	Marwadi University **Faculty of Technology** **Department of Information and Communication Technology**
Subject: Capstone Project	Ideation and stakeholder need analysis - Intermediate Review
	Date: 24/09/2025	**Enrolment No: 92200133001**

Team Member:
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Problem Statement:

Tailors, shoppers and especially in the fashion and tailoring domains, face difficulties in visualizing how a garment will look on their own body before purchase or stitching. This results in high product return rates, customer dissatisfaction, and inefficiencies in tailoring processes due to miscommunication about design, fit, or fabric. Existing virtual try-on solutions are expensive, or fail to handle complexities such as varied body measurements, fabric textures, and occlusions like hair overlapping clothing.

Virtual try-on system that leverages **computer vision, pose estimation, and segmentation techniques** to realistically overlay garments on a user's image while addressing accuracy, usability, and scalability.
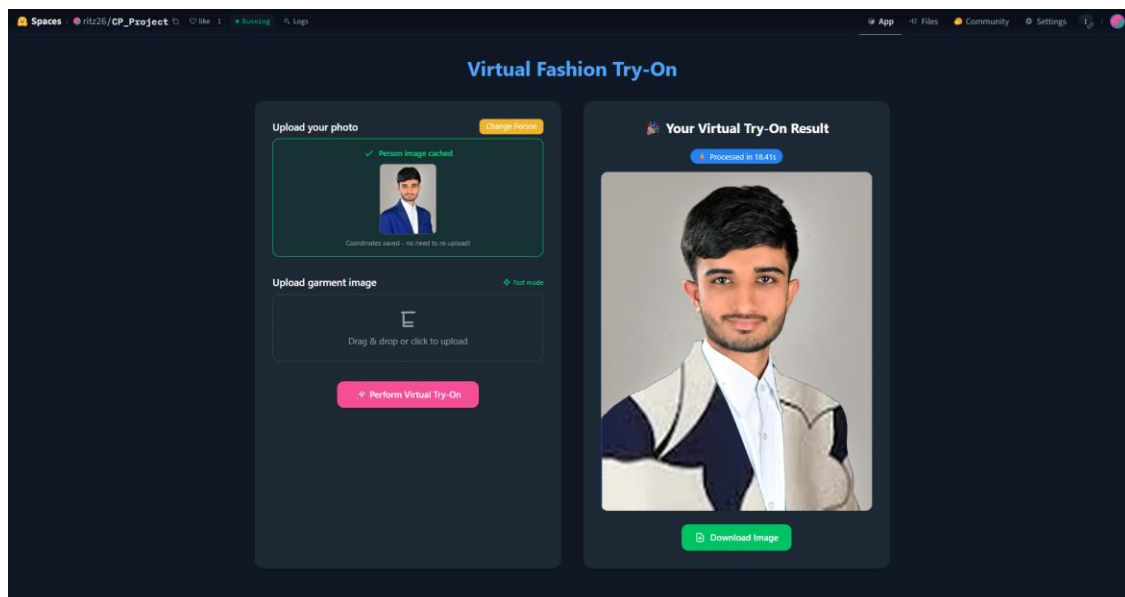
Versions:
Version 1 (V1): Basic Try-On with Raw Garment Upload
• Users could upload a raw garment image.
• The system overlaid this garment on the detected body region.
• Limitation: Users were not able to perform try-on from any online model image or fashion source.
• Purpose: Validate the feasibility of garment overlay using pose estimation + segmentation.

Version 2 (V2): Enhanced Try-On with Garment Selection
Link: https://huggingface.co/spaces/ritz26/CP_Project
• Extended functionality: Users can now upload a raw garment image or select a specific part from any outfit/model image (e.g., just the top from a catalog photo).
• Introduced region selection & cropping to isolate the garment portion before overlay.
• Improvement: Gave flexibility for users to virtually try-on garments not just from raw uploads but also from online models or outfits.

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Version 3 (V3): Female-Specific Optimization
Link: https://huggingface.co/spaces/ritz26/V-try-on-v3
• Identified a major issue: In V2, female try-ons often misaligned due to hair occlusion on shoulders, causing garments to appear incorrectly positioned on hair.
• Optimized the model by refining segmentation to differentiate between hair and garment/body regions.
• Result: More accurate and realistic outputs for female users, making the solution more inclusive and practical for broader adoption.
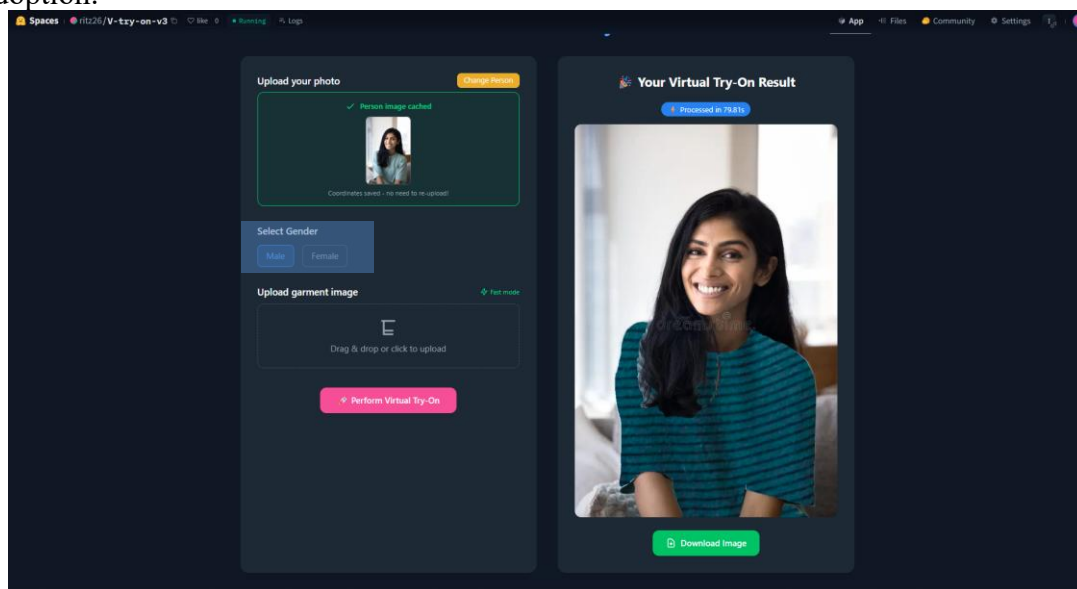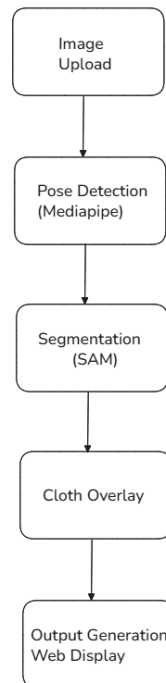

Implementation:

➢ Flask server handles user input and output rendering.
➢ MediaPipe Pose extracts coordinates (shoulder, chest, waist, hip).
➢ SAM model generates garment masks.
➢ **Gender-specific optimizations:**

  Male → shoulder-to-hip detection.
  Female → chest-to-hip detection (avoids hair misclassification).
➢ **Caching**: models can be cached to reduce loading time, but this requires ~3GB RAM, so disabled in free hosting tiers.
➢ **Non-caching:** without caching, model requires ~1.5GB RAM.

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System Flow Chart:

```
Image
Upload
   │
   ▼
Pose Detection
(Mediapipe)
   │
   ▼
Segmentation
(SAM)
   │
   ▼
Cloth Overlay
   │
   ▼
Output Generation
Web Display
```

Code:

```python
def load_model():
    """Load SAM model (CPU only)."""
    global model, processor, device
    device = "cpu"
    print(f"[INFO] Using device: {device}")
    model = SamModel.from_pretrained(
        "Zigeng/SlimSAM-uniform-50",
        cache_dir="/tmp/.cache",
        torch_dtype=torch.float32,
    )
    processor = SamProcessor.from_pretrained("Zigeng/SlimSAM-uniform-50", cache_dir="/tmp/.cache")
    print("[INFO] Model loaded successfully!")
```

```python
def detect_upper_body_coordinates(person_path, is_female=False):
    mp_pose = mp.solutions.pose
    pose = mp_pose.Pose()
    image = cv2.imread(person_path)
    if image is None:
        raise Exception("No image detected.")
    image_rgb = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
    results = pose.process(image_rgb)
    if not results.pose_landmarks:
```

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```
    raise Exception("No pose detected.")
h, w, _ = image.shape
lm = results.pose_landmarks.landmark

# Get key body landmarks
left_shoulder = (int(lm[11].x * w), int(lm[11].y * h))
right_shoulder = (int(lm[12].x * w), int(lm[12].y * h))
left_hip = (int(lm[23].x * w), int(lm[23].y * h))
right_hip = (int(lm[24].x * w), int(lm[24].y * h))

# Calculate centers
shoulder_center_x = (left_shoulder[0] + right_shoulder[0]) // 2
shoulder_center_y = (left_shoulder[1] + right_shoulder[1]) // 2
hip_center_x = (left_hip[0] + right_hip[0]) // 2
hip_center_y = (left_hip[1] + right_hip[1]) // 2

if is_female:
    # For girls: Focus on chest-to-hip area to avoid hair on shoulders
    # Calculate chest points (below shoulders to avoid hair)
    chest_offset = 80  # pixels below shoulders
    left_chest_x = left_shoulder[0]
    left_chest_y = left_shoulder[1] + chest_offset
    right_chest_x = right_shoulder[0]
    right_chest_y = right_shoulder[1] + chest_offset

    # Chest center point
    chest_center_x = (left_chest_x + right_chest_x) // 2
    chest_center_y = (left_chest_y + right_chest_y) // 2

    # Waist center point (between chest and hips)
    waist_center_x = chest_center_x
    waist_center_y = chest_center_y + (hip_center_y - chest_center_y) // 2

    coords = {
        "left_chest": (left_chest_x, left_chest_y),
        "right_chest": (right_chest_x, right_chest_y),
        "left_hip": left_hip,
        "right_hip": right_hip,
        "chest_center": (chest_center_x, chest_center_y),
        "waist_center": (waist_center_x, waist_center_y),
        "detection_type": "female_chest_to_hip"
    }
else:
    # For boys: Use shoulder-based detection (original approach)
```

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```
chest_center_x = shoulder_center_x
chest_center_y = shoulder_center_y + (hip_center_y - shoulder_center_y) // 3
waist_center_x = shoulder_center_x
waist_center_y = shoulder_center_y + 2 * (hip_center_y - shoulder_center_y) // 3

coords = {
    "left_shoulder": left_shoulder,
    "right_shoulder": right_shoulder,
    "left_hip": left_hip,
    "right_hip": right_hip,
    "chest_center": (chest_center_x, chest_center_y),
    "waist_center": (waist_center_x, waist_center_y),
    "shoulder_center": (shoulder_center_x, shoulder_center_y),
    "detection_type": "male_shoulder_based"
}

return coords
```

How to perform try on :-
https://drive.google.com/file/d/10D4rrTTrg1_uJLHHhbSbRw6BPVQZf7WS/view?usp=sharing