**Phase 1: Research & Planning**

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# **Overview of Selected Patterns and Their Roles in Portal Design**

After reviewing the Agent Design Pattern Catalogue, we selected **five** agent patterns to implement based on their ability to improve reasoning, self-checking, collaboration, and modularization:

### **1. Multi-Agent Collaboration Pattern**

* **Usage in Portal:** Our system employs multiple specialized agents, such as the Sales Agent, Budget Planner, Investment Planner, Reviewer, and Refiner, that work collaboratively to achieve the overall goal of providing personalized financial planning.
* **Role:** This pattern facilitates the decomposition of complex tasks into subtasks, each handled by different agents, promoting modularity and scalability.​

### **2. Planning Pattern**

* **Usage in Portal:** The Investment Planner and Budget Planner agents develop step-by-step plans to meet user-defined financial goals.
* **Role:** This pattern enables agents to formulate and execute multi-step plans, allowing for dynamic and goal-oriented behavior.​

### **3. Reflection Pattern**

* **Usage in Portal:** The Reviewer Agent evaluates the outputs of the Investment Planner, providing feedback for improvement.
* **Role:** This pattern allows agents to assess their own performance, facilitating self-improvement and error correction.​

### **4. Tool Use Pattern**

* **Usage in Portal:** Agents utilize external tools and APIs, such as financial data retrieval services, to enhance their capabilities.
* **Role:** This pattern enables agents to extend their functionality by integrating external tools, allowing for more informed decision-making.​

### **5. User Proxy Pattern**

* **Usage in Your Portal:** The Sales Agent acts on behalf of the user, coordinating interactions among various agents to fulfill user requests.
* **Role:** This pattern allows an agent to represent the user within the system, managing tasks and communications to achieve user goals.

# **Tool Comparison Table and Rationale for Chosen Tools**

| **Tool** | **Alternatives Considered** | **Final Decision & Rationale** |
| --- | --- | --- |
| **Streamlit** | Gradio, Flask | Streamlit was chosen for fast prototyping, flexible session handling, and easy dashboard creation. |
| **Autogen** | LangChain, custom agent handlers | Autogen provided multi-agent orchestration and UserProxy capabilities, allowing complex patterns like Refiner/Critic easily. |
| **OpenRouter API** | OpenAI API, HuggingFace API | OpenRouter offers free or low-cost access to frontier models (like Mistral) without OpenAI's cost overhead. |
| **Mistral-7B-Instruct** | GPT-4, Claude 3 | Selected for strong reasoning skills, good cost-performance tradeoff. |
| **Pandas** | Polars | Pandas offers simple and familiar CSV parsing required for user bank data analysis. |
| **dotenv** | AWS Secrets Manager | dotenv is simple for managing API keys securely during local development. |
| **No-code Tools** | Dify.ai, CrewAI | Considered but rejected because deep customization needed full Python control. |

# **Conceptual Design of Portal with Use Cases**

### **Conceptual Architecture**

[User Inputs] ➔ [Sales Agent] ➔ [Bank Summarizer Agent] ➔

[Investment Planner Agent ➔ Reviewer Agent ➔ Refiner Agent] ➔

[Budget Planner Agent] ➔

[Final Summary Display]

Agents specialize in individual financial tasks but collaborate seamlessly through multi-agent communication.

# **Scope Definition**

**Chosen Scope:** Consumer-Oriented Financial Planning Portal – focusing specifically on Savings Planning and Cash Flow Management.

**Detailed Reasoning:**After studying popular financial tools like YNAB (You Need A Budget) and Empower Personal Dashboard, it became clear that ordinary users, not financial experts, form the largest and most underserved user base.  
These users face practical challenges like:

* Planning monthly savings to meet goals (e.g., buying a home, saving for education, building an emergency fund).
* Managing their cash inflows and outflows without professional financial advisors.
* Understanding the impact of daily spending habits on their long-term wealth-building goals.

While mortgage optimization, insurance products, and advanced investing tools serve niche or high-income audiences, cashflow tracking and savings planning are universal needs for a much wider demographic.

**Portal Focus Areas:**

* **Short-Term Financial Planning:** Helping users save for specific goals within 1–3 years (e.g., $10,000 savings in 12 months).
* **Long-Term Financial Planning:** Structuring simple investment advice aligned with longer horizons (e.g., retirement savings, wealth accumulation).
* **Daily/Monthly Budgeting:** Offering users dynamic spending and saving advice based on real transaction patterns.
* **Accessible AI Advisory:** Instead of complex financial jargon, providing clear, simple, and actionable advice generated by specialized agents.

This focus ensures that the portal:

* Remains easy to use for non-expert users.
* Prioritizes practical, day-to-day financial actions.
* Bridges the gap between cash flow awareness and investment decision-making.

# **Use Cases for the Personal Financial Planning Portal**

## **Use Case 1: Helping Young Professionals Set and Achieve Savings Goals**

**Persona:** Young professional (age 22–30) starting their career, earning a moderate salary.

**Challenge:** They want to save $10,000 for a home down payment but struggle with tracking expenses and setting realistic savings targets.

**How the Portal Helps:**

* User enters a short-term goal (e.g., "Save $10,000 in 12 months") and uploads their bank statement CSV.
* The portal automatically analyzes their spending habits, identifies unnecessary expenses, and generates a custom monthly savings plan.
* The plan is simple, visualized clearly, and sets achievable monthly milestones.

**Impact:** The user moves from vague intentions ("I should save more") to a specific, trackable savings action plan.

## **Use Case 2: Assisting Mid-Career Individuals with Investment Planning**

**Persona:** Mid-career employee (age 30–45) earning stable income, interested in growing wealth over time.

**Challenge:** They know they should invest but feel overwhelmed by choices like stocks, bonds, ETFs, and different risk levels.

**How the Portal Helps:**

* Based on the user’s long-term goal (e.g. "Save $1M in 10 years"), the portal generates two investment strategies:
  + One aggressive (higher stock exposure for growth).
  + One conservative (more bonds and stable assets for security).
* Each plan is explained in plain English, without jargon, along with assumptions and risk warnings.
* Critique and refinement steps ensure that the advice is not reckless but realistic.

**Impact:** The user receives personalized, clear investment advice aligned with their risk appetite, without needing a financial advisor.

## **Use Case 3: Supporting Families in Managing Monthly Budgets**

**Persona:** Family household managing multiple expenses (mortgage, groceries, childcare, etc.).

**Challenge:** Income is stable but expenses fluctuate monthly; savings are inconsistent.

How the Portal Helps:

* The family uploads their monthly bank statements.
* The portal analyzes fixed vs variable expenses, suggesting a dynamic monthly budget that flexes around essential spending.
* Provides alerts on overspending areas (e.g. dining out, subscriptions).
* Helps optimize recurring costs and automatically prioritizes savings goals.

**Impact:** Families can better manage cash flows, avoid lifestyle inflation, and steadily build an emergency fund or college savings.

## **Use Case 4: Empowering Students or Entry-Level Workers to Build Financial Discipline**

**Persona:** Student or entry-level worker earning a limited income.

**Challenge:** They want to learn basic financial habits: budgeting, saving small amounts, avoiding debt.

**How the Portal Helps:**

* Accepts very small financial inputs (even $200/month salaries).
* Suggests a starter budget focusing on absolute essentials (rent, food, transportation) and a small, sustainable savings percentage.
* Encourages building an emergency fund even if it's $10–$20 per month.
* Shows long-term compounding effects of early saving habits.

**Impact:** Promotes financial literacy and discipline from the beginning, reducing chances of future financial distress.

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