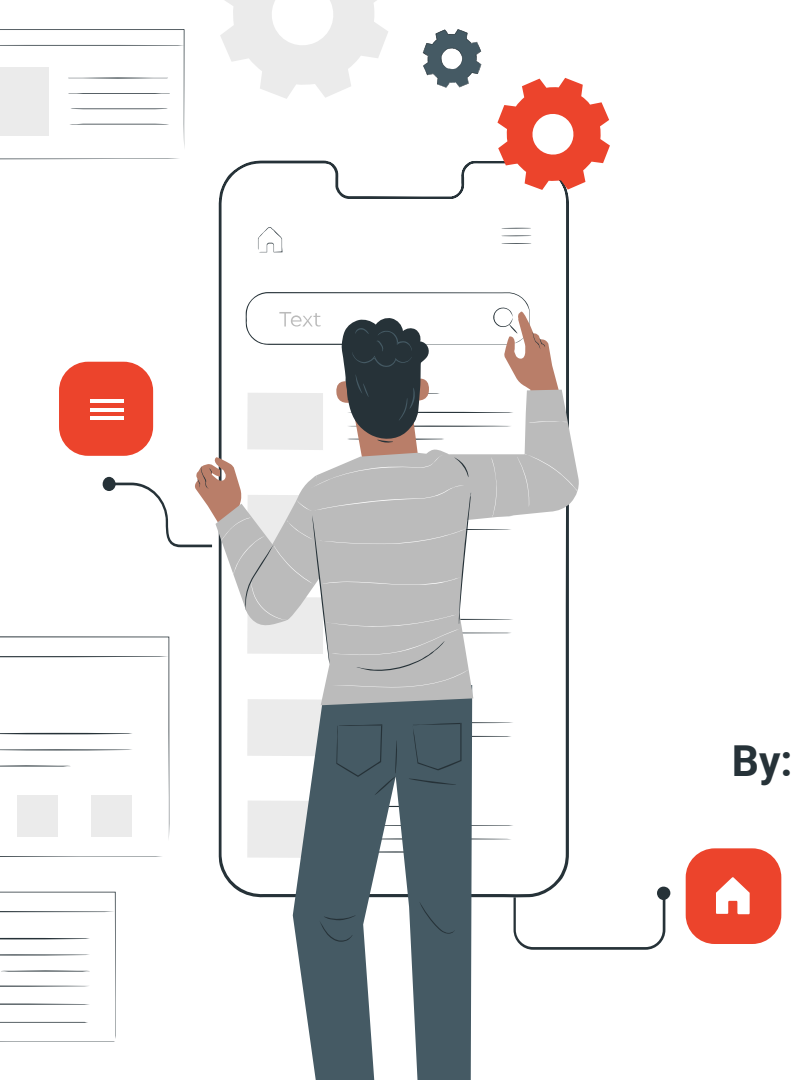


Customizable 3D-Printing Phone Cases

By: John Seon Keun Yi, Dylan Ramdhan, Chunhao Bi

Problem Statement

Designing a phone case that could integrate the usage of a sliding puzzle with customizable tile pieces. These designed tiles can be selected upon users choice of preferences.

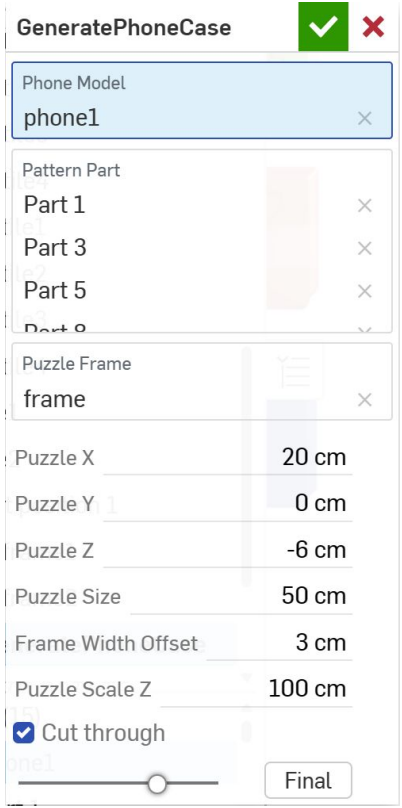
Motivation & Related Work

- Phone cases catered to specific needs and designs
- Existing products: Basic customization for cases (e.g. Custom photo or design on case back)

Easy customization + Fun Puzzle Component using 3D printing

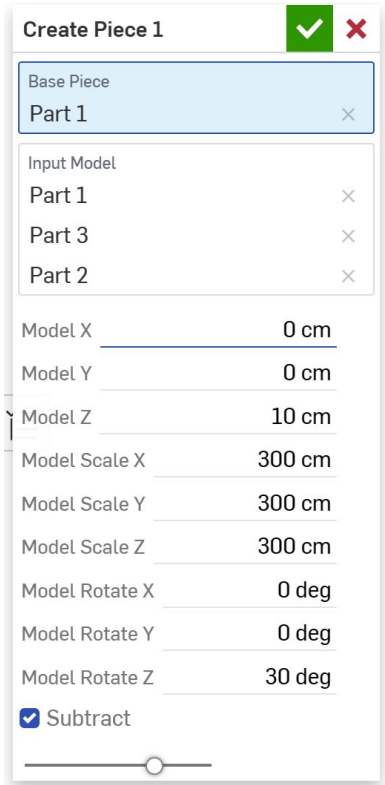
Pipeline

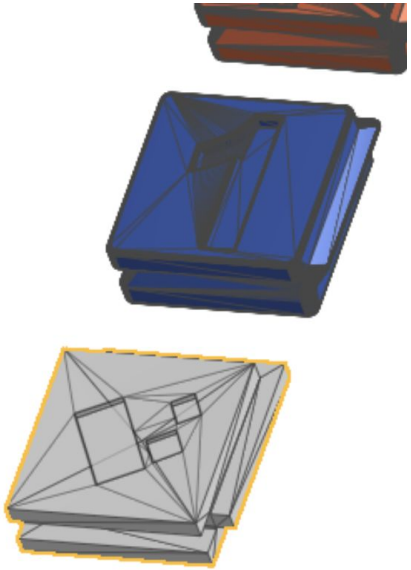
1. User customize their pieces or select from our pieces
2. Select a supported phone model and a puzzle frame
3. Customize their config for the puzzle
4. Get a phone case and pieces that can be exported and printed!



Piece Customization

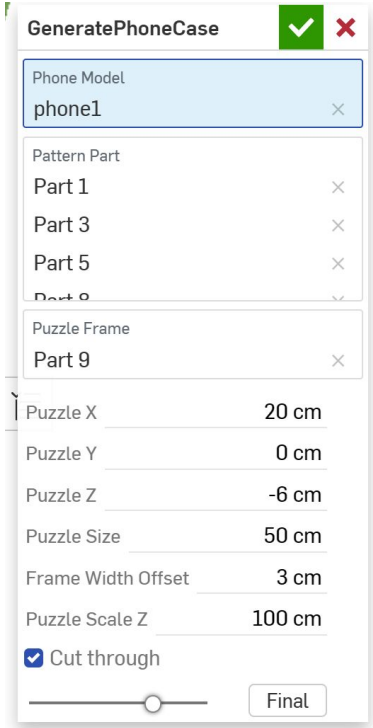
1. User create a model or import one
2. Create this feature and select the model and a base piece
3. Change these offsets to fit the piece
4. Customized piece is created!

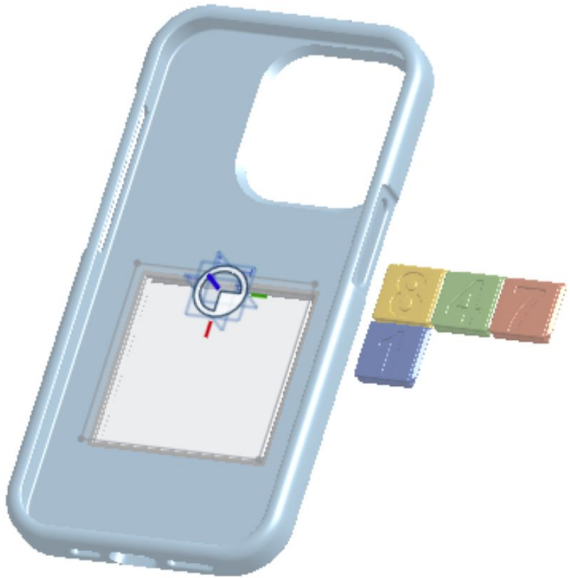




Puzzle Customization

1. Select a phone model
2. Select a puzzle frame
3. Change these offsets to fit the case
4. Customized case is created!





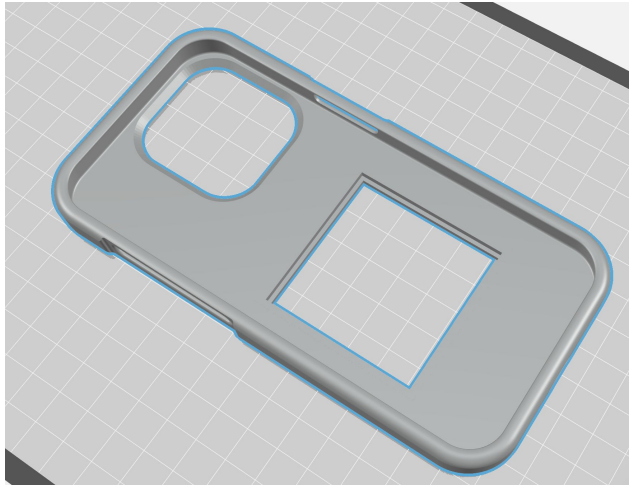
Computational Challenges

1. Written in OnShape, FeatureScript
2. Computational challenge: Models are mesh objects, no specific lengths and center. Hard to adjust position.
3. Solution: Calculate bounding box to acquire models lengths and center. Used for translation, scaling and boolean operations.

```
const getLength = function(body, axis)
{
    const bounding_box = evBox3d(
        context,
        {
            "topology" : body,
            "tight" : true
        }
    );
    return (bounding_box.maxCorner[axis] - bounding_box.minCorner[axis]);
};
```

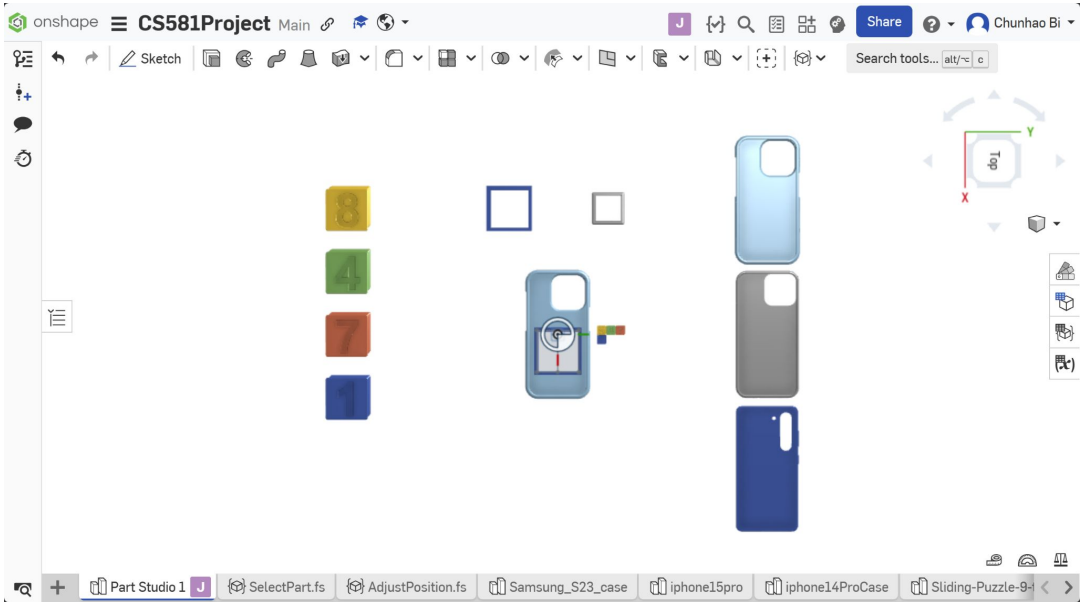
Exporting and Printing

1. Select the models, right click the export option, a .stl file will be downloaded.
2. Open the file in Makerbot and print it.
3. Phone case and pieces are printed separately for better result.

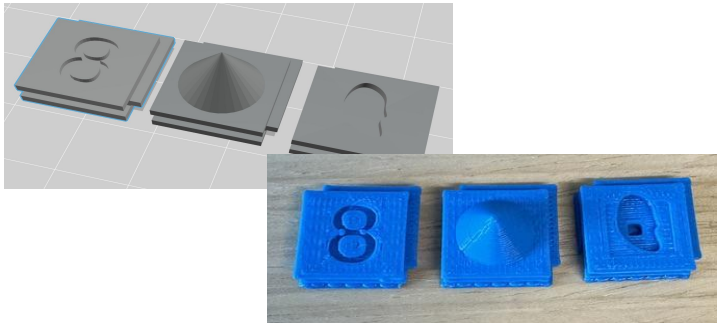


Live Demo

https://cad.onshape.com/documents/202efb2eabb4069c72ee427b/w/2a84be3b3b90e2553530777e/e/3c12d3a3e75f12d8ca3b3668



Fabrication



- Case fabrication - EPIC studio
  - **Materials**: TPU, Flexible Resin
  - Puzzle frame is integrated into the case
  - Malleable
  - Maintain enough structural rigidity to encase phone and puzzle pieces
  - ~$1 per case (resin)
- Puzzle piece fabrication - MakerBot FDM
  - **Materials**: PLA
  - Scaled to fit the frame (+3~4%)
  - May need minor adjustments for proper fit
  - ~40 min to print all eight pieces
    - Recommended to print in batches to avoid premature cooling

Fabrication Challenges

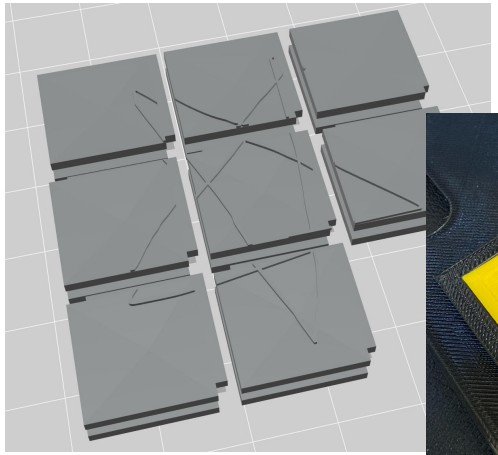
- Warping problem of PLA prints
- Environment shielding - Covering open sides of the printer to block external airflow
  - Objects are less warped with shielding
- PLA print with Makerbot is not suitable for large prints (e.g. phone case)
- Print in small batches to prevent premature cooling

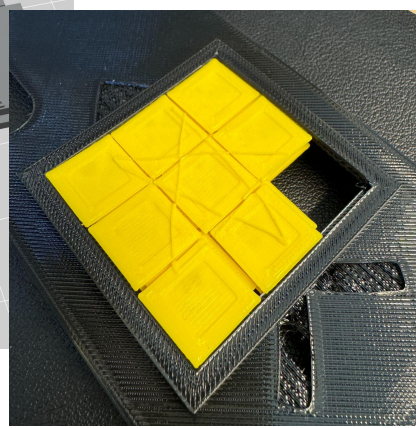
Environment Shielding

w/o shielding with shielding

Results

- Phone case models for iPhone 14/15, and Galaxy S23
- Puzzle pieces
  - Numbered (Default)
  - Custom Piece Design
  - Custom Puzzle Design





Thank You!