GenzView™ Design Reasoning Document

Simulating & Shaping Gen-Z Perception of Cosmetic Packaging

Please go to inference.pdf, to view the runtime app flow

To run the app:

(pip install -r requirements.txt)

(streamlit run frontend.py)

(backend at genzview.py)

Table of Contents

- 1. 1. Project Objective
- 2. 2. Target Demographic Persona
- 3. 3. System Architecture
- 4. 4. Explainability: Heat-Map Generation
- 5. 5. Visual-Feature Engineering
- 6. 6. Heuristic-First Perception Scoring
- 7. 7. ML-Augmented Scoring (Optional)
- 8. 8. Recommendation Engine
- 9. 9. Al Variant Generator
- 10. 10. Future Work
- 11. 11. Appendix Code Map

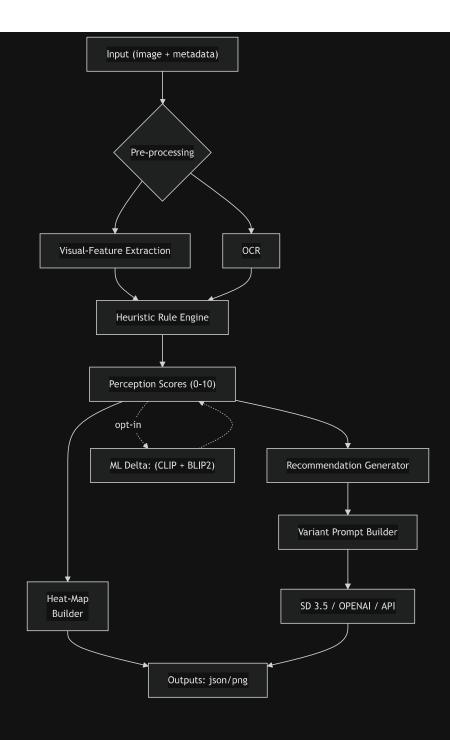
1. Project Objective

Create a Python-based studio that mimics how urban Gen-Z trendsetters (18–25, APAC) evaluate cosmetic packaging.

2. Target Demographic Persona

Attribute	Details
Age/Gender	18 – 25, female
Region	Asia-Pacific hot-spots — Seoul, Tokyo, Bangkok
Traits	Fashion-forward, trend-driven, social-media natives
Values	Visually pleasing aesthetics, novelty, minimalism, "Instagrammable" looks
Digital Behaviour	High TikTok / Instagram influence, follows beauty KOLs

3. System Architecture



4. Explainability: Heat-Map Generation

Where does Gen-Z attention land first?



Layer Composition

Weight	Layer	Visual Cue
0.4	Edges (Canny)	Complexity hotspots
0.4	OCR Map	Where text exists
0.3	Symmetry diff	Asymmetry penalties
0.2	Saturation	Color intensity focus
0.2	Hue Δ	Contrast vs dominant hue



Visual features extracted

Feature	Value	Why it matters
Dominant colour	#f3e2bc	Soft pastels score +2 Aesthetic
Pastel palette	False	Pastel look = IG-ready
Detected glass	True	Glass boosts +3 Luxury
Symmetry	0.93	>0.8 looks premium
Edge density	0.040	Busy edges hurt clarity
Text area %	12.14%	Too much text feels noisy



Feature	Extraction Method (Code)	Why It Matters to Gen-Z
Dominant Color	k-means (k=3) in _dominant_color	Sets immediate mood; Gen-Z leans pastel & muted neutrals.
Pastel Palette	HLS thresholds in _is_pastel	Soft pastel shades score +2 Aesthetic .
Edge Density	Canny ratio in _edge_density	Too many edges ⇒ clutter ⇒ – Clarity & Trust.
Text-Area Ratio	OCR contour area in _text_area	Dense copy feels noisy on small phone screens.
Symmetry	Mirror-difference in _symmetry	High symmetry subconsciously implies premium craft.
Glass Detection	Multi-cue in _is_glass (specular + transparency + edge)	Glass bottles scream luxury & recyclability.

6. Heuristic-First Perception Scoring



III Heuristic perception score

Aesthetic Purchase 5.0 5.0 10.0 6.7

Recommendation (heuristic):

Introduce softer pastel tones for an IG-ready look. Reduce dense copy; boost whitespace for minimalism. Increase brand-name contrast/size for instant recall. Add a playful micro-icon to encourage TikTok unboxings.

Rule	Impact	Attributes
Glass bottle	+3	luxury
High symmetry	+1	aesthetic
Lots of text	-1	aesthetic, trust
Premium tone	+1	luxury
High price range	+1	luxury, trust
Positive keywords	— 0	trust
Negative keywords	— 0	trust

6.1 Rule Catalogue

Rule	ΔAesthetic	ΔTrust	ΔLuxury	Rationale
Pastel palette	+2			IG-ready soft vibe
Glass bottle			+3	Premium material perception
High symmetry (> 0.8)	+1			Visually pleasing order
Busy edges (> 0.15)	-1	-1		Hurts legibility & trust
Lots of text (> 3%)	-1	-1		Gen-Z favours minimal copy
Premium brand tone			+1	Metadata boost
High price (mid ≥ \$50)		+1	+1	Price as luxury anchor
Positive keywords (e.g., "vitamin")		+1 each		Ingredient trust
Negative keywords (e.g., "paraben")		-1 each		Safety concern

Implementation: GenzView._heuristic_score() initializes all scores to 5 and pipes each rule through the helper add(rule, amt, targets) — ensuring clamp
0-10 and full audit-trail via the contrib list.

6.2 Purchase Likelihood

```
purchase = round((aesthetic + trust + luxury) / 3, 2)
```

mirrors how the three pillars interplay in purchase decisions.

7. ML-Augmented Scoring (Optional)

ML-augmented perception score

Aesthetic	Trust	Luxury	Purchase
3.5	5.0	9.0	6.0
↓ -1.50	↑ +0.00	↓ -1.00	↓ -0.65

Recommendation (ML):

Introduce softer pastel tones for an IG-ready look. Reduce dense copy; boost whitespace for minimalism. Increase brand-name contrast/size for instant recall. Add a playful micro-icon to encourage TikTok unboxings.

Model	Purpose	File Section
CLIP VIT-L/14	Measures "Instagrammable pastel minimalist" vs "outdated clutter" similarity; gives ΔAesthetic.	_ml_delta()
BLIP2 2.7 B	Generates captions; keywords like "glass" \Rightarrow \triangle Luxury, "clean" \Rightarrow \triangle Trust.	_ml_delta()
Torch seeds	torch.manual_seed(seed) for reproducible deltas.	init

Deltas are **capped** (e.g., ±1.5 for Aesthetic) to keep heuristics sovereign.

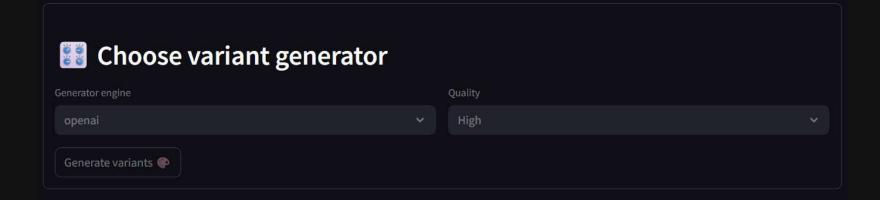
8. Recommendation Engine

```
if s.aesthetic < 7 and not f["pastel_palette"]:
    rec.append("Introduce softer pastel tones for an IG-ready look.")</pre>
```

Pattern: score-aware + feature-aware + demographic trait-aware logic.

Condition	Prototype Recommendation
Symmetry < 0.8	"Realign graphics for perfect symmetry."
Text area > 3%	"Reduce dense copy; boost whitespace for minimalism."
Missing brand name in OCR	"Increase brand-name contrast/size for instant recall."
No glass & category ∈ {serum, bottle}	"Consider frosted glass or metallic accents on the cap."
Trend-driven trait present	"Add a playful micro-icon to encourage TikTok unboxings."

9. Al Variant Generator







Prompt Builder

- _variant_prompt() stitches together:
 - Live scores (e.g., adds "pastel minimalist" if Aesthetic < 7)
 - Cached recommendation keywords ("rose-gold detail")
 - Metadata (category, brand-tone)

Back-ends (selectable)

Engine	Library/API	Strengths
Local SD 3.5	diffusers , AutoPipelineForImage2Image	GPU, offline, full control
Stability SD3 API	requests REST	Cloud render, no GPU needed
OpenAl gpt-image-1 Edit	openai Python SDK	High-quality realism

10. Future Work

- Dynamic rule learning mine new heuristics from user feedback logs
- Real-time mobile preview (AR) to test packages on shelf backdrops
- Fine-tuned diffusion checkpoint trained on brand assets to stabilise typography retention

11. Appendix – Code Map

File Section	Function / Class	Role in Pipeline
Тор	DemographicProfile	Hard-coded Gen-Z traits
Тор	PerceptionScores	Unified score container
§1	init	Seed control, optional deps
§2	_analyse()	Calls every low-level feature fn
§3	_heuristic_score()	Rule engine & audit trail
§4	_ml_delta()	CLIP/BLIP2 delta calculator
§5	_recommend()	Textual design advice
§6	_heatmap()	Layer-stacked attention map
§7	<pre>generate_variants()</pre>	Multi-backend variant maker
Low-level	_dominant_color, _edge_density, _is_glass, _symmetry,	Feature primitives