Main Features:

**Virtual Hair Lab:**

Upload photos to test colors, 3D hair model manipulation, Real-time color visualization, Before/after previews, Different hair textures/types

Let me break down how to implement the Virtual Hair Lab:

Photo Upload & Analysis:

**Technology Needed:**

AI image segmentation to isolate hair

Color detection to determine current level

Texture analysis for porosity/density

Metadata extraction for lighting conditions

**Implementation Steps:**

Use TensorFlow.js for hair detection

OpenCV for color analysis

Store in Supabase with proper metadata

Process lighting compensation

**3D Hair Model System:**

Base Technology:

Three.js for 3D rendering

WebGL for graphics processing

Physics-based hair simulation

**Key Features:**

Strand-based rendering

Light reflection simulation

Movement physics

Multiple view angles

Texture mapping

**Real-time Color Visualization:**

Color Processing:

RGB to Level conversion

Underlying pigment calculation

Developer effect simulation

Processing time visualization

**Technical Components:**

Color transformation matrices

Real-time shader updates

Layer-based processing

Tone adjustment algorithms

**Before/After System:**

Features:

Split screen comparison

Slider view (before/after)

Multiple angle comparisons

Save/share results

**Implementation:**

Canvas manipulation

State management for undo/redo

History tracking

Result sharing system

Hair Texture Library:

**Texture Types:**

Straight (Types 1a-1c)

Wavy (Types 2a-2c)

Curly (Types 3a-3c)

Coily (Types 4a-4c)

**Per Texture:**

Color absorption rates

Processing time adjustments

Developer strength modifications

Special consideration alerts

**User Interface:**

Main Controls:

CopyInsert

- Color Selection Panel

├── Level selector (1-10)

├── Tone selector

├── Developer strength

└── Processing time

- Texture Controls

├── Type selector

├── Density adjuster

├── Porosity setting

└── Previous treatment indicator

Processing Flow:

CopyInsert

Upload Photo → Analysis → Adjustments → Preview

↓ ↓ ↓ ↓

Detect Hair → Get Level → Apply Color → Show Result

↓ ↓ ↓ ↓

Save Base → Calculate → Process → Save New

**Safety Features:**

Integrity analysis

Maximum lift warnings

Processing time limits

Chemical reaction alerts

Patch test reminders

Storage System:

Original photos

Processed results

Formula history

User preferences

Sharing permissions

Performance Optimization:

Client-side processing where possible

Progressive loading

Cached results

Compressed storage

Batch processing

**Interactive Color Theory:**

Color wheel exploration

Level system visualization

Underlying pigment display

Contributing pigment charts

Interactive mixing demos

**Formula Builder:**

Step-by-step formulation

Developer selection guide

Processing time calculator

Mixing ratio calculator

Safety checks built-in

**Practice Scenarios:**

Virtual clients with different cases

Problem-solving exercises

Color correction challenges

Gray coverage scenarios

Double process situations

**Learning Tools:**

Video demonstrations

Interactive quizzes

Certification tracks

Progress tracking

Achievement badges

**Safety Features:**

Warning system for risky combinations

Contraindication alerts

Required patch test reminders

Chemical reaction explanations

Professional guidance notes

**Community Features:**

Share formulations

Discuss techniques

Ask questions

Get feedback

Success stories

**Professional Tools:**

Client consultation forms

Formula record keeping

Notes and observations

Result documentation

Progress tracking

**Mobile Features:**

Photo capture

Quick reference guides

Offline formula access

Emergency tips

Quick calculations

**Multi-Language Support:**

Instructions in multiple languages

Technical terms glossary

Cultural considerations

Regional product variations

Local certification requirements

This would be perfect for:

Beauty school students

New professionals

Experienced stylists trying new techniques

Continuing education

Certification preparation

The key is making it:

Interactive (learn by doing)

Safe (no real hair risk)

Comprehensive (covers all scenarios)

Professional (accurate formulations)

User-friendly (easy to understand)