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ADVANCED PYTHON PROGRAMMING

LAB ASSESMENT 22

WEB APP DEVELOPMENT IN PYTHON USING FLASK

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SKIN CARE PREDICTION AND RECOMMENDATION SYSTEM USING SBERT AND FM MODELS.

MAJOR OBJECTIVE:

The main objective of this project is to develop an intelligent Skin Care Prediction and Recommendation System that leverages SBERT (Sentence-Bidirectional Encoder Representations from Transformers) and Factorization Models to provide personalized cosmetic product suggestions based on individual skin profiles. The system aims to analyse the user's input data — including skin type, concerns, and preferences — and compare it with an existing cosmetic dataset using cosine similarity to measure the closeness between user features and product attributes. By identifying the most similar products in terms of composition and effectiveness, the model recommends the most suitable skincare products for the user. Additionally, the incorporation of factorization models enhances recommendation accuracy by capturing latent relationships and hidden factors influencing user-product interactions. Overall, the objective is to create a data-driven, adaptive, and user-centric skincare recommendation system that

improves the decision-making process for users seeking personalized cosmetic solutions.

KEY TAKEAWAYS:

- The project focuses on developing a Skin Care Prediction and Recommendation System.
- It utilizes SBERT (Sentence-Bidirectional Encoder Representations from Transformers) and Factorization Models.
- Cosine similarity is used to determine the closeness between user input and existing cosmetic product data.
- The system recommends the most suitable skincare products based on user-specific attributes like skin type and concerns.
- Factorization models are employed to uncover hidden patterns and improve recommendation accuracy.
- The goal is to build a personalized, data-driven, and adaptive system for skincare product recommendations.
- The system aims to enhance user experience and assist in informed decision-making for selecting cosmetic products.

CODE:

main.py

```
import os
from fastapi import FastAPI
from fastapi.staticfiles import StaticFiles
from fastapi.responses import FileResponse
from fastapi.middleware.cors import CORSMiddleware
from backend.routes import router as api_router

app = FastAPI()

app.add_middleware(
    CORSMiddleware,
    allow_origins=["*"],
    allow_credentials=True,
    allow_methods=["*"],
    allow_headers=["*"],
)

app.include_router(api_router, prefix="/api")
```

```
BASE_DIR = os.path.abspath(os.path.join(os.path.dirname(__file__), ".."))
FRONTEND_DIR = os.path.join(BASE_DIR, "frontend")
STATIC_DIR = os.path.join(FRONTEND_DIR, "static")
TEMPLATES_DIR = os.path.join(FRONTEND_DIR, "templates")

app.mount("/static", StaticFiles(directory=STATIC_DIR), name="static")

@app.get("/")
def index():
    return FileResponse(os.path.join(TEMPLATES_DIR, "index.html"))
```

routes.py

```
from fastapi import APIRouter
from backend.services.recommender import recommend_products
from backend.schemas.request_models import RecommendRequest

router = APIRouter()

@router.post("/recommend")
def get_recommendations(req: RecommendRequest):
    results = recommend_products(req)
    return {"recommendations": results}
```

test_verify.py

```
from backend.services.recommender import recommend_products
from backend.schemas.request_models import RecommendRequest

rec = recommend_products()
req = RecommendRequest(
    skin_type="dry",
    concerns=["hydration","barrier repair"],
    product_type="moisturizer",
    budget_min=300,
    budget_max=1300,
    avoid_ingredients=["fragrance"],
    prefer_ingredients=["ceramide","hyaluronic acid"],
    top_k=5,
    user_id=None
)
items = rec.recommend(req)
print("Top results (name, price, score):")
for it in items:
```

```
    print(it["name"], it["price"], round(it["score"],4))
```

index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8" />
  <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
  <title>Skincare Recommender</title>
  <link rel="stylesheet" href="/static/styles.css">
</head>
<body>
  <div class="container">
    <h1>Find Your Skincare Match</h1>
    <p class="subtitle">No ingredient knowledge needed — answer a few basics
and we'll recommend the best fits.</p>

    <form id="rec-form">
      <div class="grid">
        <!-- 1. Product Goal / Type -->
        <label>
          <span>What type of product are you looking for?</span>
          <select name="product_type">
            <option value="">Any</option>
            <option>Cleanser</option>
            <option>Moisturizer</option>
            <option>Serum</option>
            <option>Sunscreen</option>
            <option>Toner</option>
            <option>Face Mask</option>
            <option>Eye Cream</option>
            <option>Other</option>
          </select>
        </label>

        <!-- 2. Skin Type -->
        <label>
          <span>What is your skin type?</span>
          <select name="skin_type">
            <option value="">Not sure</option>
            <option>Dry</option>
            <option>Oily</option>
            <option>Normal</option>
            <option>Combination</option>
            <option>Sensitive</option>
          </select>
```

```
        </label>

        <!-- Concerns -->
        <label>
          <span>Any skin concerns?</span>
          <select name="concerns" multiple size="5">
            <option>Acne / Breakouts</option>
            <option>Dry patches</option>
            <option>Oiliness / Shine</option>
            <option>Redness / Sensitivity</option>
            <option>Dullness / Uneven tone</option>
          </select>
          <small>Tip: Hold Ctrl/Cmd to select multiple.</small>
        </label>

        <!-- 3. Budget -->
        <label>
          <span>What is your budget?</span>
          <select name="budget">
            <option value="">Any</option>
            <option>Less than $10</option>
            <option>$10 - $30</option>
            <option>$30 - $50</option>
            <option>$50+</option>
          </select>
        </label>

        <!-- 4. Brand Preference -->
        <label>
          <span>Preferred brand?</span>
          <input name="brand" placeholder="Type brand or leave blank for 'No
preference'"/>
        </label>

        <!-- 5. Ingredient Preferences / Allergies -->
        <label>
          <span>Ingredient preferences / allergies</span>
          <select name="ingredient_prefs" multiple size="4">
            <option>Fragrance-free</option>
            <option>Paraben-free</option>
            <option>Vegan / Natural</option>
            <option>No preference</option>
          </select>
        </label>

        <!-- 6. Specific Product (optional) -->
        <label>
          <span>Specific product name (optional)</span>
```

```
          <input name="product_name" placeholder="e.g., 'Niacinamide Serum'"/>
        </label>

        <!-- 7. Priority / Focus -->
        <label>
          <span>What matters most?</span>
          <select name="priority">
            <option value="">No specific priority</option>
            <option>Hydration / Moisturization</option>
            <option>Anti-aging / Wrinkle reduction</option>
            <option>Oil control / Matte finish</option>
            <option>Brightening / Even skin tone</option>
            <option>Sensitive skin friendly</option>
          </select>
        </label>

        <!-- Top K -->
        <label>
          <span>How many results?</span>
          <select name="top_k">
            <option>5</option>
            <option selected>10</option>
          </select>
        </label>
      </div>

      <button type="submit">Get Recommendations</button>
    </form>

    <div id="results" class="cards"></div>
  </div>

  <script src="/static/app.js"></script>
</body>
</html>
```

styles.css

```
body {
    background-image: url('images.jpg');
    background-size: cover;
    background-position: center;
    background-repeat: no-repeat;
    background-attachment: fixed;
    color: #e0e0ff;
```

```
    font-family: 'Segoe UI', Tahoma, Geneva, Verdana, sans-serif;
}

header {
    background: rgba(30, 30, 47, 0.8);
    backdrop-filter: blur(10px);
    border-radius: 20px;
    padding: 2rem;
    margin-bottom: 2rem;
    box-shadow: 0 8px 32px rgba(0, 0, 0, 0.7);
}

h1 {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    -webkit-background-clip: text;
    -webkit-text-fill-color: transparent;
    background-clip: text;
    text-shadow: 0 2px 4px rgba(0, 0, 0, 0.5);
}

.bg-white.rounded-lg.shadow-lg {
    background: rgba(30, 30, 47, 0.85);
    backdrop-filter: blur(10px);
    border: 1px solid rgba(168, 85, 247, 0.3);
    box-shadow: 0 8px 32px rgba(0, 0, 0, 0.7);
    color: #dcdcff;
}


select, input {
    background-color: #2a2a3d;
    color: #e0e0ff;
    border-radius: 10px;
    border: 1px solid #5a4a9a;
    transition: all 0.3s ease;
}

select:focus, input:focus {
    transform: translateY(-2px);
    box-shadow: 0 4px 12px rgba(168, 85, 247, 0.6);
    outline: none;
}

button[type="submit"] {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    border: none;
    border-radius: 25px;
    font-weight: 600;
    letter-spacing: 0.5px;
```

```
    transition: all 0.3s ease;
    color: white;
}

button[type="submit"]:hover {
    background: linear-gradient(45deg, #9333ea, #6d28d9);
    transform: translateY(-2px);
    box-shadow: 0 6px 20px rgba(168, 85, 247, 0.7);
}

.bg-gradient-to-r.from-purple-50.to-pink-50 {
    background: linear-gradient(135deg, #2a2a3d 0%, #3a2a3d 100%);
    border: 1px solid rgba(168, 85, 247, 0.5);
    border-radius: 15px;
    transition: all 0.3s ease;
    color: #dcdcff;
}

.bg-gradient-to-r.from-purple-50.to-pink-50:hover {
    transform: translateY(-5px);
    box-shadow: 0 10px 25px rgba(168, 85, 247, 0.8);
}

h3 {
    color: #cbb4f9;
    font-weight: 700;
}

@media (max-width: 768px) {
    .container {
        padding: 1rem;
    }

    header {
        padding: 1.5rem;
    }

    h1 {
        font-size: 2rem;
    }
}

@keyframes fadeIn {
    from { opacity: 0; transform: translateY(20px); }
    to { opacity: 1; transform: translateY(0); }
}

.container {
```

```
    animation: fadeIn 0.8s ease-out;
}

::-webkit-scrollbar {
    width: 8px;
}

::-webkit-scrollbar-track {
    background: #1e1e2f;
}

::-webkit-scrollbar-thumb {
    background: linear-gradient(45deg, #a855f7, #7c3aed);
    border-radius: 4px;
}

::-webkit-scrollbar-thumb:hover {
    background: linear-gradient(45deg, #9333ea, #6d28d9);
}
```

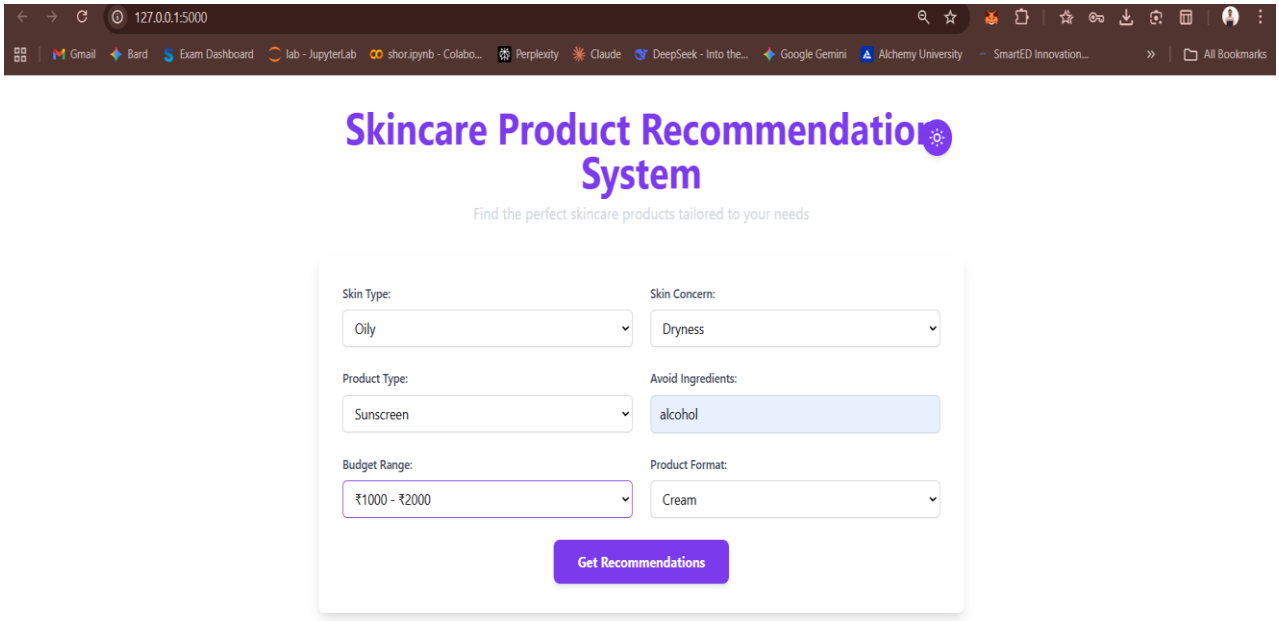
app.py

```
from flask import Flask, render_template, request
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler
from sklearn.metrics.pairwise import cosine_similarity
from sentence_transformers import SentenceTransformer

app = Flask(__name__)
df = pd.read_csv("C:/Users/gokul/OneDrive/Desktop/cosmetics.csv")

skin_cols = ["Combination", "Dry", "Normal", "Oily", "Sensitive"]
df = df[df[skin_cols].sum(axis=1) > 0].reset_index(drop=True)

def build_text(row):
    parts = []
    if pd.notna(row["Label"]): parts.append(str(row["Label"]))
    if pd.notna(row["Brand"]): parts.append(str(row["Brand"]))
    if pd.notna(row["Name"]): parts.append(str(row["Name"]))
    if pd.notna(row["Ingredients"]): parts.append(str(row["Ingredients"]))
    return " || ".join(parts)

df["text"] = df.apply(build_text, axis=1)
texts = df["text"].tolist()
model = SentenceTransformer("all-MiniLM-L6-v2")
```

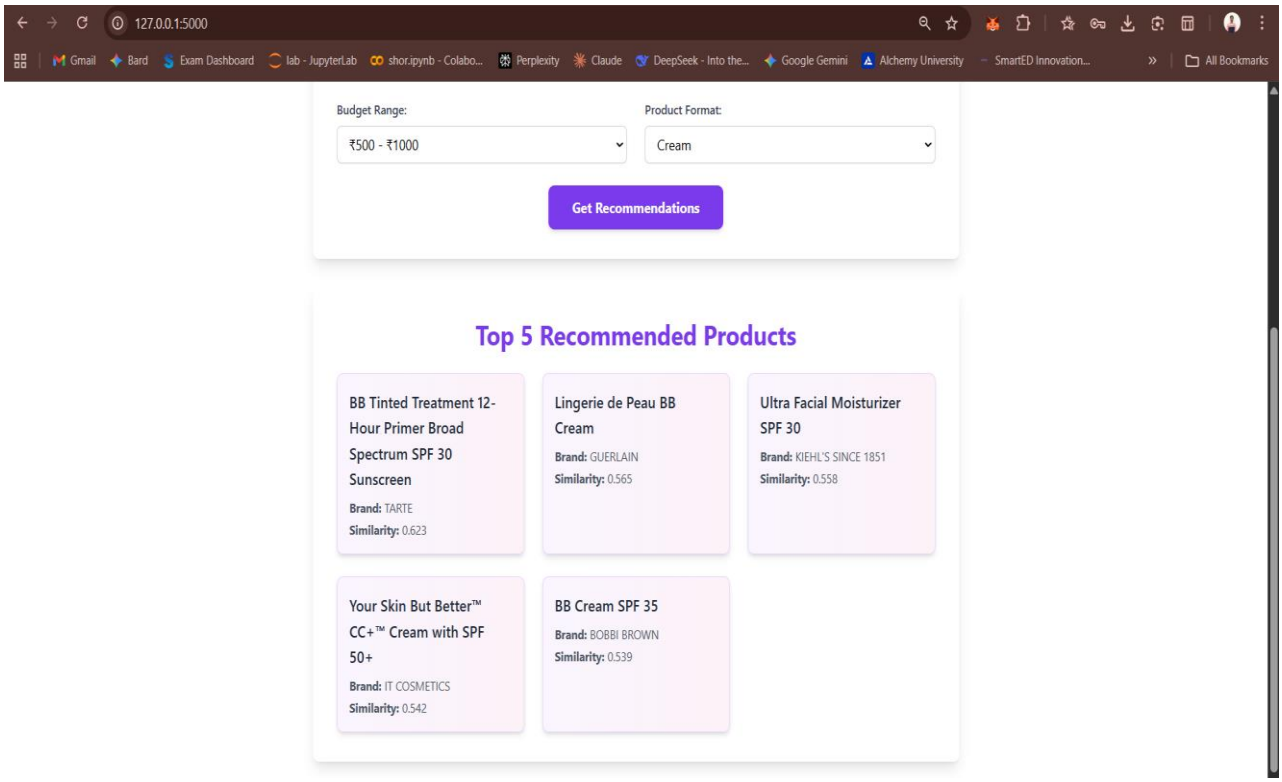
```
embeddings = model.encode(
    texts, batch_size=64, convert_to_numpy=True, normalize_embeddings=True
)
extra_cols = ["Price", "Rank"]
numX = df[extra_cols].fillna(df[extra_cols].median()).to_numpy(dtype=float)
scaler = StandardScaler().fit(numX)
numX = scaler.transform(numX)
X = np.hstack([embeddings, numX])
@app.route("/", methods=["GET", "POST"])
def index():
    recommendations = []
    if request.method == "POST":
        skin_type = request.form["skin_type"]
        skin_concern = request.form["skin_concern"]
        product_type = request.form["product_type"]
        avoid_ingredients = request.form["avoid_ingredients"]
        budget_range = request.form["budget_range"]
        product_format = request.form["product_format"]
        user_query = (
            f"Skin type: {skin_type}. "
            f"Concern: {skin_concern}. "
            f"Product: {product_type}. "
            f"Avoid ingredients: {avoid_ingredients}. "
            f"Budget: {budget_range}. "
            f"Format: {product_format}."
        )
        query_emb = model.encode(
            [user_query], convert_to_numpy=True, normalize_embeddings=True
        )
        sims = cosine_similarity(query_emb, embeddings)[0]
        top_idx = np.argsort(-sims)[:5]
        for i in top_idx:
            recommendations.append({
                "Product": df.iloc[i]["Name"],
                "Brand": df.iloc[i]["Brand"],
                "Similarity": round(sims[i], 3)
            })

    return render_template("index.html", recommendations=recommendations)


if __name__ == "__main__":
    app.run(debug=True)
```

OUTPUT SCREENSHOT

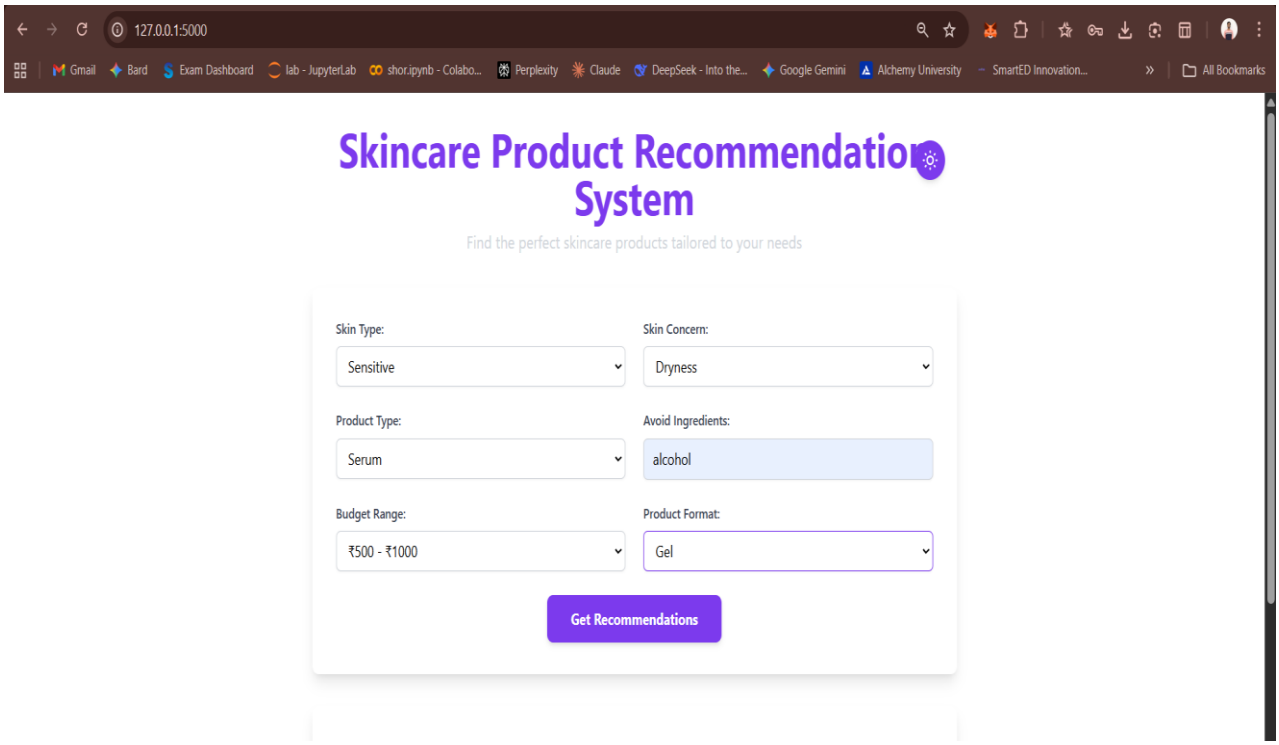
USER INPUT 1:



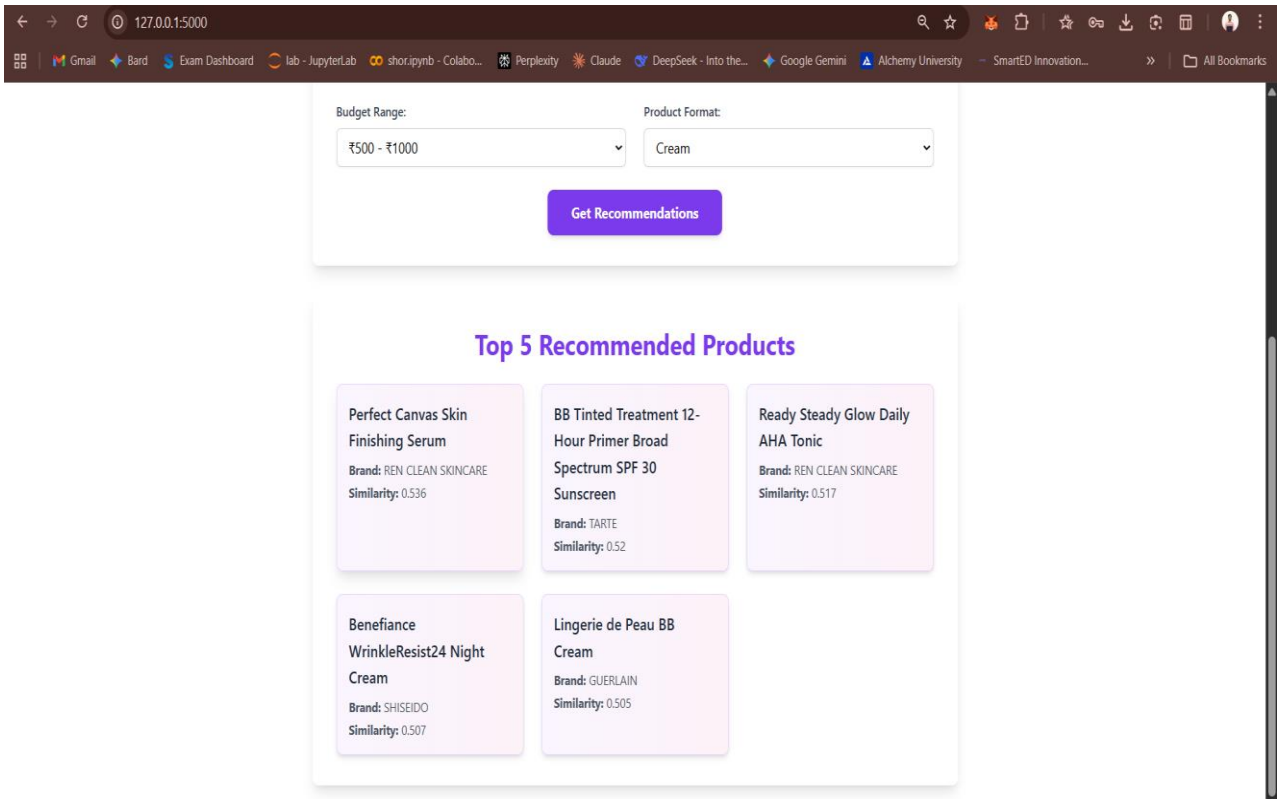
RECOMMENDATION:



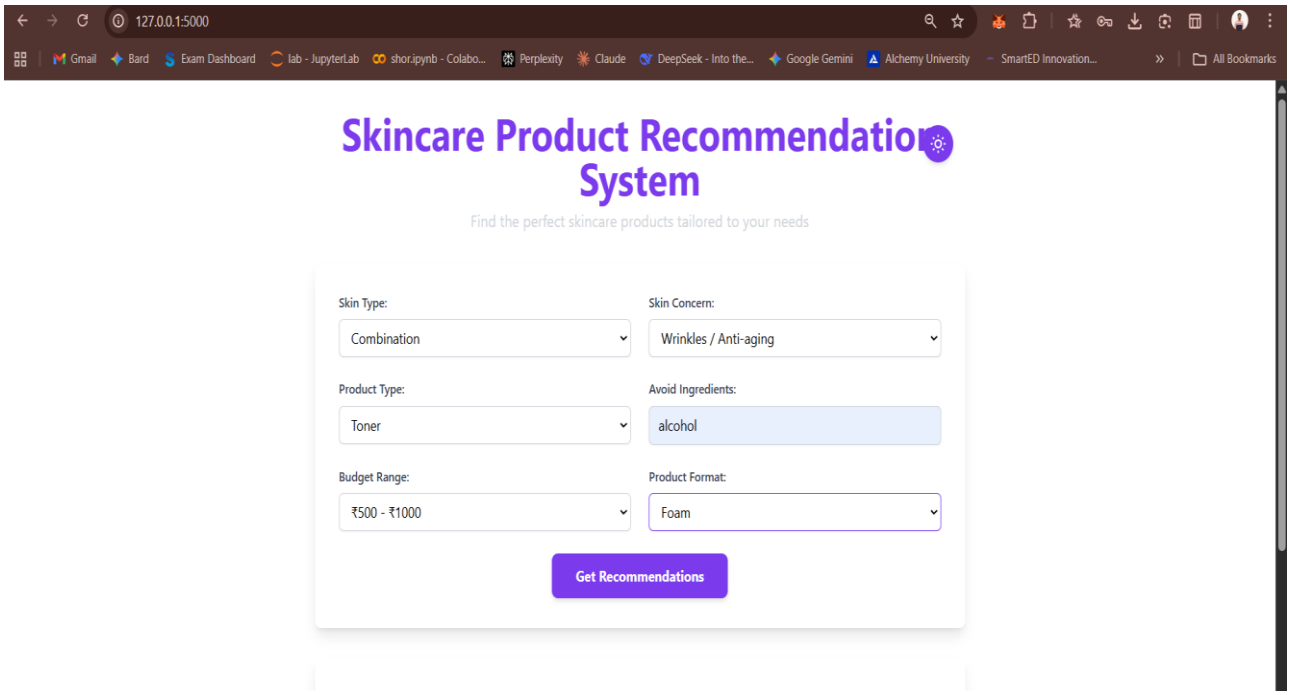
USER INPUT 2:



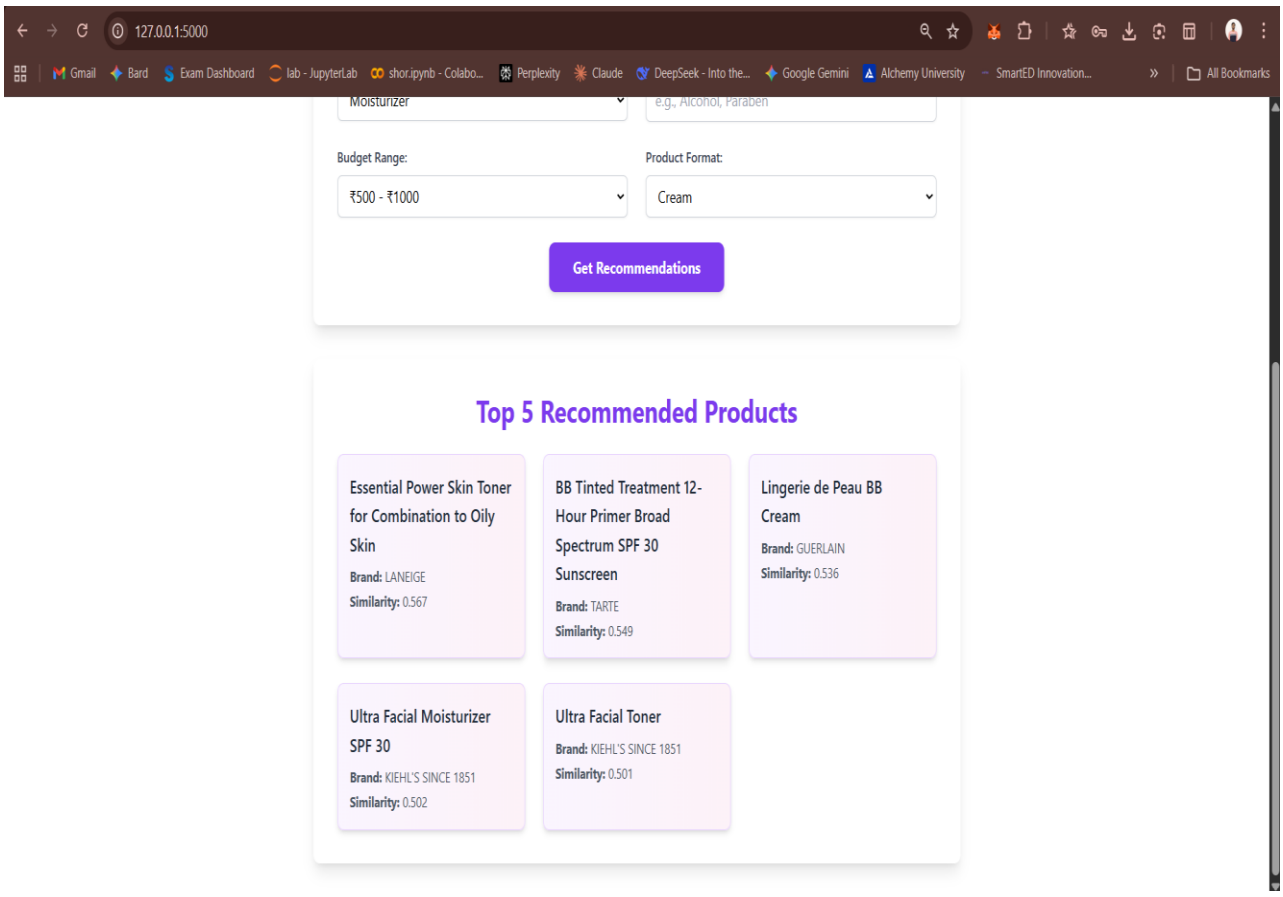
RECOMMENDATION:

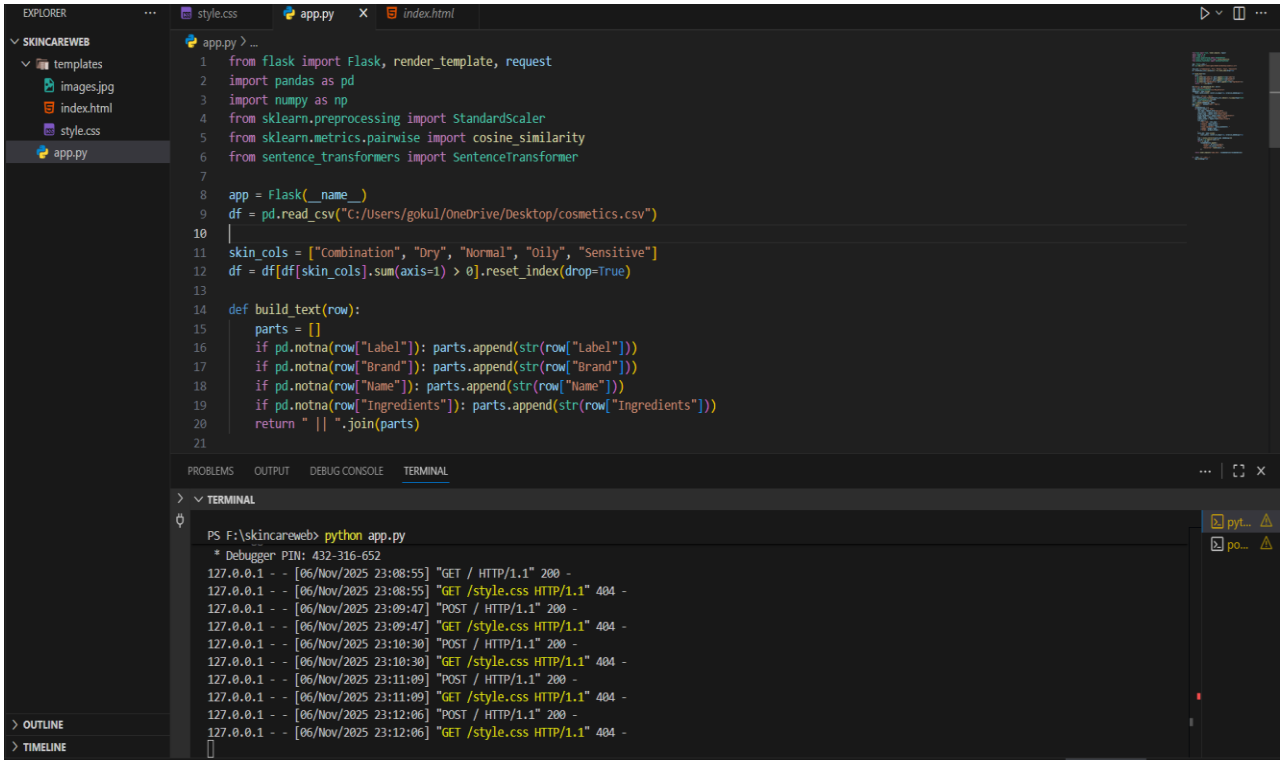


USER INPUT 3:

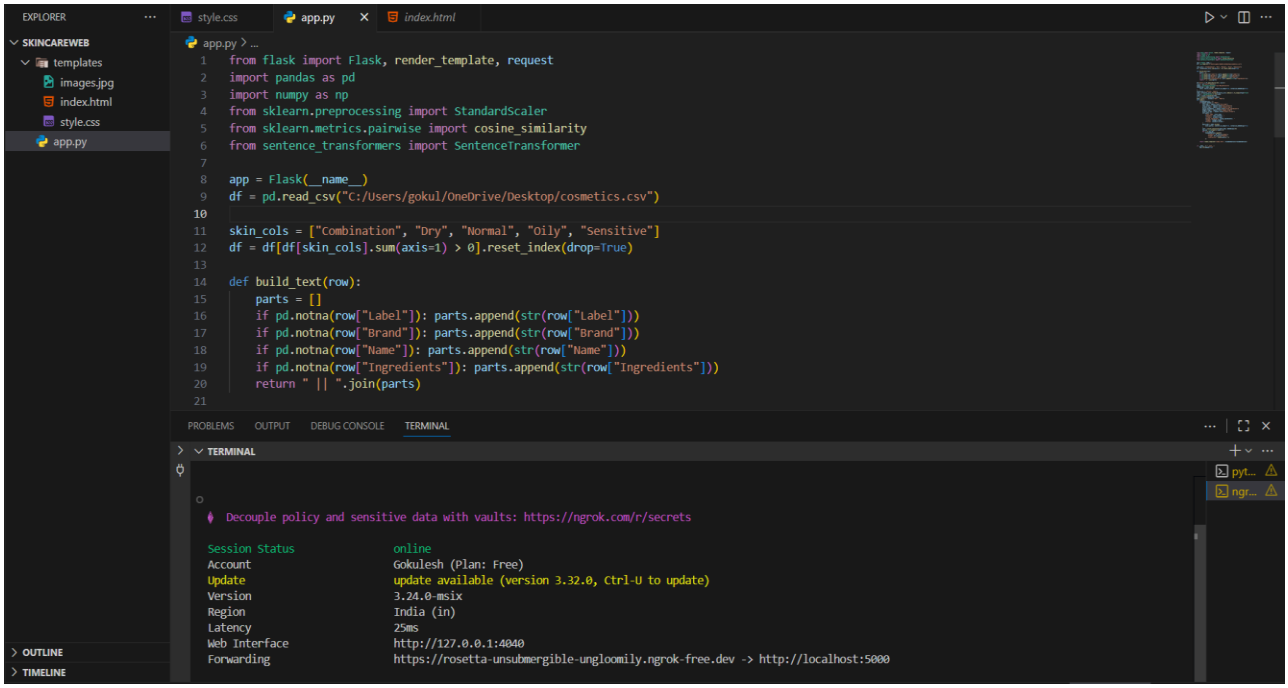


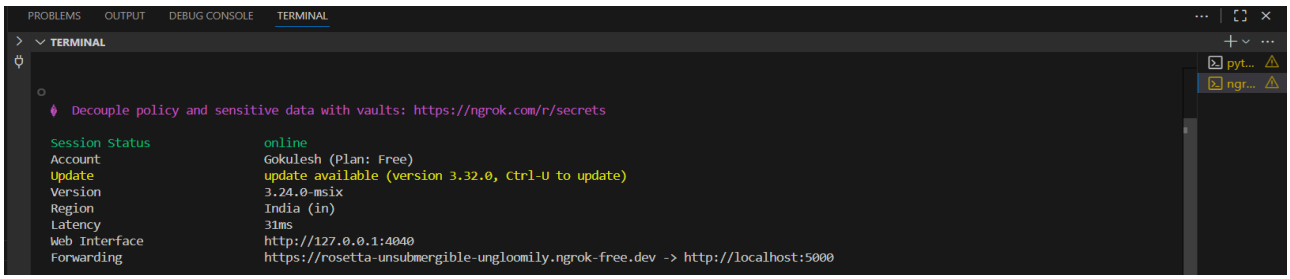
RECOMMENDATION:



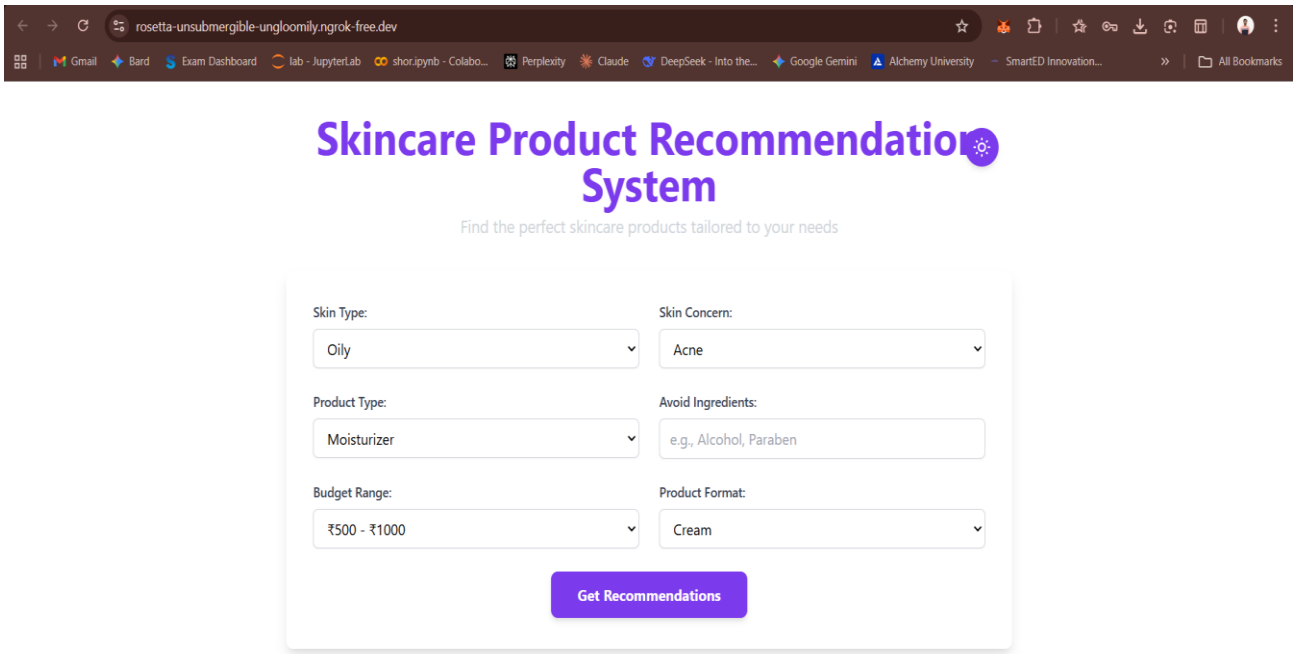


DEPLOYMENT IN NGROK SERVER





AFTER DEPLOYMENT:



WEBSITE LINK:

https://rosetta-unsubmergible-ungloomily.ngrok-free.dev/