# Ayna: a Novel LLM-Based Job Recruitment Plug-in

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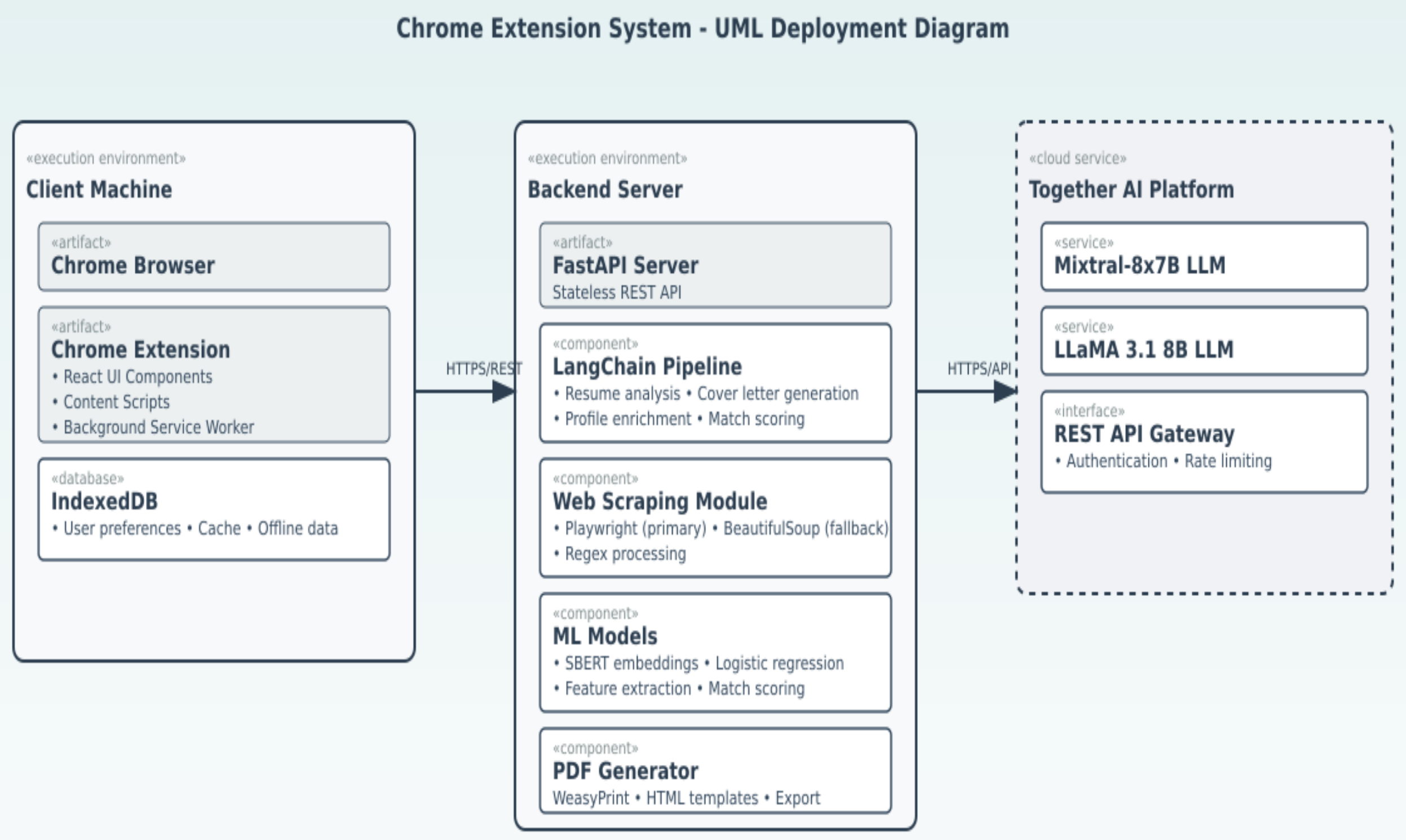
## Background

- Job seekers often have to manually tailor resumes, draft customized letters and perform repetitive tasks for their application
- Existing recruitment tools like ChatGPT Job Assist or LazyApply help automate part of the process but they often lack personalization, transparency, and user control.
- No current system integrates the different application stages into one unified solution.
- **LLMs** provide new opportunities to deliver intelligent, personalized support through this process.

## System Overview



Chrome Extension System - UML Deployment Diagram

«execution environment» Client Machine
- «artifact» Chrome Browser
- «artifact» Chrome Extension • React UI Components • Content Scripts • Background Service Worker
- «database» IndexedDB • User preferences • Cache • Offline data

HTTPS/REST

«execution environment» Backend Server
- «artifact» FastAPI Server Stateless REST API
- «component» LangChain Pipeline • Resume analysis • Cover letter generation • Profile enrichment • Match scoring
- «component» Web Scraping Module • Playwright (primary) • BeautifulSoup (fallback) • Regex processing
- «component» ML Models • SBERT embeddings • Logistic regression • Feature extraction • Match scoring
- «component» PDF Generator WeasyPrint • HTML templates • Export

HTTPS/API

«cloud service» Together AI Platform
- «service» Mixtral-8x7B LLM
- «service» LLaMA 3.1 8B LLM
- «interface» REST API Gateway • Authentication • Rate limiting

Above, we have Ayna's deployment diagram. The Chrome extension frontend (built with React) connects to a FastAPI backend, which coordinates  LangChain pipelines for enrichment, generation, scoring, and autofill. LLMs are accessed via Together AI APIs. Local storage (IndexedDB) ensures privacy.

## Methodology

We use 5 steps to define Ayna's functionality:

**1.Feature Selection**: Resume/cover letter generation, match scoring, autofill, and profile enrichment.

**2.Multi-Source Input:** Combines input from structured user profiles and uploaded resume

**3.Prompting Strategies:** Uses optimized prompting strategies (e.g., one-shot for generation, structured fallback for autofill with rule and ML based methods)

**4.Modular pipeline Architecture: I**mplemented using LangChain and FastAPI using prompts.  Models (Mistral-7B, LLaMA 3.1 8B) are accessed via Together AI with retry mechanisms

**5.User interface:** Chrome extension UI  enables user interactivity using IndexedDB for local storage and cross-session continuity.

## Evaluation

105 resumes were selected from the diverse *Sneha Anbhawal Resume Dataset* (Kaggle)

**Job Roles Tested**:

*AI Product Manager* -  technical + leadership

*Creative Strategy Lead* - storytelling + design

**Assessment Metrics** (Scored from 1 = Excellent to 5 = Poor):

Resume Quality, Cover Letter Quality, Profile Enrichment, Autofill Accuracy, Match Score Accuracy.

**Models Compared**: Mistral-7B & LLaMA 3.1 8B

## Results

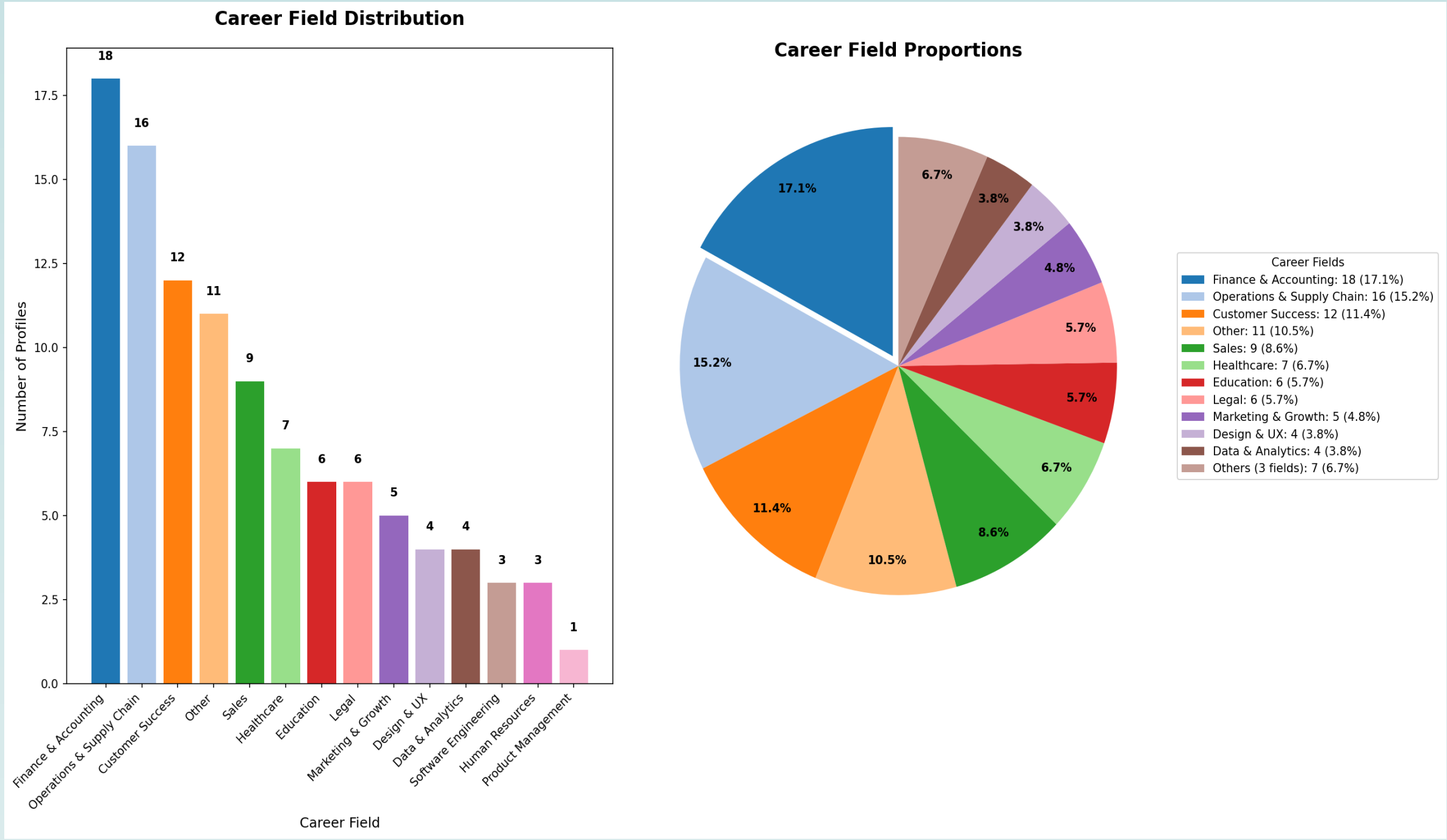


**Figure 1. Job field distribution across resumes**

*Ayna was tested on resumes across multiple domains, including both technical and creative roles.*

TABLE I: Average Evaluation Scores of Mistral and LLaMa

| Model | Resume | Cover Letter | Profile Enrich. | Autofill | Match Score |
|---|---|---|---|---|---|
| LLaMA | 1.01 | 1.0 | 1.08 | 1.08 | 1.0 |
| Mistral | 2.25 | 1.03 | 1.50 | 1.97 | 1.0 |

Both roles showed similar trends, confirming Ayna's potential.

TABLE II: Job-Based Performance Comparison

(a) AI Product Manager Position

| Model | Overall | Resume Gen. | Cover Letter | Autofill | Match Score | Profile Enrich. |
|---|---|---|---|---|---|---|
| Mistral | 1.572 | 2.360 | 1.030 | 1.970 | 1.000 | 1.500 |
| Llama | 1.034 | 1.010 | 1.000 | 1.080 | 1.000 | 1.080 |

(b) Creative Strategy Lead Position

| Model | Overall | Resume Gen. | Cover Letter | Autofill | Match Score | Profile Enrich. |
|---|---|---|---|---|---|---|
| Mistral | 1.526 | 2.140 | 1.020 | 1.970 | 1.000 | 1.500 |
| Llama | 1.032 | 1.000 | 1.000 | 1.080 | 1.000 | 1.080 |

LLaMA consistently outperformed Mistral across all core metrics. Lower scores are better (1 = Excellent, 5 = Poor).

## Conclusion

- Ayna integrates LLMs into a unified, user-friendly Chrome extension for job applications.
- The system streamlines multiple tasks including job matching, profile enrichment, smart autofill, and job tracker.
- Ayna's evaluation demonstrated its flexibility and relevance across job roles
- The modular design allows for scalability, model-agnostic performance, and privacy through local data storage.

### Future Work

- Incorporate real-time user feedback loops to improve enrichment and match scoring.
- Include multilingual support
- Extend the system to support more online platforms.
- Run additional experiments by relying on larger and more diverse datasets

## Acknowledgements

This project was conducted as part of an undergraduate research initiative at York university.
It was supervised by Dr. Alvine Belle.
We used the Sneha Anbhawal Resume Dataset (Kaggle) for the evaluation.
The system utilizes technologies including LangChain, FastAPI, Together AI, scikit-learn, and SentenceTransformers.

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