E-PROVA

VIRTUAL TRY ON SYSTEM

Experience e prova like never before, transforming online shopping into a personalized adventure.

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agenda

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the problem

Online clothes shopping offers convenience and variety, but a key issue remains: users can't try on clothes before buying. This causes uncertainty, poor fit, and high return rates. Many customers hesitate to purchase due to doubts about size and style.

Most platforms lack interactive tools to visualize clothes on real users, relying instead on static images and models. This makes the experience harder for first-time shoppers or those with limited fashion knowledge—especially in areas without access to physical stores.

solution

Our solution integrates AI-based virtual try-on into a scalable e-commerce platform, allowing users to confidently explore, visualize, and purchase clothing online through a seamless and engaging experience.

Scalable, User-Centric Platform:
A centralized catalog, user accounts, and tailored recommendations ensure 24/7 access. This seamless setup allows easy integration of features like virtual try-on without disrupting the shopping flow

Personalized, Interactive Experience:
Combining e-commerce with virtual try-on enables users to try styles virtually, get AI-based size suggestions, and receive personalized recommendations—enhancing satisfaction, loyalty, and overall engagement.

Enhanced Conversion and Reduced Returns:
Realistic garment previews increase customer confidence and conversion rates, while setting clear expectations helps reduce returns and cut retailer costs.

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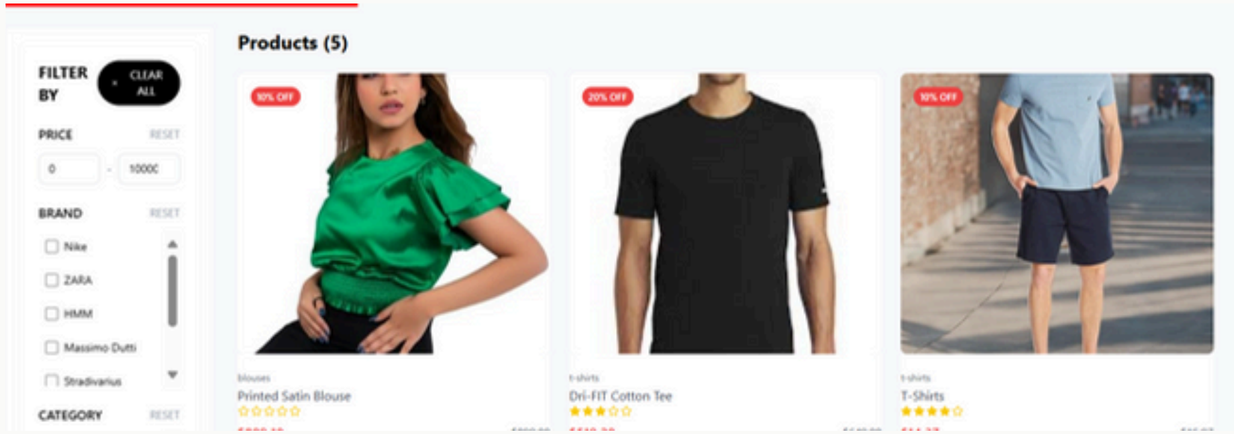
System architecture

1. The Customer Journey

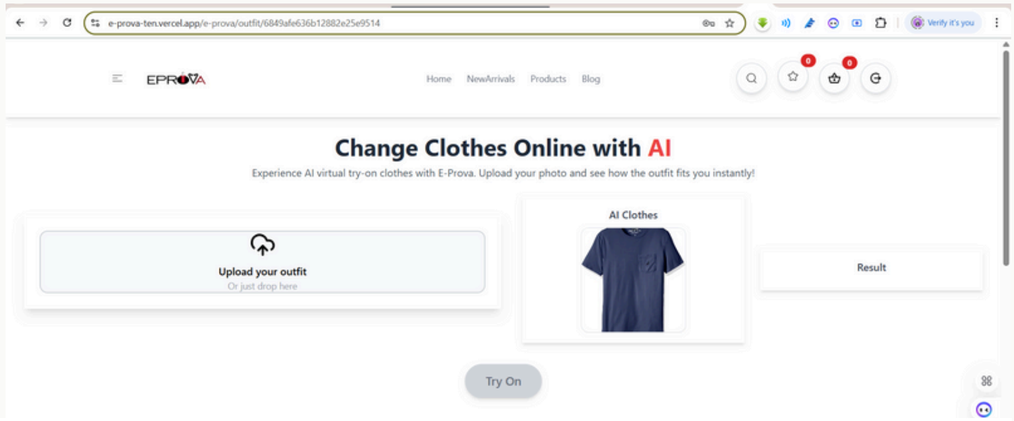
- **Browsing**: User opens the React-based website and explores categories, products, and brands.



- **Virtual Try-On**

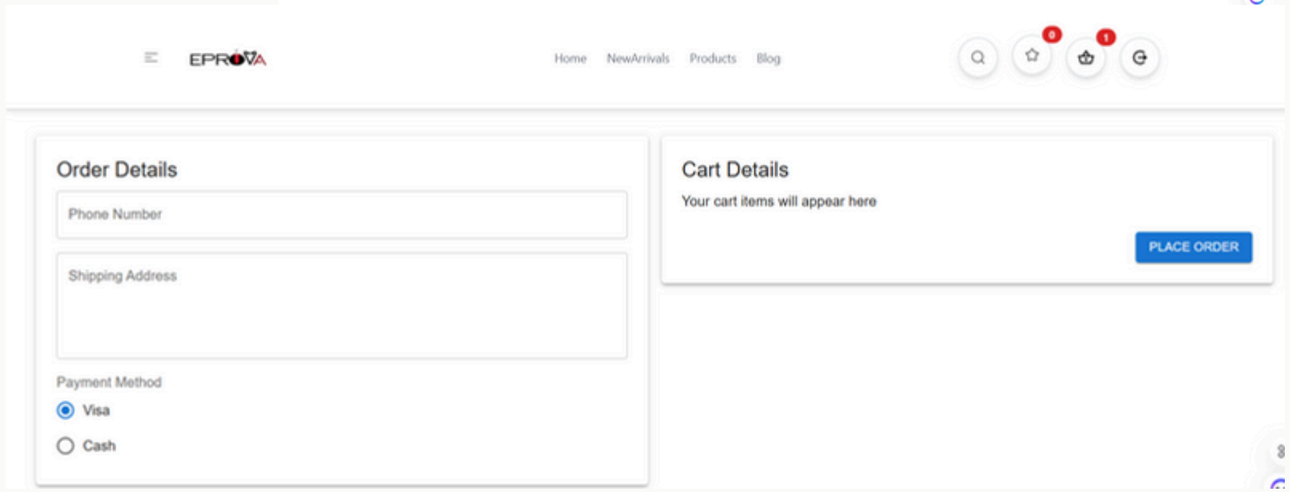
Uploads a full-body photo, selects a product → request sent to Flask AI server.

Server returns a preview showing how the product looks on the user.



- **Checkout**

Processes payment, updates inventory, and triggers confirmation emails



- **Order Confirmation:**

Order saved in MongoDB, stock updated, cart cleared

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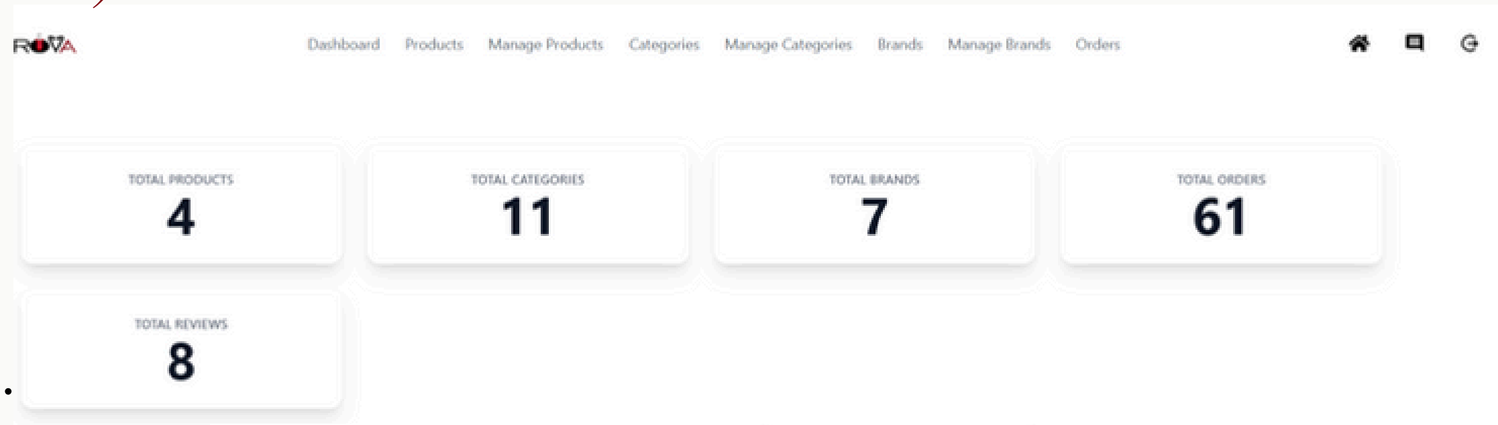
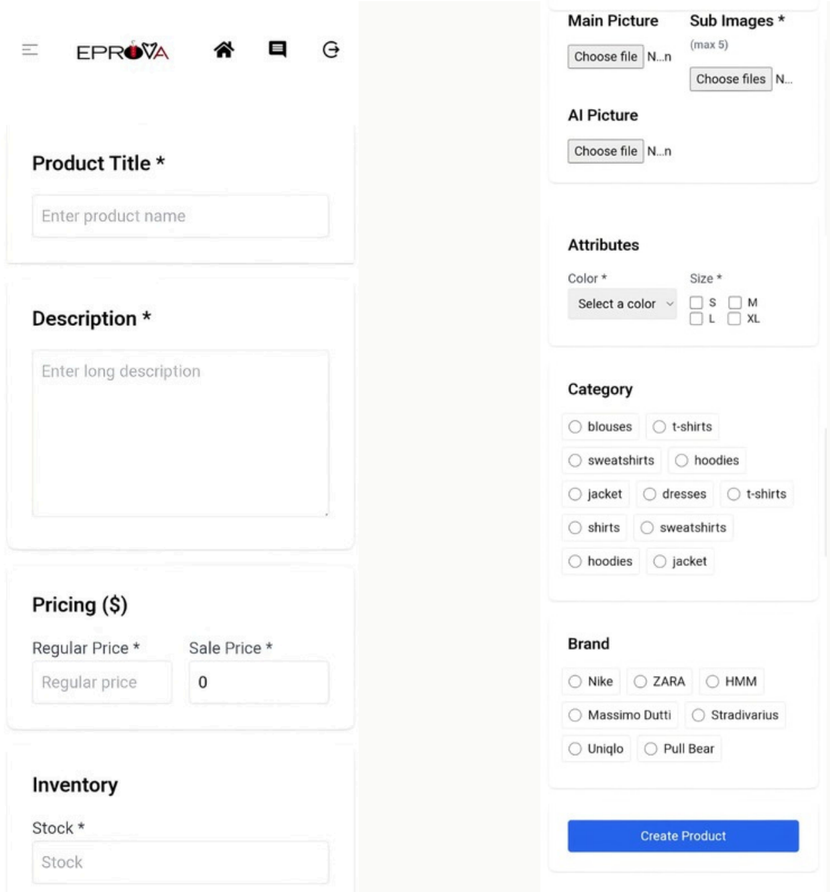
System architecture (cont)

2.Admin Role Journey



- **Manage Products**:Add, update, or remove product listings and images.



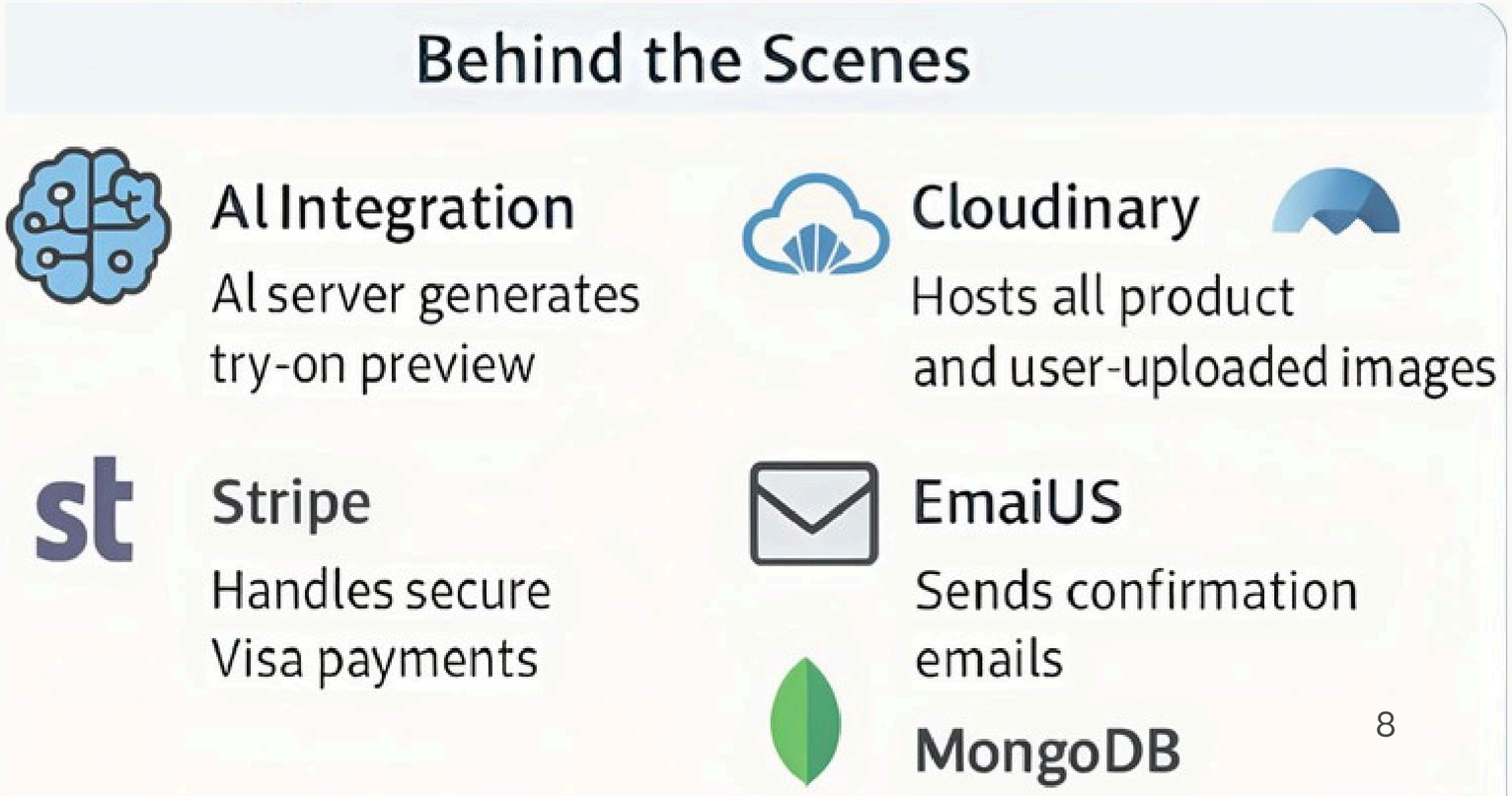
- **Manage Categories & Brands**: Organize store structure and update associations.

- **Track Orders:** View customer orders, filter by status, and update.

- **Review Monitoring:** View or delete customer reviews if needed.

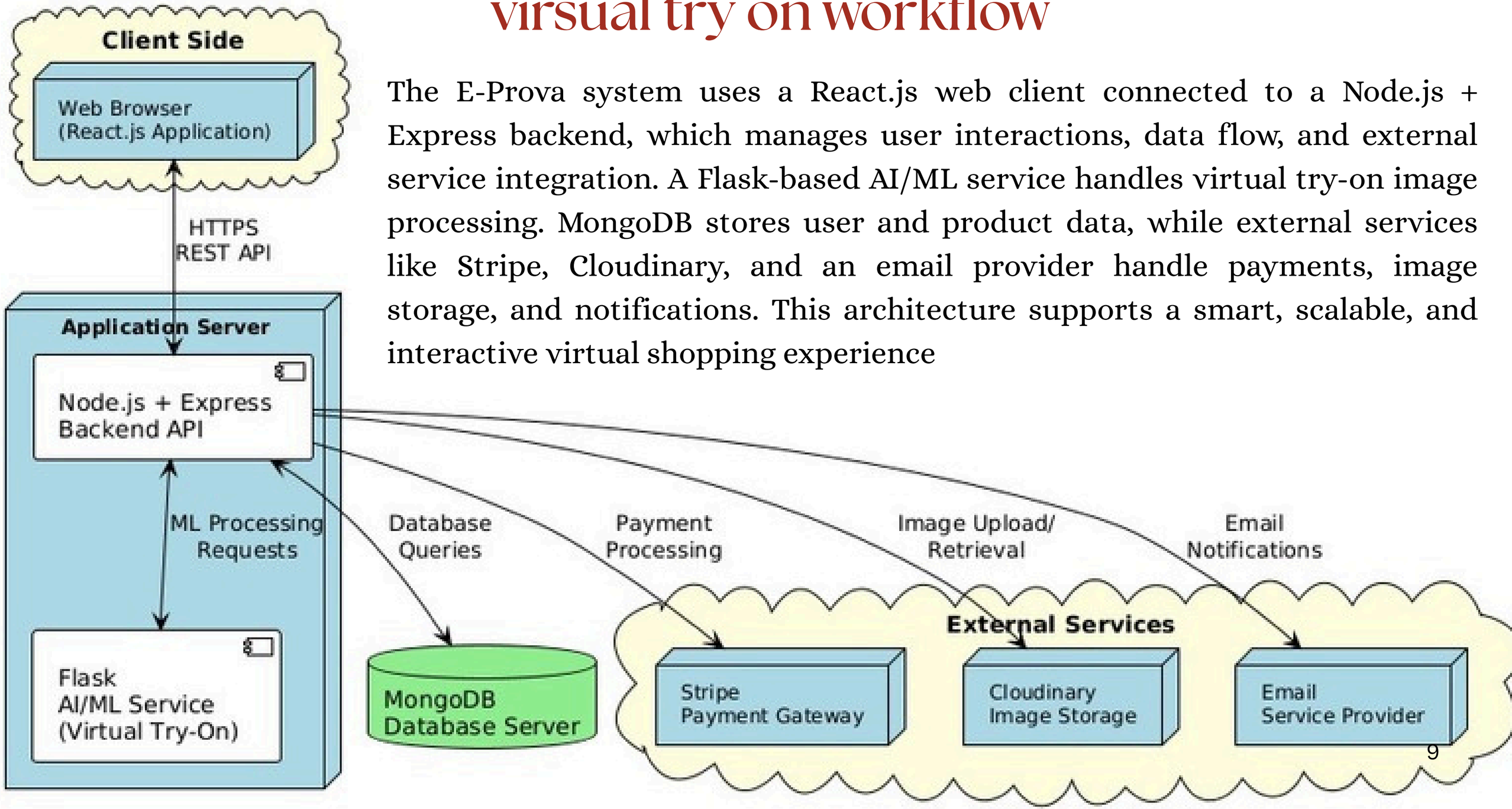
How Does the Magic Happen?

AI Integration: Flask-based backend receives image + product info → returns styled try-on.
Cloudinary: Hosts all product images and uploaded user images.
Stripe: Handles secure Visa payments.
EmailJS / NodeMailer: Sends confirmation and reset emails.
MongoDB: Stores all structured data (users, products, orders, etc.)



virsual try on workflow

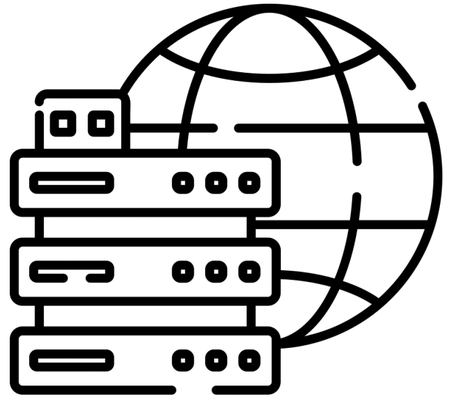
The E-Prova system uses a React.js web client connected to a Node.js + Express backend, which manages user interactions, data flow, and external service integration. A Flask-based AI/ML service handles virtual try-on image processing. MongoDB stores user and product data, while external services like Stripe, Cloudinary, and an email provider handle payments, image storage, and notifications. This architecture supports a smart, scalable, and interactive virtual shopping experience



Challenges

1.Vercel Serverless Limitations

- Problem:
  - Vercel’s serverless functions have timeout limits and experience slow cold starts
- impact :
  - Delays in receiving virtual try-on image responses from the AI model
  - Affected user experience during try-on interactions



2. **Cloudinary Storage Constraints**

- Problem:
  - Cloudinary’s free plan imposes strict limits on storage and image upload size.
- impact :
  - Limited number of product uploads
  - Required frequent image cleanup and manual monitoring

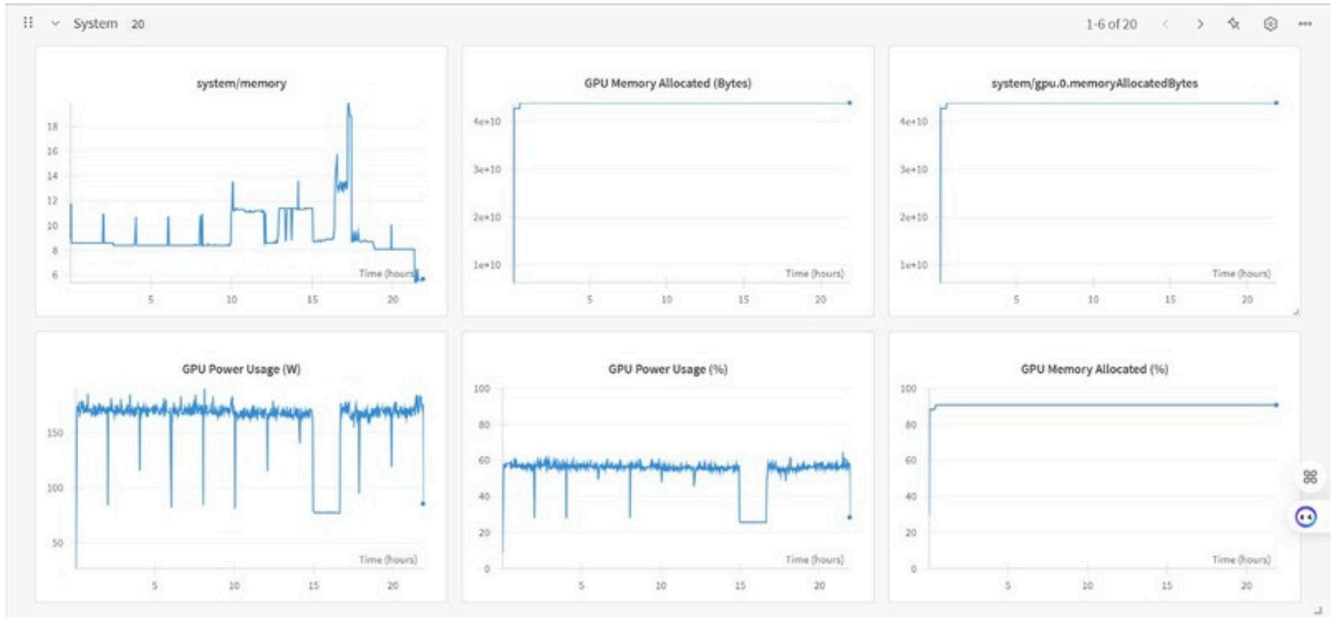
Cloudinary

3. **Stripe Business Account Verification**

- Problem:
  - Stripe required a verified business account for full payment integration..
- impact :
  - Delayed deployment of the payment feature
  - Slowed down testing and demo readiness

Challenges

4. **Limited Computational Resources**
   - Problem:
     - Only 4GB GPU memory available (Colab/Kaggle free tier)
     - Required 12GB+ for full IDM-VTON training
   - Impact:
     - 83% of experimental runs crashed during diffusion refinement
     - 3-4 hour processing times per image on CPU fallback



5. **Prohibitive Cloud Costs**
   - Problem:
     - Cloud GPUs (A100/V100) cost $2.1-$4.8/hour
     - Full training required 200+ GPU hours
   - impact :
     - Budget constraints forced 75% reduction in training iterations
     - Reliance on pre-trained checkpoints with limited customization

Challenges

6. Session Instability

- Problem:
  - Runtime disconnections after 12h (Colab limits)
  - Memory leaks during TPS warping
- Impact:
  - Lost 17 completed experiments due to session crashes
  - Required manual checkpointing every 30 minutes

Mitigation Strategies

- Adopted mixed-precision (FP16) training → 40% memory reduction
- Implemented gradient checkpointing → Enabled larger batch sizes
- Used Hugging Face cached models → Avoided redundant downloads

Related Work

1-Image-Based Virtual Try-On using GANs:

- Deform (warp) the garment to fit the person's body shape.
- Use GANs to generate the final image.
- Limitation: Poor generalization to complex backgrounds and diverse poses.

2-Diffusion-Based Virtual Try-On:

- Apply diffusion models like TryOnDiffusion with dual UNet architecture.
- Some methods treat the task as image inpainting using reference images.
- Limitation: Difficulty in preserving fine garment details.

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Related Work (cont.)

3-Conditional Control in Diffusion Models:

- Enhance generation by adding controls like pose, edges, depth.
- Models like ControlNet and IP-Adapter allow more accurate generation using both text and image prompts.

4-Customization of Diffusion Models:

- Fine-tune models using a few personal images (few-shot learning).
- Achieve better adaptation to real-world data without catastrophic forgetting.
- Also useful for tasks like image completion or restoration.

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Experiment 1: Lady VITON

Goal : Test a baseline virtual try-on system

Setup: Used Lady VITON repo with VITON-HD dataset

Preprocessing: No automatic preprocessing – required manual alignment

Results: Output lacked realism and consistencyand and Clothes were poorly aligned with user body.

Experiment 2: IDM-VTON

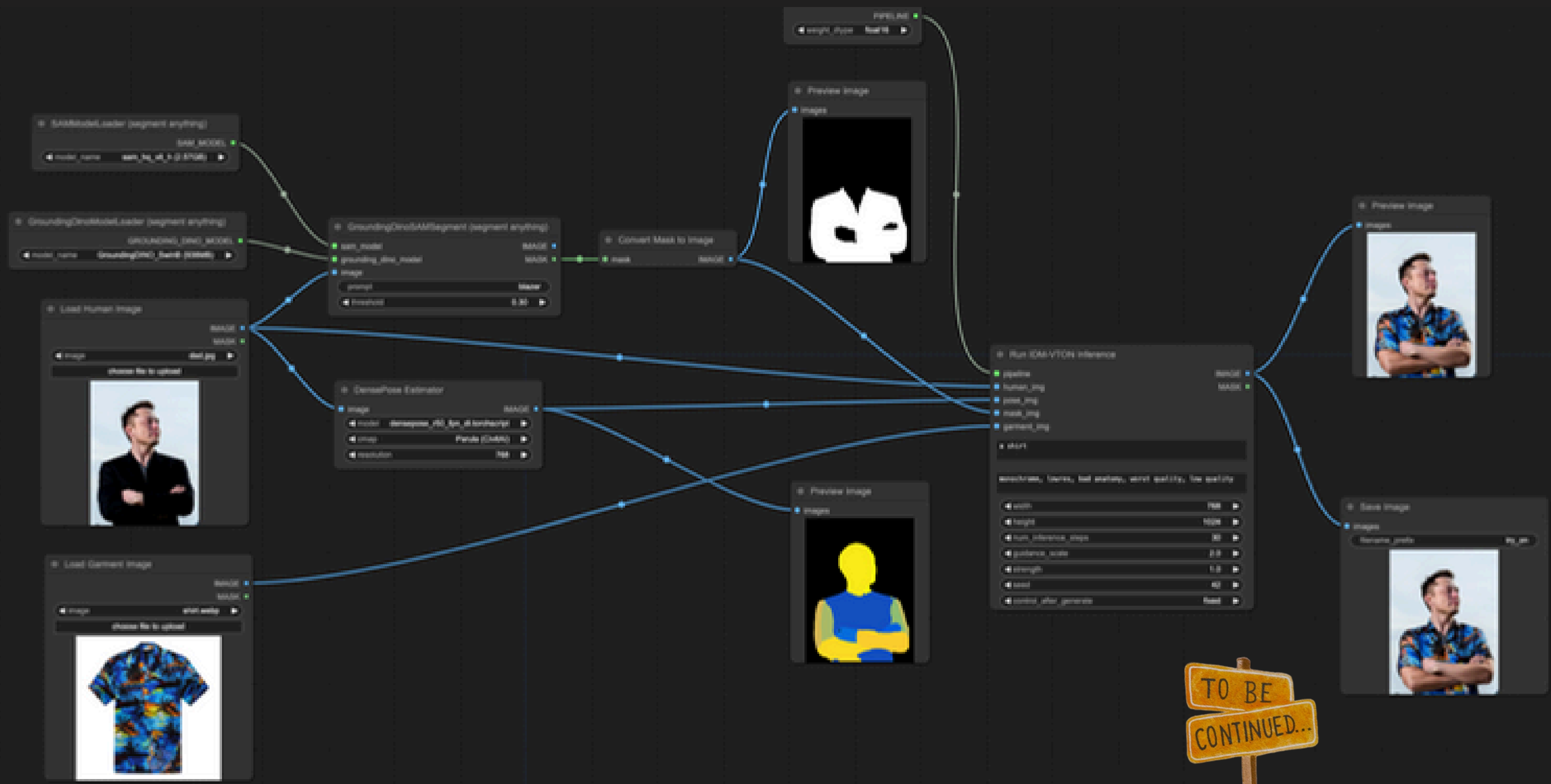
Goal : Improve realism and automate the pipeline

Setup: Used IDM-VTON with the same dataset

Preprocessing: Better fit and more realistic overlay,Handled occlusions and body shapes smoothly

Results: Better fit and more realistic overlay and Handled occlusions and body shapes smoothly.

implementation flow



implementation flow (cont)

1. Load Human Image

The first thing you do is upload an image of the person (the person you will try the clothing on)

2. Load Garment Image

Then you upload an image of the clothing you want to try on (the shirt or blouse, for example)

3. Segment the Garment (Cloth Mask Generation)

- Using:GroundingDINO + SAM (Segment Anything)
- The clothing in the image is automatically identified based on a prompt word like "blazer."
- SAM creates a mask to define the boundaries of the clothing.
- This mask is converted to a black and white image (binary mask).

implementation flow (cont)

4. Get Human PoseUsing:

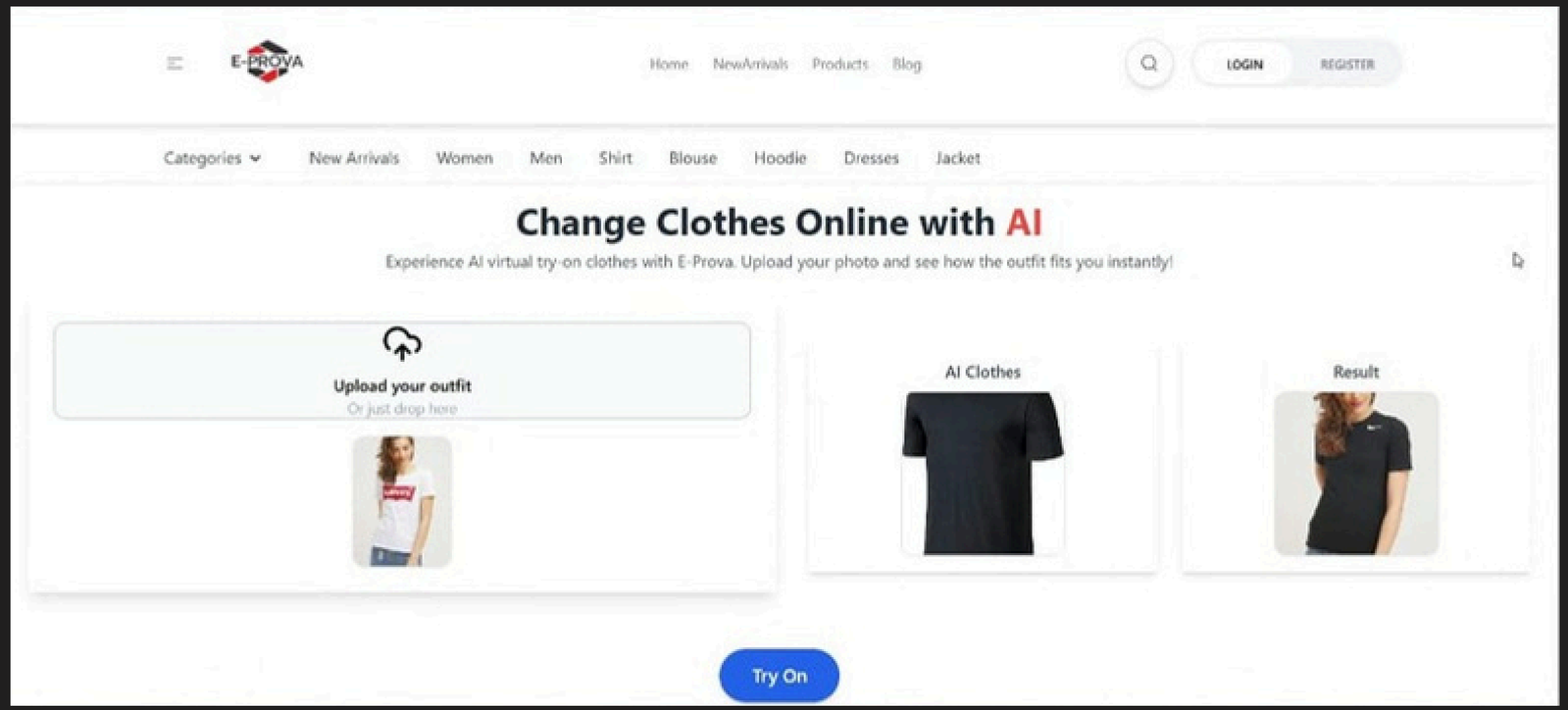
- DensePose Estimator
- This extracts the body shape and distribution of parts (head, arms, body) as a pose
- image.This image helps in adjusting the clothing to fit the person's body

5. Run IDM-VTON InferenceIt

takes as inputs :human_img → the person's image
garment_img → the clothing image
mask_img → the mask that defines the clothing
pose_img → the image showing body distribution
garment_des → a simple description of the clothing (like "a shirt")
the output:A new image of the person as if they are wearing the clothing you selected.

implementation flow (cont)

6. Output + Save ImageIt displays the output as a new image that you can save.



Evaluation

```
100% 64/64 [00:08<00:00,  7.43it/s]
{'ssim_score': 0.7334049344062805, 'lpips_score': 0.25036758184432983, 'fid_score': 35.53354407692765
Steps: 100% 250/250 [51:45<00:00, 12.42s/it, lr=5e-6, step_loss=0.00806]
```

this is like a comparison between ladi and IDM in :

SSIM (Structural Similarity Index): Measures image similarity

LPIPS (Learned Perceptual Image Patch Similarity): A perceptual metric where lower is better

Metric	LaDI-VTON	IDM-VTON	Best
SSIM ↑	0.872	0.870	LaDI-VTON
LPIPS ↓	0.156	0.102	IDM-VTON
FID ↓	8.85	6.29	IDM-VTON
CLIP-I ↑	0.834	0.883	IDM-VTON

FID (Fréchet Inception Distance): Lower FID indicates better alignment with real distribution

CLIP-I (CLIP Similarity Score): Evaluates how well the generated image matches the textual description (or reference image) using CLIP embeddings

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Why Better?

- **Automatic Preprocessing:**

handles preprocessing steps (like pose estimation and parsing) automatically

- **Better Garment Fit:**

aligns clothes more accurately on the body, especially with complex poses.

- **More Realistic Results:**

The output images are more natural and preserve garment details better.

- **Stronger Performance:**

works better with complex backgrounds and diverse user poses.

- **Easier Integration:**

IDM-VTON is modular and easier to use in a complete system.

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Future work :

- Add 3D body modeling for more accurate and multi-angle try-on.
- Enable real-time try-on using webcam and AR.
- Implement AI-based size recommendations.
- Use user feedback to refine model accuracy.
- Develop a mobile app for better accessibility.

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Conclusion

Our system presents a smart, user-centric solution that transforms the online fashion shopping experience. By integrating AI-powered Virtual Try-On technology into a scalable e-commerce platform, we bridge the gap between physical and digital retail. Customers can now visualize garments on their own image before purchasing, which enhances confidence, reduces returns, and increases satisfaction. This fusion of innovation and convenience not only improves user engagement but also offers businesses a competitive edge in the fast-growing digital market.

Frontend repo

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Notebook IDM

Backend repo

Notebook LADI

Thank You ! ☺