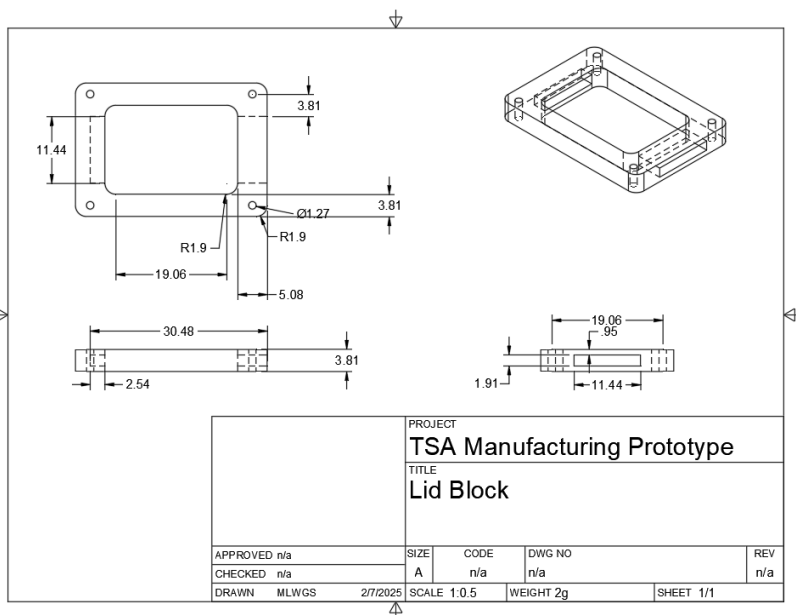


Lid Block (2x)

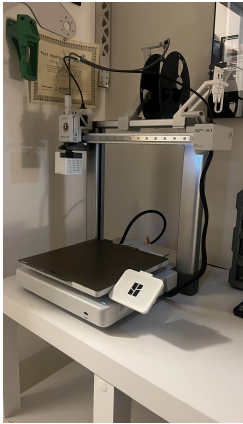
The lid block was 3D printed using white PLA filament.

The lid block's purpose is to hold the slider in either position whether the candy chute is open or closed. It helps to maintain the slider in a certain position.

The main structure of the lid block was constructed with blocks of 19.06mm and 11.44mm given a 1.91mm thickness and four holes on each end that have a diameter of 1.27mm.



Photographs of the Construction Process of Prototype

3D Printing	Vinyl Cutting
 <p>The above pictures the 3D printer that was used to print the design. The final pieces are three-dimensional using white and black filament for a sleek design. The components of the final product that came from this printer include the two covers, two dials, frame, two sliders, and two lid blocks. These components were printed by one of our member's 3D printers.</p>	 <p>The above picture displays the Vinyl Cutting machine that was used to create the candy designs that are located on the covers to add some fun to the design. These designs were cut by one of our member's vinyl cutters.</p>

Photographs of Design Improvements and Product Testing

Prototype #1:



Description: Our first cardboard prototype depicted a rough idea of the picture frame design. We cut out two slots at the top of the frame in order to insert candy. Two crescent shaped holes were cut at the bottom in order to collect the candy. Additionally, we added a rectangular piece of cardboard in the center to represent where the picture holder would be placed. This prototype definitely wasn't practical but it served as a basic model for what our final product would look like.

Strengths:

- Can collect and drop candy
- Maintains stability despite quality of material

Weaknesses:

- Can't hold a picture
- No cover for the slots on the top
- Uses tape and weak materials causing it to have weak structural integrity
- Not aesthetically pleasing
- No mechanism or moving parts
- Lacks a way to hold the candy in place

Product Testing: The basic idea of the candy dispenser worked, as most of the time the candy fell out of the designated holes. However, we noticed that when entering the candy into the top holes, we were not able to see the drop of the candy. This would prevent us from knowing if there was a backlog in the dispensing. Additionally, the picture area did not have a designated frame or function to hold the picture in place. Also, candies would often roll out of the exit holes.

Prototype #2:

Description: Our second cardboard prototype is a more refined version of our initial prototype and provides a better representation of the final picture frame design. We cut out two slots at the top of the frame in order to insert candy. Long rectangular cutouts were also made in order to visualize the candy so that the frame looks appealing. Additionally, circle cutouts were made at the bottom of the rectangle cutouts to show where the dials would be. The candy can fall through the holes and tubes and be collected at the bottom of the frame. A holder for the actual picture was also made and placed in the center of the frame.

Strengths:

- Demonstrates realistic proportions for the picture frame design
- Maintains stability despite quality of material

Weaknesses:

- No mechanism or rotating parts for a dial to dispense candy
- No cover for the slots on the top
- Picture holder isn't big or practical
- Constructed from a weaker material and doesn't maintain aesthetic appeal
- No spot to hold the candy in place

Product Testing: To address the lack of complexity in previous prototype, this design incorporated a few new features in order to make the produce look and feel more practical. We added two cutouts to visualize the candy and a holder for the picture. Although, while testing this product we realized that candy could easily fall out and it lacked a proper mechanism to dispense candy.

Final Product:

Description: When compared to the previous prototypes made, the final product is much more intricate and complex. The final product is much more usable as well, as the insertion holes for the candy are opened and closed with a sliding mechanism, and the dispenser of candy is controlled with a rotatable latch. We were also able to add aesthetic details, like the contrast in colors with the black and white, and candy images on both sides of the frame. The final produced was constructed with 3D printed parts with vinyl decorations, and was put together with screws.

Strengths:

- Stronger materials
- Aesthetic additions to positively influence consumer perception
- Rotating and sliding functions add degrees of complexity
- Ease of access for candy and easier to control the candy dispenser

Weaknesses:

- A few fabrication inaccuracies
- Knobs for rotating are relatively hard to use
- Not much protection for a picture inserted into the frame
- Narrow candy chutes

Product Testing: We were able to add more reliable parts to address issues in our previous prototypes. The rotating mechanisms were tested several times before assembly, and were both able to control the flow of candy through the chutes. Additionally, the sliders were easily opened and closed by the user. Also, to make the product more user-friendly, we revamped to design, adding more color and small candy depictions. With the optimizations, we were also able to maximize the space for the picture frame.

Bill of Materials

Product Part	Materials	Manufacturing Method	Cost for Total Materials Used:
Cover (2x)	PLA filament (White)	3D printing	\$4.998 ~ \$5
Dial (2x)	PLA filament (White)	3D printing	
Frame	PLA filament (Black)	3D printing	
Slider (2x)	PLA filament (White))	3D printing	
Lid Block (4x)	PLA filament (White)	3D printing	
Candy Designs (x3)	Vinyl (Purple)	Vinyl Cutting	\$3
Total Cost:			\$8

Plan of Work Log

TECHNOLOGY STUDENT ASSOCIATION WORK LOG				
Date	Task	Time involved	Team member responsible (student initials)	Comments
11/14 - 12/5 1.	Preliminary brainstorming and project design	6 hours	MW, AK, NP, AM, SS, PC	We brainstormed several potential designs for the project and listed out the 5 major parts we planned to manufacture
12/5 - 12/19 2.	Finished brainstorming and began CAD blueprint	3 hours	AK, AM, MW, SS, AL	We decided on a final design and began designing using the CAD program Onshape
12/19 - 1/9 3.	Continued CAD blueprint, built first prototype, and decided on methods for fabrication	4.5 hours	AM, MW, NP, AK, ET	We continued to work on the CAD blueprint and decided how to manufacture the different parts of the assembly. Our first prototype was built during this time.
1/9 - 1/23 4.	Finished CAD blueprint and built second prototype	3 hours	AK, AM, PC, MW, AL, ET	Completed our CAD design and built our second and final prototype before beginning fabrication.
1/23 - 1/30 5.	Began product fabrication and portfolio	4 hours	KN, ET, MW, AK, AM, SS	Started portfolio work as our parts began to be 3D printed
1/30 - 2/6 6.	Finished product assembly and portfolio	7 hours	KN, ET, MW, AK, AM, SS, NP	Completed all necessary portfolio work after receiving and putting together all 3D printed parts, finishing our product

Citations

- <https://www.woodchuckusa.com/collections/picture-frame-collection/products/planter02>
- <https://www.diypete.com/framed-photo-hidden-storage/>