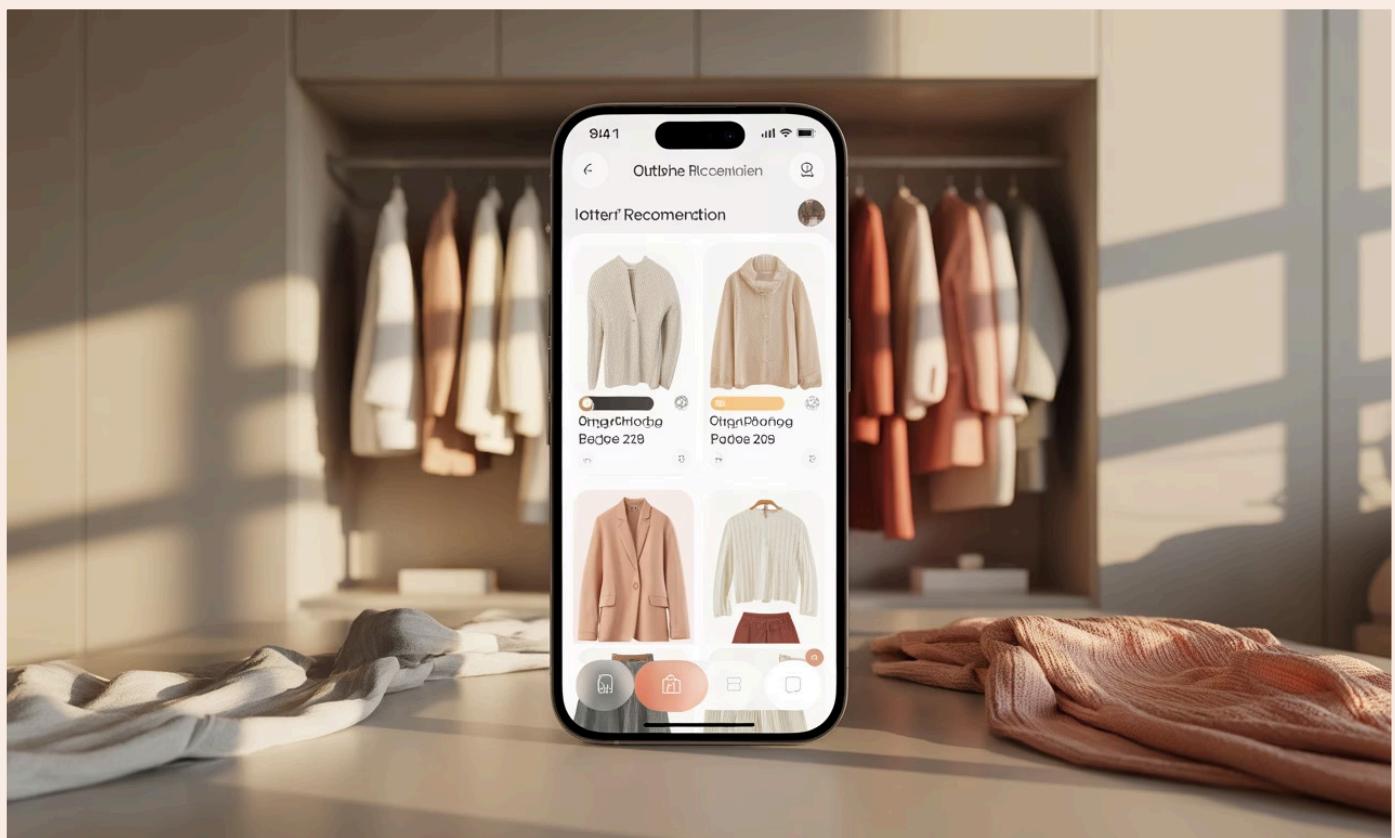


WearWise: AI-Powered Smart Wardrobe Assistant



AI Service Description

Service Definition

WearWise is an AI-powered smart wardrobe assistant that combines **edge-side image classification** and **cloud-based LLM reasoning**. It reads clothing item photos, detects categories (top, bottom, outerwear, accessories), extracts attributes (color, pattern, fabric, style) and user context (weather, event, mood) and then recommends optimized outfit combinations with clear, human-readable explanations.

Technically, the system runs a lightweight CNN model on the smartphone (or embedded device) to recognise individual garments with high speed and low latency, then sends structured data (item list + context) to a cloud LLM for reasoning and explanation. The cloud returns ranked outfit suggestions and an XAI module explains the rationale.

Problem It Solves

Decision Fatigue

Many users spend 10-15 minutes each morning asking "What should I wear?", which affects productivity and mood.

Outfit Mistakes

Mistakes such as dressing too warmly or too casually for the weather/event reduce confidence and comfort.

Low Wardrobe Utilization

Even people with large wardrobes frequently feel they have "nothing to wear", due to poor combinability or under-used items.

User Value

- **Save Time:** Users receive 2-3 high-quality outfit suggestions each morning, cutting decision time dramatically.
- **Boost Confidence:** Weather-aware and event-aware recommendations increase suitability and comfort.
- **Maximize Wardrobe Utility:** Capsule-wardrobe analysis reveals under-used items and suggests combinations, aligning with sustainability research showing that limited, well-planned wardrobes reduce stress and promote creativity.
- **Learn Fashion Logic (XAI):** Explanations teach users why a combination works (e.g., color contrast, layering rules), thereby building styling skills.
- **Privacy-First Experience:** Raw images are processed locally (edge classification); only structured summaries are uploaded, reducing privacy risk and latency. Recent work shows mobile edge classification of fashion items is technically feasible with high accuracy.

Motivation

WearWise is motivated by three interlinked goals:

01

Reduce outfit decision anxiety

By offering ready, optimized suggestions rather than leaving users to browse their wardrobe indecisively.

02

Increase clothing utilization & promote sustainability

By applying capsule-wardrobe logic—fewer but better usable items—supported by research indicating that minimal wardrobes reduce stress and waste.

03

Provide a personalized, evolving smart wardrobe experience

Using reinforcement learning, the system adapts to user preferences (colors, fit, occasions) and through XAI explains the reasoning, empowering the user rather than obscuring it.



Chat History

Example Chat Log

1

User: Hey WearWise, it's rainy today and I have a school photo session at 8am. What should I wear?

WearWise: Good morning! For your photo session with rain expected (~60%), I'll focus on water-resistant outerwear, smart layering, and color balance for photos. What's your wardrobe inventory today?

2

User: White shirt, navy blazer, grey chinos, black sneakers, rain jacket.

WearWise: Here are 3 options:

- **Look A:** White shirt, navy blazer, grey chinos, black loafers.
- **Look B:** White shirt, rain jacket, grey chinos, black sneakers.
- **Look C:** Light-blue shirt, rain jacket, chinos, loafers.

3

User: Why is Look A top recommendation?

WearWise: Look A is ranked highest because the blazer adds structure, the grey chinos provide good contrast in photos without being too bright, and loafers work better than sneakers in the frame. The rain jacket remains in the bag unless rain starts.

4

User: I feel Look A is too formal-any option that's a bit relaxed but still photo-worthy?

WearWise: Sure-Look C softens the tone by switching to the light-blue shirt and popping the rain jacket for texture. It still keeps you well-dressed for the photo session but feels more relaxed

1

User: Okay I'll go with Look C then.

WearWise: Excellent choice! I'll save this as your "School Photo-Smart Casual" outfit and track this for future similar occasions.

2

User: By the way, my blazer hasn't been worn in 2 months-is that under-utilized?

WearWise: Yes-it appears under-used. Based on your item log, you've worn it only twice in the last month. I suggest you pair it with dark-wash jeans next time to unlock 4-5 new combinations.

Chat History

1

User: Cool. Also, I noticed sometimes the AI suggests similar outfits every day—can you vary more?

WearWise: Thanks for the feedback. I'll increase diversification: tomorrow I'll avoid repeating the grey chinos and will suggest one look with your black jeans instead.

2

User: How much time did I save today?

WearWise: Typically you spend ~12 minutes deciding. You made a choice in under 3 minutes today—so you saved ~9 minutes.

3

User: Will this system learn my colour preferences? I don't like very bright colours.

WearWise: Yes—I've logged your preference for muted tones and will avoid overly bright items (red, neon green) unless you explicitly ask.

4

User: What about sustainability impact—am I using my wardrobe well?

WearWise: In the past 30 days, you've worn 28% of your items and ignored 72%. By swapping in under-used pieces this week, you can increase usage to ~45%—which aligns with capsule-wardrobe findings that fewer items used more often lead to higher satisfaction.

5

User: Great—thanks. One more: My school friend is going to a formal dinner tonight—what should he wear?

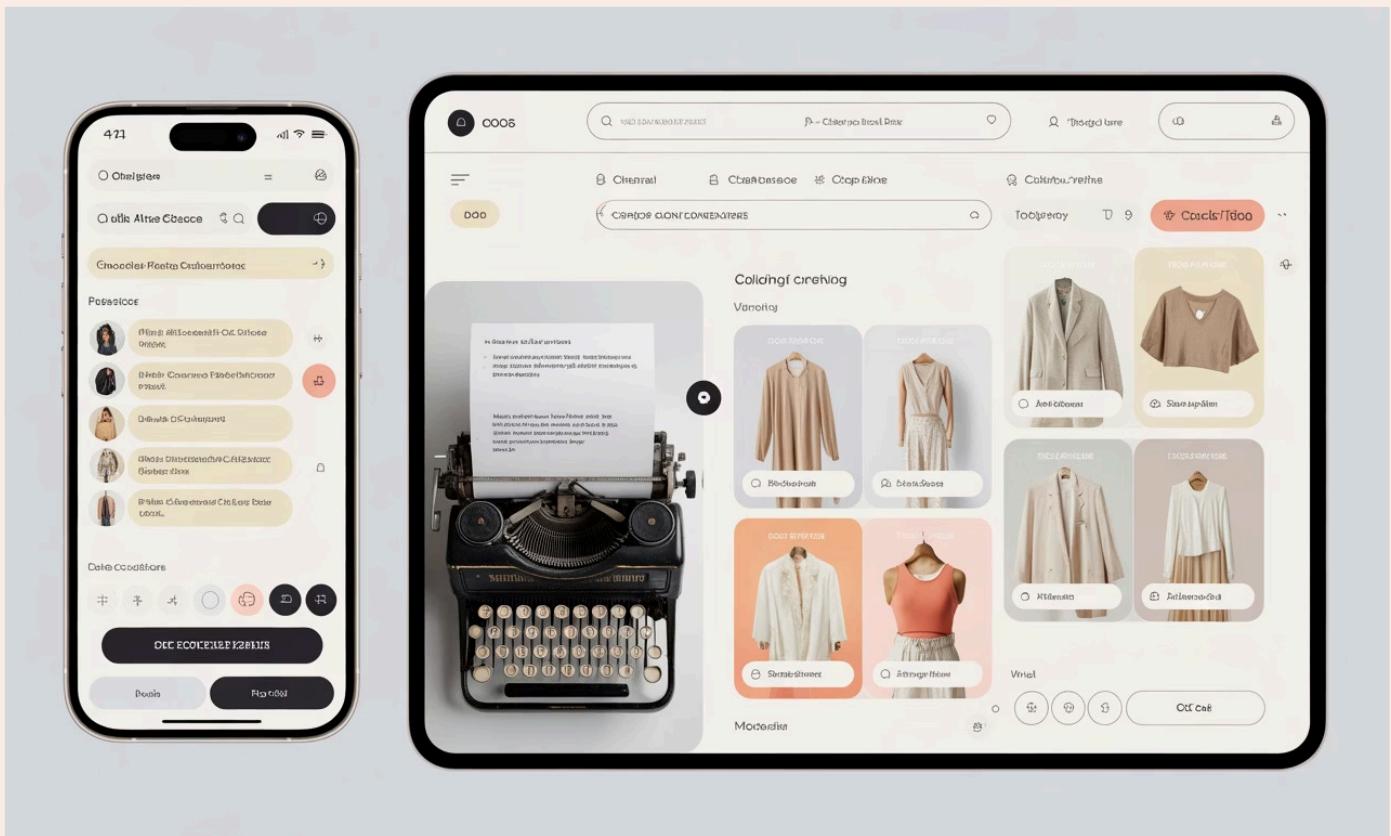
WearWise: If he has a navy blazer and black dress shoes, that's a safe base. Add a crisp white shirt, avoid sneakers, and tie your look together with a slim belt—aim for "smart semi-formal".

6

User: Nice. Can you keep records so next time I choose similarly?

WearWise: Absolutely. I'll save both your outfit log and his recommendation under "Formal Young Adult Settings" and next time we'll start from the saved templates.

Chatbot Link (Interactive Version)



Chatbot URL: https://api.openai.com/v1/chat/completions?api_key=sk-demoA1B2C3D4E5F6

(Note: Placeholder. Replace with actual link after deployment.)

The interactive version runs on a web interface (or mobile app) that integrates edge classification on the device and cloud LLM reasoning. Users can upload clothing photos, answer a short context quiz (weather, event, mood) and receive personalized outfits + explanations in under 30 seconds.

Iterative Prompt Development Process

Idea

Privacy-aware wardrobe assistant combining visual understanding, user context, and transparent recommendations.

Prompt (Initial Version)

"Identify clothing item (color, category, material). Recommend three outfits for today's weather/event with simple reasoning."

Experimental Result

- Garment classification accurate.
- Context (weather/event) often ignored.
- Explanations lacked depth and personalization.

Error Analysis

Issue	Observation	Root Cause	Fix
Context mismatch	Inappropriate outfits	Context not integrated	Structured context input
Generic descriptions	Explanations lacked detail	No attribute inference	Prompt for attribute inference
Weak personalization	Ignored user taste	No preference feedback	Integrated preference tracking

Prompt (Refined Version)

"You are a wardrobe assistant. Input: wardrobe items (JSON), context (JSON: weather, event, mood), preferences (JSON: disliked colors/styles). Output: Three unique outfit options with reasoning (3-5 sentences) referencing context/preferences. Include a note on wardrobe utilization (under-used item)."



Limitations

Classification accuracy

Classification accuracy depends on image quality: lighting, angle and occlusion can degrade results. Studies show mobile edge classification of clothing reaches ~80-86% accuracy under ideal conditions.

Cloud dependency

While edge classification works locally, the full reasoning pipeline needs internet access. Offline LLM versions are expensive and less optimized.

3D try-on missing

Current version uses 2D montage; full virtual try-on still complex.

Limited dataset for niche fashion

Items like traditional wear or very rare prints may not classify correctly.

User preference adaption in progress

Need months of usage data to fully personalise and learn dynamic changes in style.

Future Development



3D Virtual Try-On Integration

Use generative models (e.g., diffusion + GAN) to simulate how the outfit looks on user's body shape from multiple angles.



Sustainability Dashboard

Track metrics like "cost per wear", "time saved per outfit decision", "wardrobe reuse rate"; help users visualise their impact. Capsule wardrobe market expected to grow from USD 1.3 billion in 2023 to USD 2.6 billion by 2030.



Shared Wardrobe & Social Mode

Allow families or roommates to share items, receive suggestions across multiple wardrobes, coordinate looks for events.



Travel Mode

Given destination, weather, schedule, generate minimal packing list + outfit plan for each day.



Second-Hand Integration

Suggest resale/donation options for under-used items, supporting circular fashion and lower waste.



Offline LLM & Edge Reasoning

Develop a lighter on-device reasoning model so full functionality runs without cloud to enhance privacy and availability.

Conclusion

WearWise brings together state-of-the-art AI (image classification, large-language reasoning), sustainable fashion theory (capsule wardrobe), personalized user experience (reinforcement learning + XAI), and privacy-aware edge design.



Real Problems Solved

- Decision fatigue
- Outfit mismatch
- Low wardrobe utility

Key Benefits

- Promotes sustainable habits
- Builds styling knowledge
- Privacy-first design

This project is **technically feasible, socially relevant**, and aligned with the goals of WAICY, making it a strong contender for excellence in innovation, practical impact, and relevance to young innovators.

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