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LAVAZZA
TORINO, ITALIA, 1895

AI PERSONAS

Enrico Chen - s337750
Van Thanh Nguyen - s336748
Xiaoning Ma - s337332

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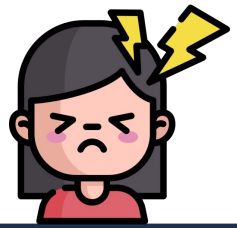
Challenges

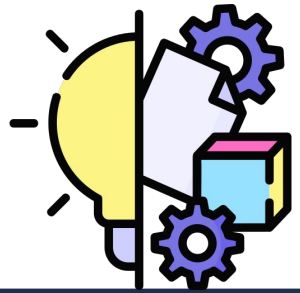
In the context of delivering new products or enhancing existing ones, main pains are:

- **Consumers Insight Department** -> high time demand for data collection and analysis
- **Product Department** -> product development and product testing difficulties
- **Marketing Department** -> high cost and uncertain advertisement campaigns
- **IT Department** -> limited data, model testing



Objective - Project Value Proposition

For **business units** struggling in **evaluating marketing performances, customer understanding, models and ideas testing**, our software allows **interacting with data-driven AI Personas** representing the different **market segments**



Objective - Sustainable Development Goals

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Our project is aligned with the **SDG 9 - Industry, Innovation and Infrastructure.**
By using advanced AI improve company's efficiency and effectiveness.

Objective - Project Goal

The goal is to develop a **software application** where employees can **interact** dynamically with **AI Personas** representing different **market segments** to:

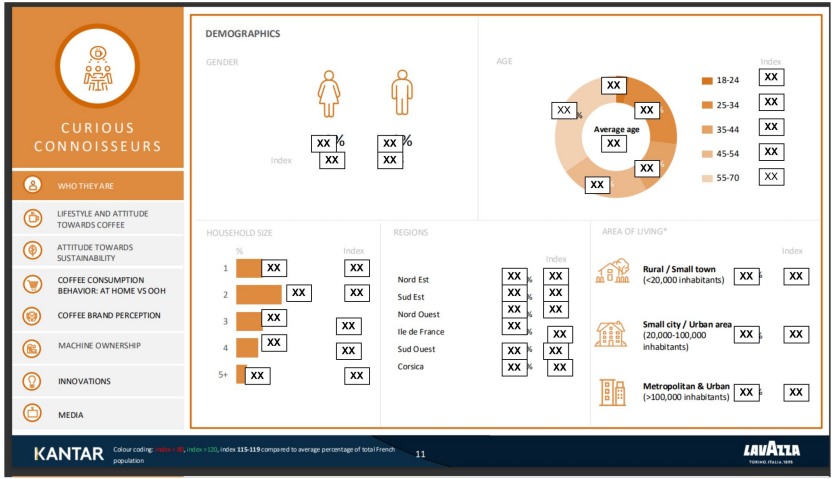
- Identify weak ideas at an earlier phase by saving time and resources
- Enable focused market strategies
- Scale winning concepts efficiently and effectively

Research Questions

Q1 (Extraction): How can we extract structured data from complex, visually rich PDF in an accurate and automated way?

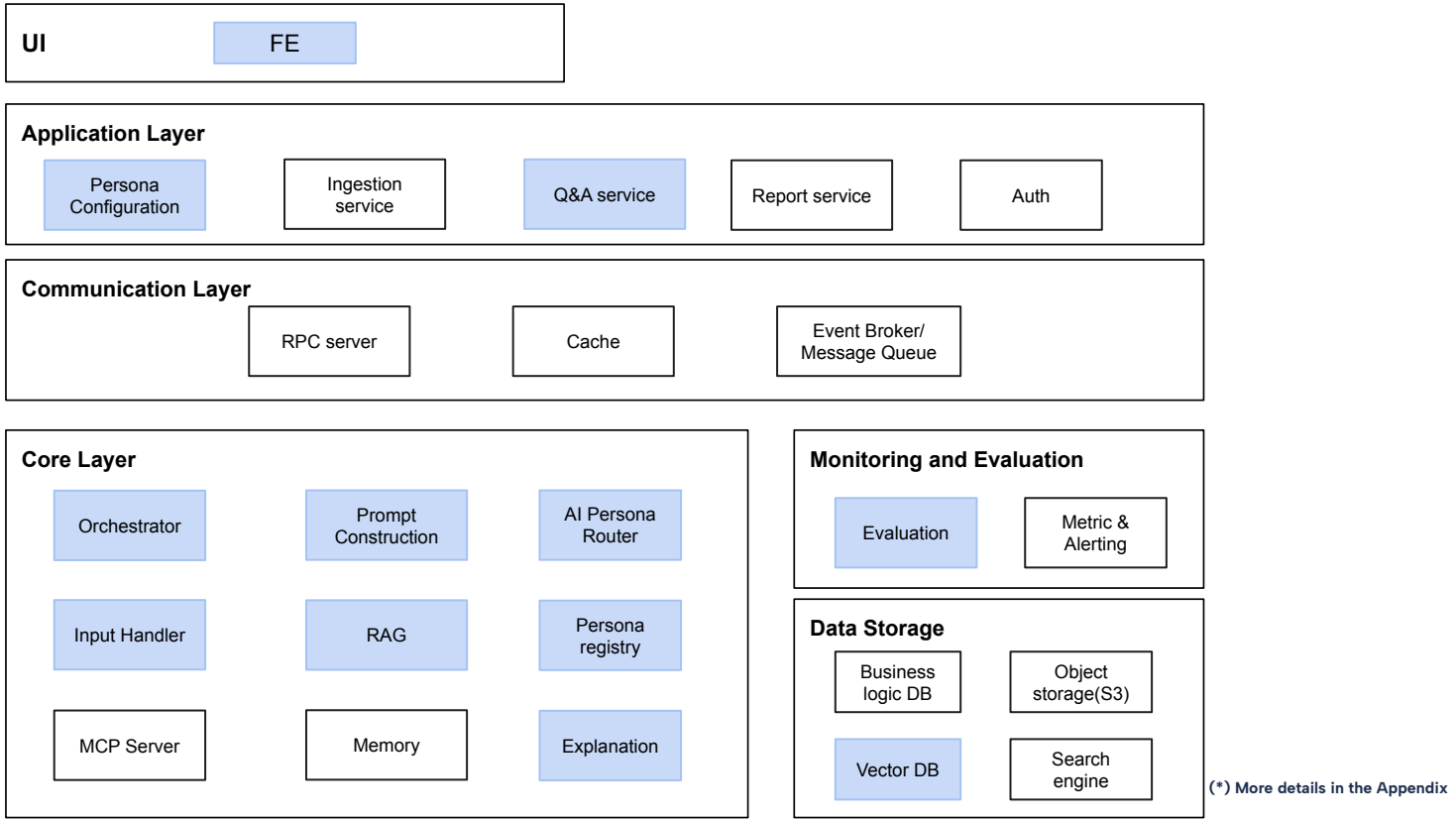
Q2 (Personality): Can "Reasoning Traits" (Style Profile, Value Frame) be derived from the raw data to create AI Personas?

Q3 (Grounding): How to prevent models from hallucinations?



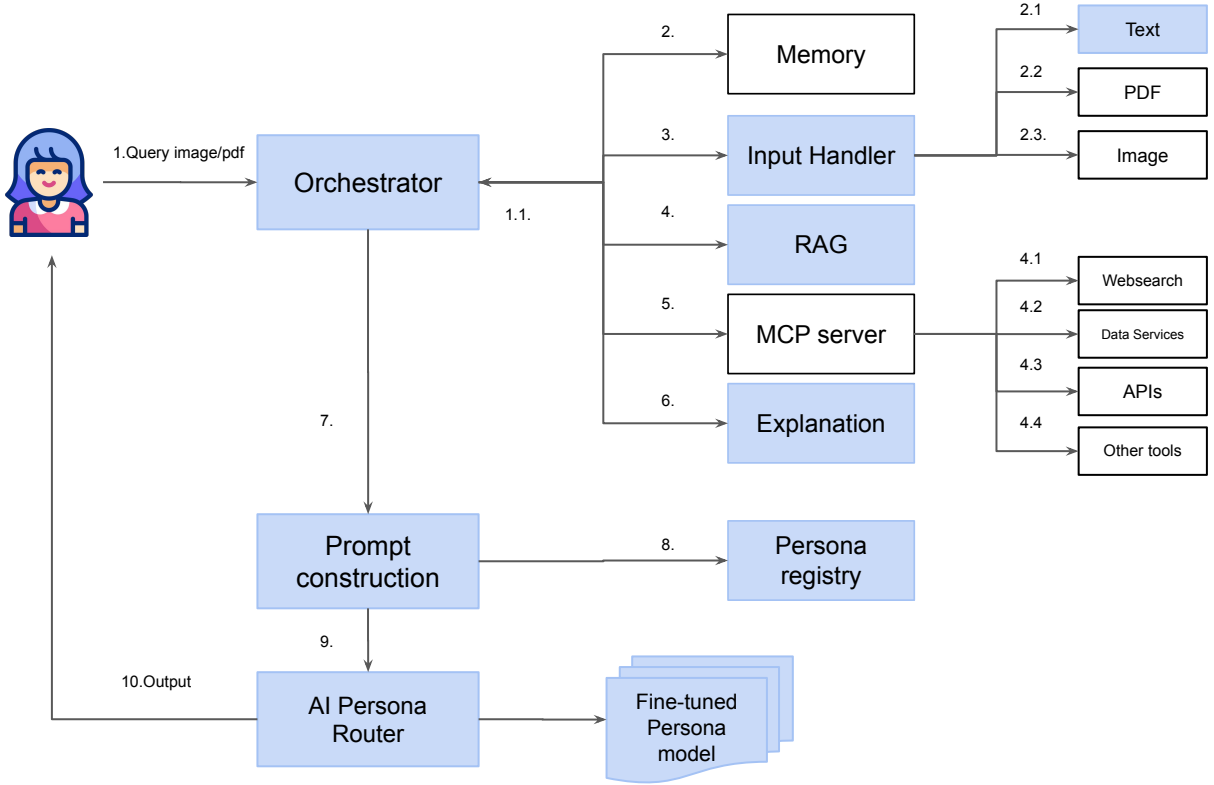
Example data

Method - System Architecture



(*) More details in the Appendix

Method - Functional Diagram



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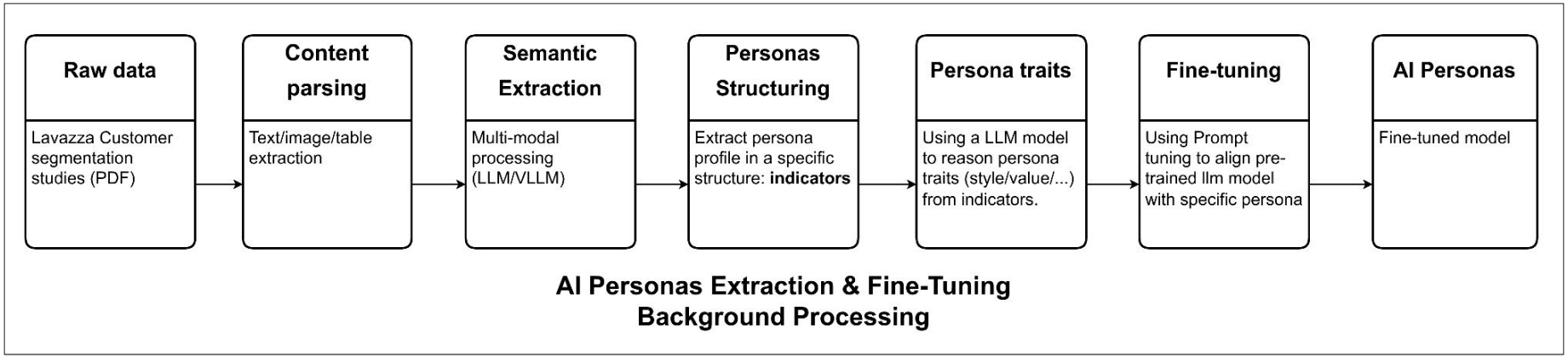
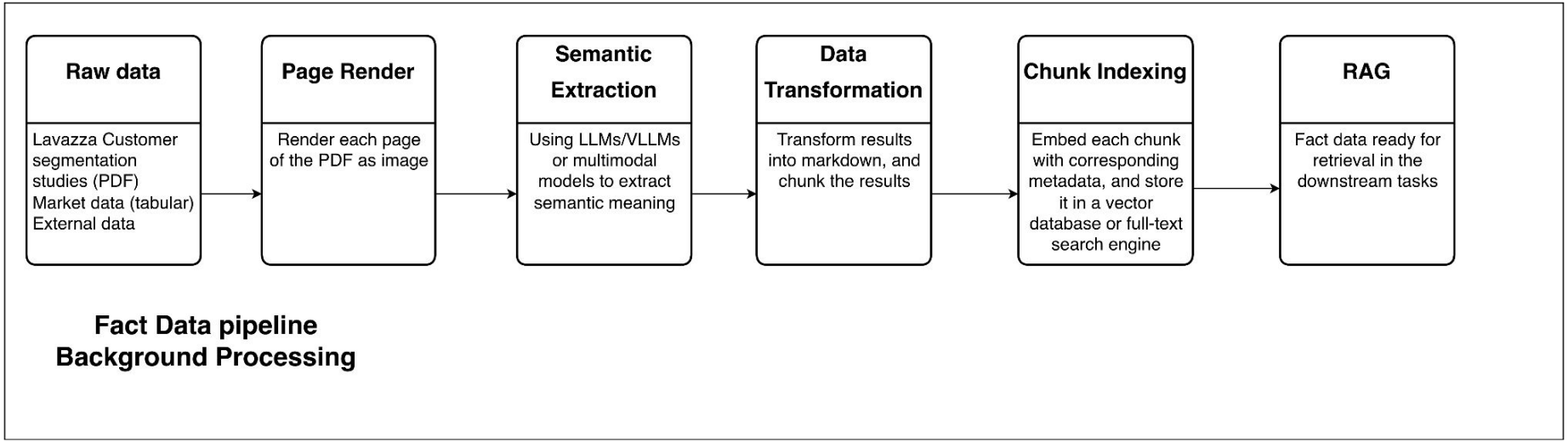
Method - Functional Diagram



Method - Functional Diagram



Method - LLM Generation Demo

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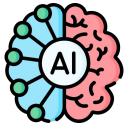
Front End

In general, what is your age?



As Curious Connoisseurs, we tend to skew toward older groups, with a significant portion of our demographic falling between 35 and 70 years old. Specifically, 35% are between 35-44 years, 15% are between 45-54 years, and 24% are between 55-70 years. Our average age is 47 years, reflecting a mature and experienced cohort. This age distribution aligns with our exploratory nature and appreciation for high-quality, innovative products.

Back End

Load Persona JSON

Embed snippets

Index embeddings

Retrieve relevant snippets

Build system prompt

Generate persona-style answer

Experiments - Data Description

Source & Scale

- Kantar France 2023
- 4,001 Respondents
- 9 consumer segments
- Rich qualitative + quantitative data

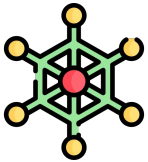
Data Structure

- Multi-modal composition
- Inconsistent layouts across segments
- Mixed granularity
- No unified or machine-readable format

Key Dimensions

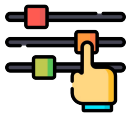
- Demographics
- Psychographics
- Coffee attitudes
- Consumption behaviours
- Brand perception & sustainability attitudes

Experiments - Experiment Configuration



Model

- MPNet: Converts persona indicators into vector embeddings
- Mistral: Produces the final persona-styled answer

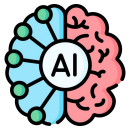


Parameters

- Temperature = 0.5 Balanced creativity and consistency
- Top-p = 0.5 Limits randomness; promotes focused outputs
- Max tokens = 4024 Allows long persona-consistent explanations
- Timeout = 300s Ensures long retrieval/generation runs complete

Experiments - Quality Assessment

In general, what is your age?



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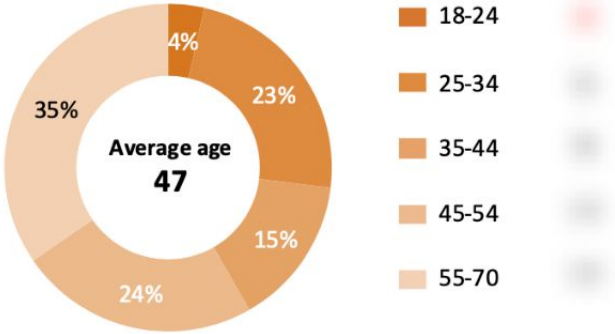


Conclusions

Objective

To create data-driven AI personas that support accurate consumer insight and decision-making.

Method

We combined multi-modal data extraction, persona trait generation, and a RAG-enhanced LLM pipeline within an orchestrated system architecture.

Why Effective

This approach ensures factual grounding, consistent persona behavior, and reliable, insight-aligned responses.

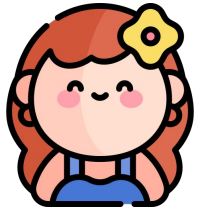
Manage

Enrico

- Semantic extraction of fact data
- Fact data indexing
- Retrieval logic in RAG system
- Corresponding slides

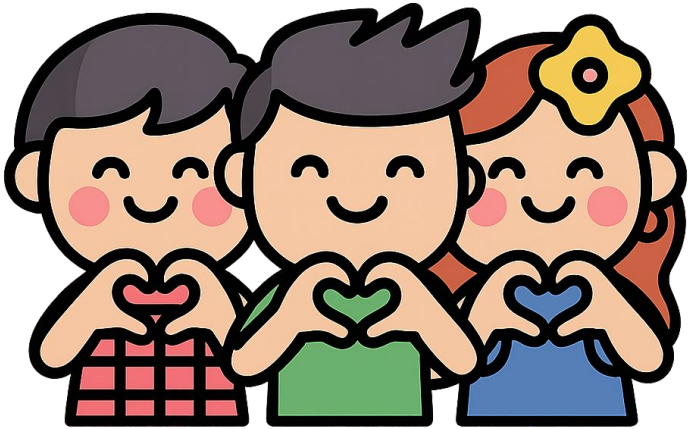
Thanh

- System architecture design
- Persona semantic data extraction
- AI persona prompt tuning
- Corresponding slides



Xiaoning

- AI persona common trait extraction
- AI persona inference and serving
- Quality assessment
- Corresponding slides



THANK YOU

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Appendix

Manage - Gantt

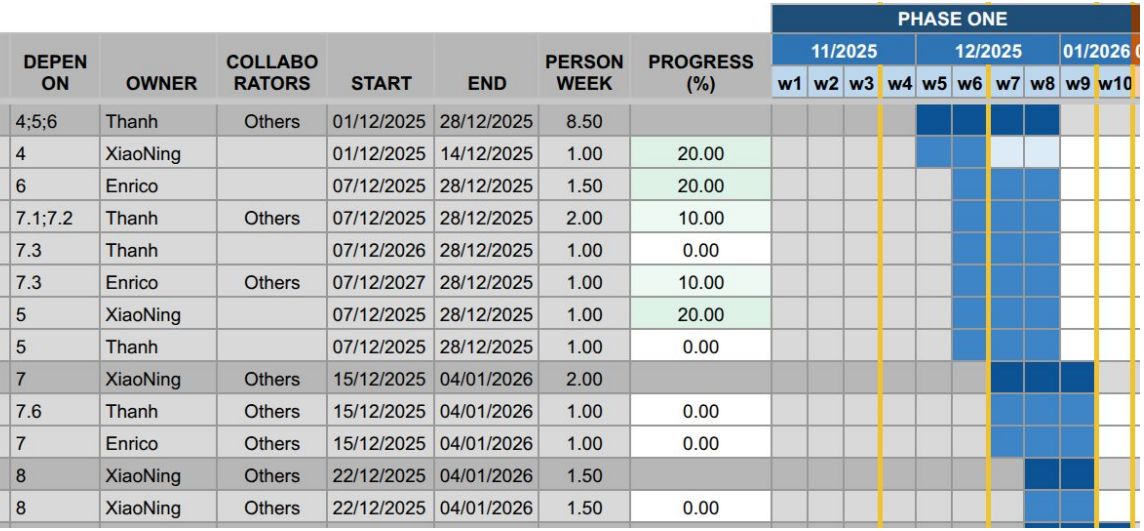
WB No	TASK TITLE	DEPEN ON	OWNER	COLLABO RATORS	START	END	PERSON WEEK	PROGRESS (%)
1	Project Conception and Initiation		Thanh	Others	03/11/2025	14/11/2025	3.00	
1.1	Project structure+ work flow		Thanh	Others	03/11/2025	03/11/2025	0.50	100.00
1.2	Kick off with Lavazza tutor		XiaoNing	Others	03/11/2025	07/11/2025	0.50	100.00
1.3	Research		Enrico	Others	03/11/2025	14/11/2025	2.00	100.00
2	Design	1	Enrico	Others	03/11/2025	16/11/2025	7.50	
2.1	Objective and Goal Definition	1.2	Thanh	Others	03/11/2025	14/11/2025	0.50	100.00
2.2	Stakeholder Map	1.2	Enrico	Others	03/11/2025	14/11/2025	1.00	100.00
2.3	User Personas Definition	1.2	Enrico	Others	03/11/2025	14/11/2025	0.50	100.00
2.4	User Journey Definition	1.2	XiaoNing	Others	03/11/2025	14/11/2025	1.00	100.00
2.5	User Requirements Definition	1.2	XiaoNing	Others	03/11/2025	14/11/2025	0.50	100.00
2.6	Usecase diagram	1.2;1.3	XiaoNing	Others	03/11/2025	16/11/2025	1.00	100.00
2.7	Func and Non-Func Requirements Definition	1.2;1.3	Enrico	Others	03/11/2025	16/11/2025	1.00	100.00
2.8	System Architecture and Func Diagram	1.2;1.3	Thanh	Others	03/11/2025	16/11/2025	1.00	100.00
2.9	Risk Analysis	1.2;1.3	Thanh	Others	08/11/2025	16/11/2025	1.00	100.00
3	Management	2	XiaoNing	Others	08/11/2025	16/11/2025	1.00	
3.1	Tasks Breakdown and Gantt Diagram	2	XiaoNing	Others	08/11/2025	16/11/2025	1.00	100.00

Manage - Gantt

WB No	TASK TITLE	DEPENDON	OWNER	COLLABORATORS	START	END	PERSON WEEK	PROGRESS (%)
4	Data Foundation	1.2	Thanh	Others	17/11/2025	23/11/2025	6.00	
4.1	Data acquisition & ingest	1.2	Thanh	Others	17/11/2025	23/11/2025	3.00	90.00
4.1.1	Collect data from Lavazza	1.2	Enrico	Others	17/11/2025	21/11/2025	1.00	100.00
4.1.2	Collect data from external source		Thanh	Others	17/11/2025	21/11/2025	1.00	100.00
4.1.3	Understand dataset	4.1.1;4.1.2	XiaoNing	Others	21/11/2025	23/11/2025	1.00	100.00
4.2	Finalize PersonaProfile schema	4.1	XiaoNing	Others	20/11/2025	28/11/2025	1.00	100.00
4.3	Data processing pipelines	4.2	Thanh	Others	20/11/2025	30/11/2026	2.00	100.00
4.3.1	Handle fact data pipeline	4.2	Enrico	Thanh	20/11/2025	30/11/2025	1.00	100.00
4.3.2	Handle persona data pipeline	4.2	XiaoNing	Thanh	20/11/2025	30/11/2025	1.00	100.00
5	Prompt Tuning AI Persona	4.3.2	XiaoNing	Thanh	24/11/2025	27/12/2025	4.00	
5.1	Semanctic Extraction/Personas Structuring from Customer Segmentation Data	4.3.2	XiaoNing	Thanh	24/11/2025	12/12/2025	2.00	100.00
5.1.1	Extract common traits/rules for each personas	4.3.2	XiaoNing	Thanh	24/11/2025	12/12/2025	1.00	100.00
5.1.2	Create personas fine-tuning dataset	4.3.2	XiaoNing	Thanh	30/11/2025	12/12/2025	1.00	100.00
5.2	Implement Training pipeline	5.1	Thanh	XiaoNing	01/12/2025	28/12/2025	1.50	30.00
5.3	Implement Inference & serving	5.2	Thanh	XiaoNing	13/12/2025	28/12/2025	0.50	0.00
6	Fact Data Ingestion	4.3.1	Enrico	Others	24/11/2025	21/12/2025	2.50	
6.1	Semanctic Extraction from Fact Data	4.3.1	Enrico	Thanh	24/11/2025	21/12/2025	1.00	50.00
6.2	Indexing fact data	6.1	Enrico	Thanh	24/11/2025	21/12/2025	0.50	30.00
6.3	Implement retrieval logic with RAG	6.2	Enrico	Thanh	01/12/2025	21/12/2025	1.00	30.00

Manage - Gantt

WB No	TASK TITLE	DEPEN ON	OWNER	COLLABO RATORS	START	END	PERSON WEEK	PROGRESS (%)
7	Core Layer	4;5;6	Thanh	Others	01/12/2025	28/12/2025	8.50	
7.1	Input handling	4	XiaoNing		01/12/2025	14/12/2025	1.00	20.00
7.2	Retrieval-Augmented Generation	6	Enrico		07/12/2025	28/12/2025	1.50	20.00
7.3	Implement Orchestrator logic	7.1;7.2	Thanh	Others	07/12/2025	28/12/2025	2.00	10.00
7.4	Implement Explaination module	7.3	Thanh		07/12/2026	28/12/2025	1.00	0.00
7.5	Prompt construction	7.3	Enrico	Others	07/12/2027	28/12/2025	1.00	10.00
7.6	Persona registry	5	XiaoNing		07/12/2025	28/12/2025	1.00	20.00
7.7	AI Persona Router	5	Thanh		07/12/2025	28/12/2025	1.00	0.00
8	Application Layer	7	XiaoNing	Others	15/12/2025	04/01/2026	2.00	
8.1	Persona configuration	7.6	Thanh	Others	15/12/2025	04/01/2026	1.00	0.00
8.2	Q&A service	7	Enrico	Others	15/12/2025	04/01/2026	1.00	0.00
9	UI	8	XiaoNing	Others	22/12/2025	04/01/2026	1.50	
9.1	FE	8	XiaoNing	Others	22/12/2025	04/01/2026	1.50	0.00

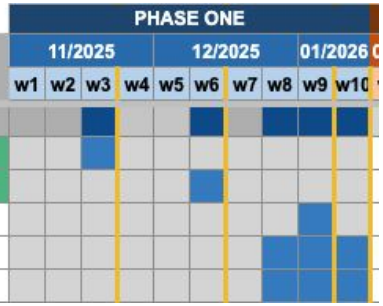


Manage - Gantt

WB No	TASK TITLE	DEPEN ON	OWNER	COLLABO RATORS	START	END	PERSON WEEK	PROGRESS (%)	PHASE ONE									
									11/2025				12/2025				01/2026	
									w1	w2	w3	w4	w5	w6	w7	w8	w9	w10
10	Monitoring and Evaluation	7	Enrico	Others	22/12/2025	11/01/2026	2.00											
10.1	Evaluation	7	Enrico	Others	22/12/2025	11/01/2026	2.00	0.00										
11	Deployment	7;8;9	Thanh	Others	22/12/2025	11/01/2026	2.00											
11.1	Packaging	7;8;9	Thanh	Others	22/12/2025	11/01/2026	1.00	0.00										
11.2	Deploy entire system	11.1	Thanh	Others	22/12/2025	11/01/2026	1.00	0.00										
12	Testing	7;8;9	XiaoNing	Others	22/12/2025	11/01/2026	2.00											
12.1	Test	7;8;9	XiaoNing	Others	22/12/2025	11/01/2026	1.00	0.00										
12.2	Fix Bug	12.2	Thanh	Others	22/12/2025	11/01/2026	1.00	0.00										
13	Demo	12	Enrico	Others	29/12/2025	11/01/2026	1.00											
13.1	Run full flow & get feedback	12	Enrico	Others	22/12/2025	11/01/2026	1.00	0.00										

Manage - Gantt

WB No	TASK TITLE	DEPEN ON	OWNER	COLLABO RATORS	START	END	PERSON WEEK	PROGRESS (%)
14	Communication		Enrico	Others	14/11/2025	19/11/2025	5.00	
14.1	First Checkpoint Presentation		Enrico	Others	14/11/2025	19/11/2025	1.00	100.00
14.2	Second Checkpoint Presentation		XiaoNing	Others	02/12/2025	09/12/2025	1.00	100.00
14.3	Third Checkpoint Presentation		Thanh	Others	30/12/2025	06/01/2026	1.00	0.00
14.4	Final Presentation		Enrico	Others	23/12/2025	12/01/2026	1.00	0.00
14.5	Final Report		XiaoNing	Others	23/12/2025	13/01/2026	1.00	0.00



Design

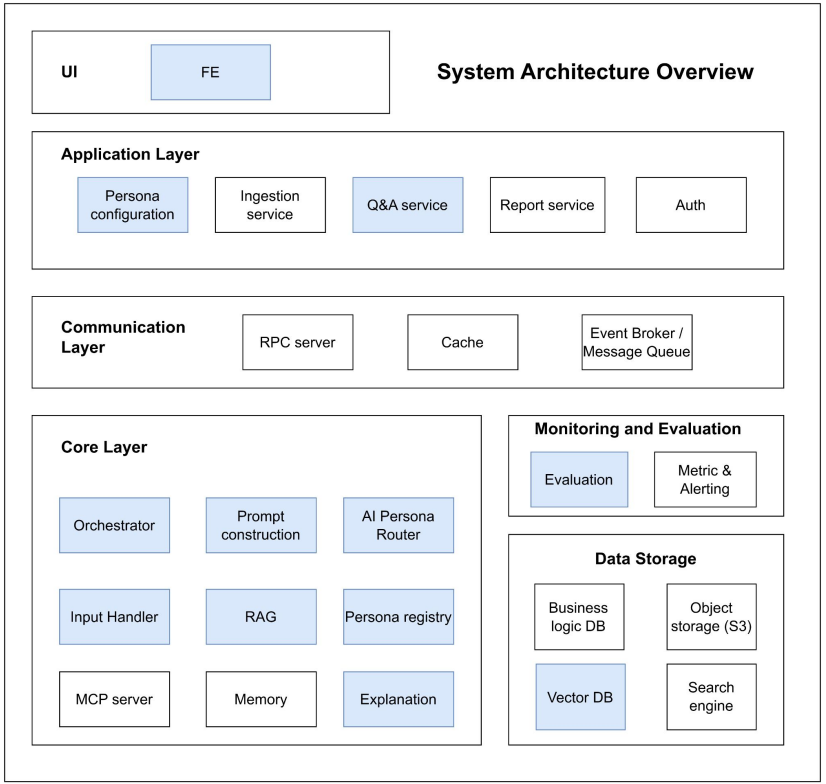
1. User Interface (UI)
The user interface serves as the system's entry point, built as a **Frontend (FE)** application. It enables users to interact seamlessly with the platform, submit queries, upload data, and view results or reports.

2. Application Layer
This layer contains the core application logic and manages all user-driven workflows.
Key components include:

- **Persona Configuration**: Enables users to select or customize AI personas dynamically.
- **Ingestion Service**: Handles ingestion of raw data such as PDFs or images and stores them in S3.
- **Report Service**: Generates structured, formatted reports from processed and analyzed data.
- **Q&A Service**: Manages interactive question-and-answer exchanges with the AI.
- **Auth Service**: Provides authentication and authorization for users, ensuring secure access and operations.

3. Communication Layer
This layer facilitates efficient communication and coordination among microservices.

- **RPC Server**: Enables direct service-to-service communication via Remote Procedure Calls.
- **Cache**: A high-speed memory layer that stores frequently accessed data to optimize performance.
- **Event Broker / Message Queue** (RabbitMQ or Kafka): Handles asynchronous communication and event-driven processing across services, ensuring reliability, scalability, and robust monitoring.

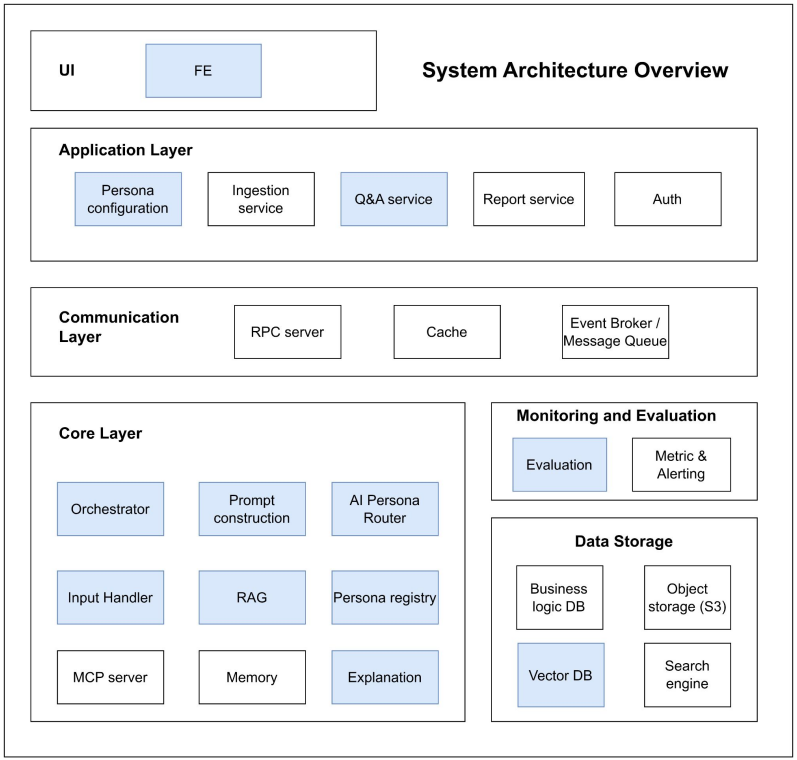


Design

4. Core Layer

The intelligence engine of the system—handles AI persona logic, LLM orchestration, and data-driven grounding.

- **Orchestrator**: The central coordinator of the Core Layer. When a request arrives, the Orchestrator manages the entire generation process, directing which services to call.
- **Input Handler**: Preprocesses and normalizes user inputs, including text extraction from PDFs and preparation of image data for AI analysis.
- **Prompt Construction**: Dynamically builds structured prompts by combining user input, persona rules, and retrieved data.
- **AI Personas**: Represents the fine-tuned Large Language Models (LLMs) tailored to embody distinct customer segment personalities.
- **RAG (Retrieval-Augmented Generation):** Provides factual grounding by retrieving relevant information from the Vector DB, ensuring responses remain accurate.
- **Persona Registry:** Stores the static attributes and behavioral definitions of each persona, guiding prompt construction and response tone.
- **Explanation:** This module allows for an in-depth explanation of the thought process behind the reasoning model and the data used in the thinking process.
- **MCP Server (Model Context Protocol Server)**: Enriches LLM interactions with real-time contextual or external domain data.
- **Memory**: It stores the recent history of the user's chat, allowing the persona to remember what was said earlier in the conversation and provide context-aware answers.



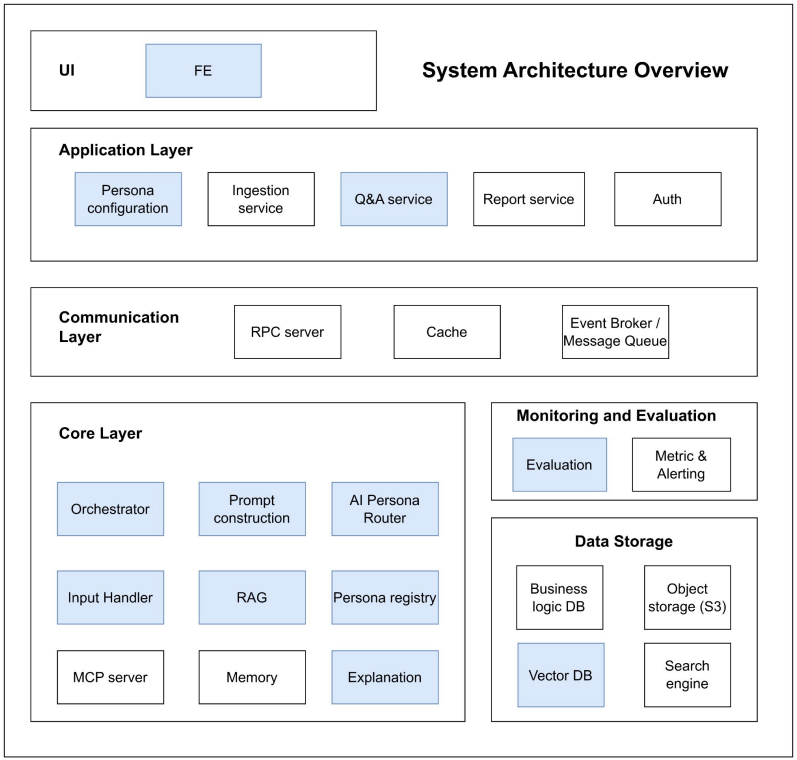
Design

5. Monitoring and Evaluation
A centralized observability layer that tracks performance, quality, and reliability across all services.

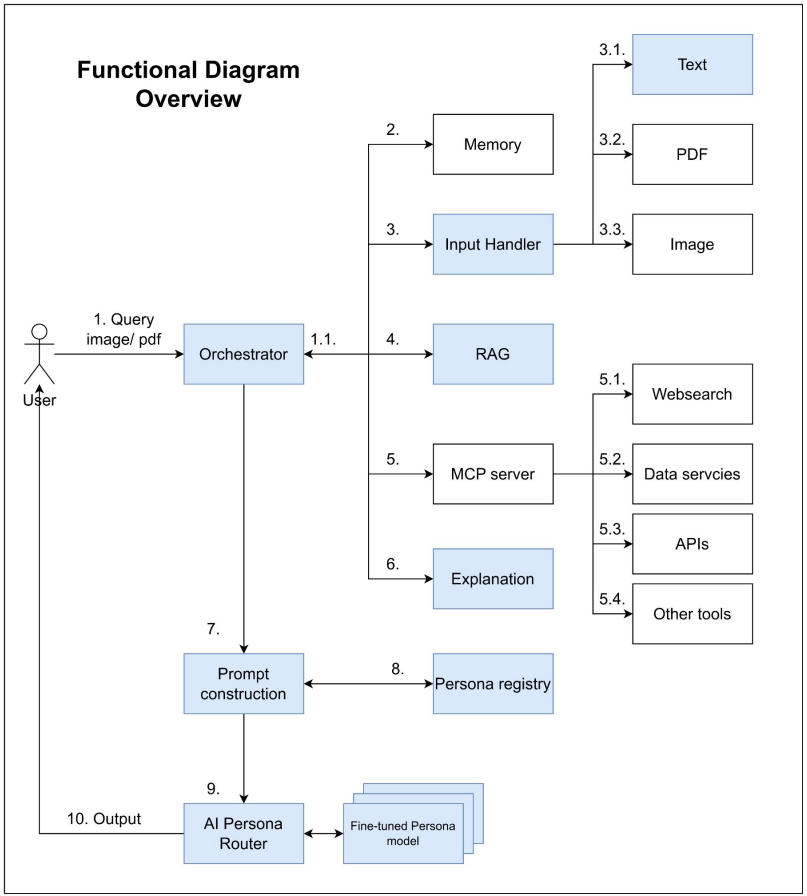
- **Evaluation Tools**: Measure the accuracy and quality of AI responses and data processing outcomes.
- **Metrics & Alerting**: Monitor key indicators such as latency, error rates, resource utilization, and token usage, triggering alerts for anomalies or system degradation.

6. Data Storage Layer
The persistence foundation of the system, designed for scalability, durability, and speed.

- **Business Logic Database**: Stores structured data such as user profiles, authentication records, saved reports, and persona definitions.
- **Object Storage (S3)**: Manages large, unstructured data files (e.g., raw PDFs, images, and uploaded datasets).
- **Vector Database**: Stores embeddings for persona-related documents, historical interactions, and reference materials — powering RAG retrieval and factual grounding.



Design



1. User Query Submission: User sends a query with optional attached files (image, PDF, etc.) to the Orchestrator.
1.1 Orchestrator Analysis: The Orchestrator analyzes the query and attachments to decide which services should be used.
2. Memory Integration : Extract useful information from chat history.
3. Input Preprocessing: Inputs are preprocessed before passing to the model.
3.1 Text Input: Normalize text to make it easier to handle in later steps.
3.2 PDF Input: Parse, process, and extract meaningful information from PDF files.
3.3 Image Input: Process images and extract valuable information.
4. Context Retrieval (RAG System): Use the query and relevant input information to retrieve context (e.g., market data) via a RAG system.
5. Tool Selection & MCP Server Requests

- Decide which tools should be used to enrich the context.
- Send requests to the MCP server to gather corresponding context.

5.1 Web Search: Extract updated information from the internet (trends, real-time data, missing internal data, etc.).
5.2 Database Query: Retrieve useful data from internal or external databases.
5.3 External APIs: Call APIs to obtain additional information.
5.4 Other Tools: Use calculators, simulators, weather data extractors, or other utilities to enrich context.
6. Explanation: The explanation module will explain in detail the thought process of the reasoning model and the data used for the thinking process.
7. Prompt Construction: The Orchestrator aggregates useful context and passes it to Prompt Construction.
8. Persona Selection : Apply the selected Persona profile, including: Demographics, Behavior Data, Transactional Data, …
9. Persona Model Routing

- Route to a fine-tuned Persona model.
- Pass the enriched prompt and context.

10. Model Response: Generate a response with: Specific personality,Tone, Linguistic style of the Persona

AI Personas Extraction & Fine-Tuning

Indicators (VLLM extraction output)

Example indicator shape (JSON):

```
{
  Indicator: {
    sources: {
      "url: {"https://www.pclavazza.com/nead/20/Indicator"
    },

    statements: {
      'statement: individual insights within an indicator, sostons and influences'},
      'metrics' {'marks whethr a svisually emphasiz: 'index', '%', 'count', 'rank'},
      'influene': flags whether a statement shapes tone or stance, 'smex': 'sources'}
    }
  }
}
```

AI Personas Extraction & Fine-Tuning

Politecnico di Torino
International University

Traits (reasoning output)

Persona Blueprint (Traits)

style_profile

how they speak: tone, formality, directness, emotional flavour, criticality, verbosity, preferred structures, example phrases.

value_frame

what they prioritize: priority_rank (sustainability, price, etc.), novelty seeking, brand loyalty, health concern, description.

reasoning_policies

purchase_advice, product_evaluation, information_processing, content_filters (biases, rules, praise/criticism triggers, trust, disclaimers).

Example JSON Structure

```
// How the model should "speak"
style_profile: (
  tone_adjectives: string[],      // ["Curious", "confident", "quality-focused", "pragmatic", ...],
  formality_level: "low" | "medium" | "high",
  directness: "very_direct" | "balanced" | "hedged",
  emotional_flavour: "neutral" | "enthasiastic" | "cool_detached" | "warm_reflective",
  criticality_level: "high" | "medium" | "low",
  verbosity_preference: "concise" | "detailed" | "varies_by_question",
  preferred_structures: string[],  // ["bullet_point", "clear_rsadeoffs", "pros_cons", "step_by_step"]
  typical_register_examples: string[]// short example phrases in target style
},

// What they care about – used to biss recommendations / reasoning
value_frame: (
   priority_rank: string[],       // e.g. ["quality", "convenience", "sustainability", "price"],
   sustainability_orientation: "high" | "medium" | "low",
   price_sensitivity: "high" | "medium" | "low",
   price_sensitivity: "high" | "medium" | "low",
   novelty_seeking: "high" | "medium" | "low"
),
}
```

Design - Risks Analysis

Technical Risks

- Hallucinations and inaccurate responses: mitigate with RAG system
- Insufficient critical thinking: mitigate with RAG and prompt engineering
- Opacity: mitigate with RAG
- Inconsistent or generic personality: mitigate by fine-tuning (in case of limited resource use PEFT, smaller models, RAG with few-shot prompting)
- Performance evaluation difficulty

Design - Risks Analysis

Governance and Security Risks

- Privacy and compliance with AI Act and GDPR
- Proprietary data protection
- System integration difficulty with existing systems and infrastructure

Design - Risks Analysis

Data and Other Risks

- Data integration difficulty
- Data quality and bias
- Over relying on AI Personas